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U. S. Department of Labor
Bureau of Labor Statistics.

1. Industrial Health And Efficiency.
(Final Report of The British
Health of Munition Workers'
Conference.) 1919.
X9(MV4;3):943
2. Industrial Efficiency And Fatigue
in British Munition Factories. 1917.
X9(MV4;3):94.3
3. Hours, Fatigue, And Health in
British Munition Factories. "
X9(MV4;3):94-3
4. Welfare Work in British Munition
Factories. "
X9(MV4;3):948.3

X9(MV4;3):948.3

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PREFACE.

This bulletin is the fourth of a group of bulletins to be published by the Bureau of Labor Statistics of the United States Department of Labor in compliance with the following resolution voted April 7, 1917, by the Council of National Defense:

That the complete reports of the committee appointed by the British Minister of Munitions to investigate conditions affecting the health and welfare of workers be edited so that the salient features thereof may be made applicable to the conditions pertaining in the United States, and printed in condensed form by the Department of Labor.

The matter contained in the memoranda and other publications issued by the British Health of Munition Workers Committee is of such interest and importance that their publication is continued in this bulletin, which contains an interim report on industrial efficiency and fatigue and two memoranda bearing on the health of munition workers.

An earlier bulletin (Bulletin 221) contains documents, official and unofficial, dealing with hours, fatigue, occupational diseases, and the provisions of the Munitions of War Act relating to labor disputes and the restoration of trade-union conditions after the war, a second bulletin (Bulletin 222) contains memoranda relating to welfare supervision and welfare work, while a third bulletin (Bulletin 223) contains reprints of official and unofficial documents dealing with the employment of women and juveniles.

It is thought that these bulletins published at the request of the Council of National Defense will be of great service to the country, by giving wider circulation to the experiences of Great Britain, France, Canada, and other countries, in dealing with labor in the production of the largest quantity of munitions in the shortest space of time.

ROYAL MEEKER,
United States Commissioner of Labor Statistics.

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The matter contained in the reports and memoranda issued by the British Health of Munition Workers Committee is of such interest and importance that the documents relating to hours, fatigue, and occupational diseases are reproduced in full in this bulletin.

Later bulletins will contain documents, official and nonofficial, dealing with welfare work and the employment of women and juveniles and such related documents, either official or nonofficial, as are of sufficient interest and importance to warrant reprinting or summarizing in bulletin form.

It is thought that these bulletins, published at the request of the Council of National Defense, will be of great service to the country by giving wider circulation to the experiences of Great Britain, France, Canada, and other countries in dealing with labor in the production of the largest quantity of munitions in the shortest space of time.

ROYAL MEEKER,

United States Commissioner of Labor Statistics.

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PREFACE.

This bulletin is the second of a group of bulletins to be published by the Bureau of Labor Statistics of the United States Department of Labor in compliance with the following resolution voted April 7, 1917, by the Council of National Defense:

That the complete reports of the committee appointed by the British Minister of Munitions to investigate conditions affecting the health and welfare of workers be edited so that the salient features thereof may be made applicable to the conditions pertaining in the United States, and printed in condensed form by the Department of Labor.

The matter contained in the memoranda issued by the British Health of Munition Workers Committee is of such interest and importance that the documents relating to welfare supervision and welfare work are reproduced in full in this bulletin.

An earlier bulletin (Bulletin 221) contains documents, official and unofficial, dealing with hours, fatigue, occupational diseases, and the provisions of the Munitions of War Act relating to labor disputes and the restoration of trade-union conditions after the war, while a later bulletin (Bulletin 223) will contain documents, official and unofficial, dealing with the employment of women and juveniles.

It is thought that these bulletins published at the request of the Council of National Defense will be of great service to the country, by giving wider circulation to the experiences of Great Britain, France, Canada, and other countries, in dealing with labor in the production of the largest quantity of munitions in the shortest space of time.

ROYAL MEEKER,

United States Commissioner of Labor Statistics.

U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES }
BUREAU OF LABOR STATISTICS } No. 249

LABOR AS AFFECTED BY THE WAR SERIES

INDUSTRIAL HEALTH
AND EFFICIENCY

FINAL REPORT OF THE BRITISH
HEALTH OF MUNITION WORKERS'
COMMITTEE

31



FEBRUARY, 1919

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

PUBLICATIONS OF THE BUREAU OF LABOR STATISTICS.

The publication of the annual and special reports and of the bimonthly bulletins was discontinued in July, 1912, and since that time a bulletin has been published at irregular intervals. Each number contains matter devoted to one of a series of general subjects. These bulletins are numbered consecutively, beginning with No. 101. Up to No. 236 they also carried consecutive numbers under each series. Beginning with No. 237 the serial numbering has been discontinued. A complete list of the reports and bulletins of the Bureau will be furnished on application.

A list of the series now issued by the Bureau is as follows:

- Wholesale Prices.
- Retail Prices and Cost of Living.
- Wages and Hours of Labor.
- Employment and Unemployment.
- Women in Industry.
- Workmen's Insurance and Compensation (including laws relating thereto).
- Industrial Accidents and Hygiene.
- Conciliation and Arbitration (including strikes and lockouts).
- Labor Laws of the United States (including decisions of courts relating to labor).
- Foreign Labor Laws.
- Vocational Education.
- Labor as Affected by the War.
- Miscellaneous Series.

LABOR AS AFFECTED BY THE WAR.

The present bulletin is the second in the new series on "Labor as affected by the war." The following bulletins, published since July 1, 1912, contain matter relating to the subject:

- Bul. 170, May, 1915. Foreign food prices as affected by the war.
- Bul. 219, May, 1917. Industrial poisons used or produced in the manufacture of explosives.
- Bul. 221, April, 1917. Hours, fatigue, and health in British munition factories.
- Bul. 222, April, 1917. Welfare work in British munition factories.
- Bul. 223, April, 1917. Employment of women and juveniles in Great Britain during the war.
- Bul. 230, July, 1917. Industrial efficiency and fatigue in British munition factories.
- Bul. 237, October, 1917. Industrial unrest in Great Britain.

PREFACE.

This bulletin reproduces in full the final report of the British Health of Munition Workers Committee, and completes the group of bulletins which the Bureau of Labor Statistics of the United States Department of Labor undertook to publish in compliance with the following resolution voted April 7, 1917, by the Council of National Defense:

That the complete reports of the committee appointed by the British Minister of Munitions to investigate conditions affecting the health and welfare of workers be edited so that the salient features thereof may be made applicable to the conditions pertaining in the United States, and printed in condensed form by the Department of Labor.

The first bulletin (Bulletin 221) published in compliance with the foregoing resolution contains documents, official and unofficial, dealing with hours, fatigue, occupational diseases, and the provisions of the Munitions of War Act relating to labor disputes and the restoration of trade-union conditions after the war. The second bulletin (Bulletin 222) contains memoranda relating to welfare supervision and welfare work. The third bulletin (Bulletin 223) contains reprints of official and unofficial documents dealing with the employment of women and juveniles. The fourth bulletin (Bulletin 230) includes the interim report of the Health of Munition Workers Committee on industrial efficiency and fatigue, which sets out the result of a number of investigations which had been made for the committee. The final report of the committee, reprinted in this bulletin, gives a concise survey of the problems set forth in the various memoranda of the committee covered in the above bulletins.

It is believed that these bulletins, published at the request of the Council of National Defense, will be of great service alike to employers and workers in this country because they give the experience of Great Britain in dealing with labor in the production of the largest quantity of munitions in the shortest space of time—an experience which offers many suggestions capable of practical application in the promotion of peace time industry.

**BULLETIN OF THE
U. S. BUREAU OF LABOR STATISTICS.**

NO. 249

WASHINGTON

FEBRUARY, 1919

INDUSTRIAL HEALTH AND EFFICIENCY.

FINAL REPORT OF THE BRITISH HEALTH OF MUNITION WORKERS' COMMITTEE.

TERMS OF REFERENCE.

The committee were appointed in September, 1915, by the Right Hon. David Lloyd George, M.P., with the concurrence of the Home Secretary. The committee were invited "To consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops."

The reference and appointment were subsequently approved by the succeeding Ministers of Munitions, the Right Hon. E. S. Montagu, M.P., the Right Hon. C. Addison, M.P., M.D., and the present Minister, the Right Hon. Winston S. Churchill.

CONSTITUTION OF COMMITTEE.

Sir George Newman, K.C.B., M.D., F.R.C.P. (Chairman); chief medical officer, board of education; member of the central control board (liquor traffic); emeritus lecturer in preventive medicine at St. Bartholomew's Hospital.

Sir Thomas Barlow, Bart., K.C.V.O., M.D., LL.D., F.R.S., physician extraordinary to H.M. the King; late president of the Royal College of Physicians.

Gerald Bellhouse, Esq., C.B.E., H.M. deputy chief inspector of factories, Home Office.

Professor A. E. Boycott, M.D., F.R.S., director of pathological department, University College, London.

J. R. Clynes, Esq., M.P., parliamentary secretary to the Ministry of Food.

E. L. Collis, Esq., M.B., H.M. medical inspector of factories, Home Office; director of health and welfare, Ministry of Munitions.

Sir Walter M. Fletcher, K.B.E., M.D., Sc.D., F. R. S., F. R. C. P., secretary to the medical research committee; fellow of Trinity College, Cambridge.

Leonard E. Hill, Esq., M.B., F. R. S., director, department of applied physiology and hygiene, medical research committee; professor of physiology, London Hospital Medical School.

Samuel Osborn, Esq., J.P., managing director Clyde Steel Works, Sheffield.

Miss R. E. Squire, O.B.E., H.M. deputy principal lady inspector of factories, Home Office.

Mrs. H. J. Tennant, C.H.

E. H. Pelham, Esq., (secretary); assistant secretary, board of education.

To the RIGHT HON. WINSTON S. CHURCHILL, M. P., MINISTER OF MUNITIONS.

SIR:

1. The committee now beg to submit the following final report.
2. Since their appointment the committee have held 39 meetings and in addition subcommittees have met on numerous occasions.
3. Inmediately on their appointment the committee arranged to sit and take evidence not only in London but also in Birmingham Sheffield, Newcastle, Glasgow, Manchester, and Coventry. Special arrangements were also made for taking evidence at Woolwich. Witnesses were heard representative of employers, workers, factory inspectors, and other interested persons. From time to time special witnesses have also been heard on particular questions. In addition a number of other persons have—by the submission of memoranda or by other means—placed their special knowledge at the disposal of the committee. The committee have decided to content themselves with quoting extracts from the evidence, and not to publish it in full. In arriving at this decision they have been influenced not only by the urgent need for economy in paper, but also by the fact that much of the evidence was either not intended for publication or had special reference to particular conditions then existing, but now largely modified. Some persons, while allowing their statements to be made use of, have desired that their names should not be published.
4. Throughout their inquiries the committee have found it desirable to rely for much of their information on visits paid to factories. Such visits, which were generally paid by two or three members of the committee together, enabled them not only to interview a number of employees, foremen, and workers whose evidence would hardly otherwise have been available, but also to ascertain at first hand the conditions under which munition work was being carried out. In addition, individual members of the committee, whilst discharging other duties, have collected a considerable body of information bearing on questions under consideration.

5. From the first the committee have been strongly impressed with the importance of obtaining exact and scientific data. The Medical Research Committee not only gave permission for Dr. Leonard Hill, F. R. S., head of their applied physiology department, to serve upon the committee, but placed the experimental resources of his laboratories at the disposal of the committee, and offered to render any other assistance in their power. The assistance thus offered has proved of the highest value. In addition to other work Dr. Leonard Hill has conducted a number of detailed inquiries in regard to the dietaries of munition workers, and also in regard to ventilation. Dr. Benjamin Moore, F. R. S., and his staff have carried out a long series of experiments and inquiries in regard to the effects of TNT upon the health of workers (separately published). In conjunction with that committee arrangements were made for Mr. P. Sargant Florence, Mr. H. M. Vernon, M. D., fellow of Magdalen College, Oxford (with whom has been associated Mr. W. Neilson Jones), Prof. Thomas Loveday, Armstrong College, University of Durham, and Capt. M. Greenwood, R. A. M. C. (with whom has been associated Mr. S. H. Burchell), to collect data bearing on the relationship of output to hours of work and other industrial problems. Capt. T. H. Agnew, R. A. M. C., conducted, on behalf of the committee, a medical inspection of about 3,000 male workers. Two series of medical inspections covering together about 2,500 women and girls were organized under the supervision of Dr. Janet Campbell (a senior medical officer of the board of education).

6. In Appendix A are set out the names of—(a) the witnesses, other than those who desired that their names should not be published; (b) the medical officers, inspectors, and others who assisted in the medical inspections; and (c) certain other persons who, by the submission of memoranda or by other means, placed their special knowledge at the disposal of the committee. The committee desire to place on record their cordial appreciation of the assistance rendered, often at much personal inconvenience, by all those who have thus enabled the committee to collect a body of reliable information, without which it would have been impossible for them adequately to perform the duties with which they were charged. The committee are also under a great obligation to the many munition firms and their staffs for the facilities so readily accorded for the pursuit of inquiries. Finally, the committee desire to express their thanks to the Home Office (factory department), the Ministry of Munitions, the board of education, and the national insurance commissioners for the assistance afforded the committee by the loan of their officers and the supply of information.

7. In view of the urgency of many of the problems involved by their terms of reference the committee decided that it was desirable

that they should submit their views and recommendations in regard to particular matters in separate memoranda rather than that they should defer making any report until their investigations were completed. In accordance with this decision the committee have submitted to the ministry the following 21 memoranda :

- No. 1. Sunday labor. (Cd. 8132.)
 [Summarized in Monthly Review, May, 1916, pp. 66, 67; reprinted in Bul. 221.]
- No. 2. Welfare supervision. (Cd. 8151.)
 [Summarized in Monthly Review, May, 1916, pp. 68, 69; reprinted in Bul. 222.]
- No. 3. Industrial canteens. (Cd. 8133.)
 [Summarized in Monthly Review, May, 1916, pp. 69, 70; reprinted in Bul. 222.]
- No. 4. Employment of women. (Cd. 8185.)
 [Summarized in Monthly Review, June, 1916, pp. 74-76; reprinted in Bul. 223.]
- No. 5. Hours of work. (Cd. 8186.)
 [Summarized in Monthly Review, June, 1916, pp. 77-79; reprinted in Bul. 221.]
- No. 6. Canteen construction and equipment. (Appendix to No. 3.) (Cd. 8199.)
 [Summarized in Monthly Review, June, 1916, p. 91; reprinted in Bul. 222.]
- No. 7. Industrial fatigue and its causes. (Cd. 8213.)
 [Summarized in Monthly Review, June, 1916, pp. 79-81; reprinted in Bul. 221.]
- No. 8. Special industrial diseases. (Cd. 8214.)
 [Summarized in Monthly Review, June, 1916, pp. 83-88; reprinted in Bul. 221.]
- No. 9. Ventilation and lighting of munition factories and workshops. (Cd. 8215.)
 [Summarized in Monthly Review, June, 1916, pp. 81-83; reprinted in Bul. 221.]
- No. 10. Sickness and injury. (Cd. 8216.)
 [Summarized in Monthly Review, June, 1916, pp. 88-90; reprinted in Bul. 221.]
- No. 11. Investigation of workers' food and suggestions as to dietary. (Second appendix to No. 3.) (Cd. 8370.)
 [Summarized in Monthly Review, January, 1917, pp. 56, 57; reprinted in Bul. 222.]
- No. 12. Statistical information concerning output in relation to hours of work. (Cd. 8344.)
 [Summarized in Monthly Review, December, 1916, pp. 105-119; reprinted in Bul. 221.]
- No. 13. Juvenile employment. (Cd. 8362.)
 [Summarized in Monthly Review, December, 1916, pp. 92-97; reprinted in Bul. 223.]
- No. 14. Washing facilities and baths. (Cd. 8387.)
 [Summarized in Monthly Review, January, 1917, pp. 150, 151; reprinted in Bul. 222.]
- No. 15. The effect of industrial conditions upon eyesight. (Cd. 8409.)

[Summarized in Monthly Review, April, 1917, pp. 538-540; reprinted in Bul. 221.]

No. 16. Medical certificates for munition workers. (Cd. 8522.)

[Reprinted in Bul. 230.]

No. 17. Health and welfare of munition workers outside the factory.

[Summarized in Monthly Review, August, 1917, pp. 91, 92; reprinted in Bul. 230.]

No. 18. Further statistical information concerning output in relation to hours of work, with special reference to the influence of Sunday labor. (Cd. 8628.)

[Summarized in Monthly Review, November, 1917, pp. 61, 62.]

No. 19. Investigation of workers' food and suggestions as to dietary. (Second appendix to No. 3.) Revised edition. (Cd. 8798.)

No. 20. Weekly hours of employment (supplementary to Memorandum No. 5.) (Cd. 8801.)

[Reprinted in Monthly Review, February, 1918, pp. 82-87.]

No. 21. Investigation of the factors concerned in the causation of industrial accidents. (Cd. 9046.)

[Summarized in Monthly Labor Review, July, 1918, pp. 161-164.]

All of these memoranda with the exception of No. 17 (Health and welfare of munition workers outside the factory) have been published and placed on sale.

An interim report, entitled "Industrial efficiency and fatigue," was also published (Cd. 8511) in February, 1917, in which was set out the results of a number of investigations which had been made for the committee. The studies included were:¹

(a) Industrial fatigue and its causes (reprint of Memorandum No. 7).

(b) Output in relation to hours of work (reprint of Memorandum No. 12).

(c) The comparative efficiencies of day work and night work.

(d) The causes and conditions of lost time.

(e) Incentives to work, with special reference to wages.

(f) Report on the health and physical condition of male munition workers.

(g) Inquiry into the health of women engaged in munition factories.

Finally, in December, 1917, the committee, acting on your instructions, issued a handbook on the "Health of the munition worker,"² summarizing shortly and concisely the principal suggestions contained in their earlier publications.

8. The committee are satisfied that the procedure thus adopted has been justified by the results attained. The publication of separate

¹ The report was summarized in Monthly Review, July, 1917, pp. 14-19; the studies included in the report, with the exception of (a) and (b), were reprinted in Bul. 230.

² Summarized in Monthly Review, April, 1918, p. 311.

memoranda has undoubtedly rendered the committee's recommendations more readily accessible. The demand for the memoranda has been large and continuous; upward of 210,000 of the committee's memoranda and reports have been sold or distributed, and the recommendations contained in them have received a wide measure of acceptance, both officially and unofficially.

9. The committee consider that they have now reached a definite stage in their work. Though doubtless fresh matters for inquiry may arise from time to time there can be no doubt that the position is now substantially different from what it was when the committee were first appointed in September, 1915. There is apparently an increased appreciation of the importance of the whole question of industrial hygiene, and there can be no doubt that the environment and conditions of employment of munition workers throughout the country are now vastly better than they were two and one-half years ago, though there is still much room and much need for improvement. The developments which have occurred may be roughly grouped under the following heads:

(a) The various memoranda and reports already prepared by the committee may be broadly regarded as containing recommendations in regard to all the principal questions which fall within their terms of reference. All these recommendations have been generally accepted as reasonable, and have been widely adopted.

(b) In January, 1916, the Ministry of Munitions established a welfare section under the direction of Mr. B. S. Rowntree, for the purpose of the executive work arising out of the committee's recommendations and other necessary undertakings for promoting the health of the large body of workers for which the ministry was responsible. The activities of the department were at first concentrated on securing improved conditions of health and welfare within "controlled" factories by encouraging factory managers to appoint some person or persons to maintain a close personal relationship with the workers, and also to make the requisite structural provision.¹ Early in 1917, the pressure of other duties prevented Mr. Rowntree from continuing to direct the department, which was about the same time entirely reorganized under the direction of Dr. E. L. Collis, a member of the committee. The new department was made responsible for all matters concerned with the health and welfare of munition workers in national as well as in "controlled" factories, including the medical problems involved in the prevention of TNT poisoning and the maintenance of the health of those employed in the manufacture of lethal gas. The sphere of the department was at the same time extended to cover the conditions of life of munition

¹ The conditions under which such expenditure may be met out of excess profits are given in Appendix K.

workers outside the factory, together with the inspection of the large number of temporary hostels for munition workers that were being provided. In addition, special provision was made for research and the collection of accurate knowledge upon which administrative action could be based. More recently the department has been taking steps to deal with the various maternity problems which arise in munition areas. The staff, in addition to the central administrative officers, includes men and women welfare officers¹ charged with the inspection of conditions inside the factories, the supervision of conditions outside the factories and the inspection of hostels, medical officers charged with the supervision of the doctors appointed to individual factories and also with advising on all health questions, and special research investigators.

(c) Under section 7 of the Police, Factories, etc. (Miscellaneous Provisions), Act, 1916, the Home Office were given power to make orders requiring special provision to be made at a factory or workshop for securing the welfare of the workers. The matters to which the section applies include: Arrangements for preparing or heating and taking meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers.

As the result of these developments the questions now at issue are concerned not so much with the determination of general policy as with the application of agreed principles to particular cases. They are, in fact, administrative rather than advisory in character. In saying this the committee must not be regarded as in any sense underrating the urgent necessity for the continuance and development of the various scientific inquiries which they have initiated. Other means can, however, be found for attaining this end, and the committee concur in the propriety of the decision of the ministry to discharge their reference and to establish in their place an office committee in association with the executive.

10. It has only remained accordingly for the committee to prepare a final report of their proceedings. In this report, which they now submit, they have endeavored to survey concisely (even at the risk of some repetition), the nature and development of all the various problems covered by their memoranda. Many of the memoranda would, in any case, have required substantial modification in view of developments which have occurred since their publication, but what is more important, the bringing together of the various matters which have been dealt with in their various memoranda serves to emphasise in a manner otherwise impossible the close relationship

¹ There are now probably about 800 welfare supervisors employed in munition factories; of these approximately 80 per cent are for women and girls and 20 per cent for boys.

and interdependence which exists between the problems involved. Though it is too early yet to draw any final conclusions as to the permanent effect on the health and physical efficiency of the munition work of the abnormal conditions which have existed during the war, it is at any rate possible to set out the extent to which normal restrictions have been abandoned, to suggest some conclusions as to the results which have followed, and, finally, to indicate certain conclusions as to the steps which should be taken to maintain and promote permanently the health of industrial workers when more normal conditions are restored.

SECTION II—PRELIMINARY AND HISTORICAL SURVEY.

11. At the outset of their investigation and inquiry the committee were confronted with the width and complexity of the reference with which they were charged. It had to do with the environment of the worker and the worker himself; it was concerned with immediate as well as remote problems; its issues had to be viewed in relation to present exceptional and ephemeral conditions and circumstances, and also in relation to what would be practicable and permanent after the war; it involved the consideration of the health, not only of the munition worker in the narrow sense, but of all industrial labor—for all branches of labor are interdependent upon each other—and of many health questions, such as housing and maternity provision, which lie outside the walls of the factory or work place; and lastly, it raised far-reaching social and even moral questions which are not commonly thought of as appertaining to health.

The fact is that this report of the committee's work, though concerned primarily with the munition worker, deals also with vital principles and practical methods affecting all forms of industry. Moreover, the health of the industrial worker—man and woman—is but part, essential, plastic, living, of the health of the people as a whole, which in its turn raises manifold problems of administration, economics, social relationships, and even ethics, which, though apparently remote from questions of medicine, are in truth intimately associated. The nation a century ago was wise in its generation in recognizing the relation obtaining between "the health and morals of apprentices," and, a hundred years later, it is found that some of the most intricate problems of health and physical efficiency are inseparable from large issues of physiology, of social relationship or morals, and of human conduct. It is sufficient to name two examples: First, there is the advent of the woman worker—an advent which brings with it new issues of physique, of physiological function, of staying power, of nutrition, of maternity. The entrance into the ranks of labor of the "young person" of either sex raises many questions concerning the development of the adolescent and the effects of labor conditions upon such growth and the national results which are likely to follow. All such questions are doubly difficult in the case of the woman worker. There has been witnessed what can not be described otherwise than as a mighty revolution in industry, and the committee have been deputed to study some of the physiological con-

comitants or effects of this revolution. They do not profess to solve the problems thus presented. They are under no delusion in the matter. They can but open the door and invite other students to enter this unexplored region of science and labor. They are convinced that it offers a wide field for research, for careful experiment, for firm, frank, and bold statecraft, for a large and sympathetic understanding, which shall secure the inestimable advantages of woman's skill and energy without those irremediable and far-reaching evils which will inevitably arise if her contribution be not wisely and effectually safeguarded. Secondly, there is the old problem of the relation of the man to the machine. During the industrial revolution in England there was a tendency, to put it no higher, for the man to be made subservient to the machine. But physically, socially, and even morally, this seems to reverse the proper order. Their investigations have convinced the committee that to secure harmony and smooth working, to secure efficiency and maximum output, the machine must be subservient to the man; it is his individual health, mental development, and moral well-being which is the guaranty of effective labor. The reference here is not to the social relationships between master and man, or between man and man, though the proposition may be true in that regard also. It is only in respect of the physiological basis of labor and of all endeavor of whatever kind. In short, physical health is the fundamental basis. There must be a proper distribution of function of labor, a correct understanding of the part played by nutrition, by rest, by fatigue, by health conditions, if waste is to be avoided and maximum energy attained. The human being is a finely adjusted physiological instrument, which must no longer be wasted, much less destroyed, by ignorant or willful misuse. A workingman's capital is, as a rule, his health and his capacity to perform a full day's work. Once that is impaired or damaged beyond recuperation, two things happen: First, his whole industrial outlook is jeopardized and he becomes by rapid stages a liability and even a charge on the State. Secondly, if the bodily defense is undermined by stress and strain the man falls a ready prey to disease, such as tuberculosis. Therefore, as the problems to which reference is made in this report concern the future as well as the present, so also they are concerned with the new preventive medicine which has as its object the removal of the occasion of disease and physical inefficiency combined with the husbanding of the physical resources of the worker in such a way and to such a degree that he can exert his full powers unhampered, and with benefit to himself and all concerned.

12. Any account of steps which have been taken to promote the health of workers in the engineering and other trades with which

this report is immediately concerned must inevitably deal in a large measure with the efforts that have been made generally to promote the health of all industrial workers during the century and a quarter which has elapsed since public opinion first became aroused on the subject. At first the health of children in cotton factories was the primary matter for concern. The evils of long hours of work and insanitary surroundings, though they had existed previously, had become accentuated by the aggregation of large numbers of workers in factories and by a marked increase in the demand for child labor. The children were helpless to protect themselves against the demands of the employer for cheap labor and against the cupidity of the parents. That any action was taken was due partly, no doubt, to a fear that the conditions of employment might react, not only on the health of those immediately concerned, but on that of the nation as a whole. Action was, however, mainly due to the gradual awakening of the political and social conscience which occurred during this period. It was a time, not only of factory legislation, but of educational advancement and of prison reform. The awakening was religious as well as social, and the first factory act was concerned not only with the health of apprentices but with their "morals." It dealt with their education and religious training as well as with their physical welfare. The modern factory acts were only gradually evolved; legislation was directed to removing particular evils as they became recognized, rather than to the realization of definite principles, based on a critical examination of the causes of the evils. That progress was slow was due in the main to the strength and character of the individualistic views then held and to the widespread belief that any curtailment of the liberty of action of the manufacturer must be prejudicial to the national prosperity. More than half a century passed before there was any general acceptance of the principle that the State has both a right and a duty to concern itself with the physical and moral welfare of its people.

13. The movement of reform expressed itself in two ways. First, there was the individual effort of the more enlightened pioneering employers, and secondly, there was the intervention of the State through its central board of health and, subsequently, the factory department of the Home Office. From the days of Robert Owen, and before his days, down to the present time, there has been a succession of benevolent employers who have made it their business to provide for the well-being of their workers, and have thus set a standard and an example to the State. Wood and Walker, of Bradford, who inspired Oastler; John Fielden, who, in 1836, felt he was "the trustee of the interests" of those he employed; Robert Gardner, of Preston; and

others were forerunners in a long line of famous employers who have taken upon themselves the responsibility of the care of their workers. "We manufacturers," wrote Robert Owen, "are always perfecting our dead machinery, but of our living machinery we are taking no care." The movement began with the reduction of hours of labor, but it now comprehends the whole wide compass of "welfare." The medical examination of applicants, the provision of surgeries, convalescent homes and dental clinics; a nursing staff, prevention of accidents, supervision of sick, slow, or backward workers; canteen accommodation, recreation agencies, clubs, swimming baths and playing fields, libraries, allotments, educational classes; welfare supervisors; improved wage systems savings clubs, profit-sharing—make a formidable array of agencies for the benefit of the worker. "It is taken for granted," writes an employer, "that before any so-called scheme of welfare work can be of lasting good a living wage must be paid and hours of labor and hygienic conditions must not involve the deterioration of the workers. It must be quite evident that clubs and classes, savings funds and libraries are quite thrown away upon workers who are overworked and underfed."¹

14. It is important to observe that, with few exceptions, the pioneer reforms of employers were inspired by social and moral motives rather than by scientific or economic evidence. There was, indeed, all through this long period of tardy reform, little or no appeal to the actual facts of the relation between the hours and conditions of labor on the one hand and the energy and output of the workman on the other. It seems now, on looking back, an extraordinary thing that there should have been little or no scrutiny or inquiry, no experiment, no research, no investigation into the real state of the case. Men guessed, or assumed, or were guided by their own prejudice, or at best, were compelled by humane or religious ideals. One of the first control experiments on this subject made in the workshop was that initiated in 1892 by the Right Hon. Sir William Mather in the engineering works of Messrs. Mather & Platt at Salford. As a result of negotiation between employer and employed it was arranged to make a year's trial (1st March, 1893–28th February, 1894) of a 48 hours' system, excluding the two hours of work before breakfast (7.45 to 12 noon and 1 to 5.30). The results showed—(a) that there was an increase of 0.4 per cent in the ratio of the wages cost to the turnover; (b) that there was a saving in gas, electricity, fuel, wear and tear, etc., amounting, by coincidence, to 0.4 per cent; (c) that there was a fall in the amount of lost time from 2.46 per cent in the 53-hour period to 0.46 per cent in the 48-hour period; (d) that though pieceworkers lost 1.76 per cent at the beginning of the trial year, this fell to 0.78 per cent at the end; and (e) that there was

¹ Experiments in Industrial Organization, by Edward Cadbury, 1912.

"increased cheerfulness and brightness" on the part of the work-people. "We seem," wrote Sir William Mather in 1894, "to have been working in harmony with a natural law, instead of against it, as in the unnatural conditions of men beginning the work of the day without provision required by nature for the proper exercise of their mental faculties and physical powers. * * * Of this I am assured, that the most economical production is obtained by employing men only so long as they are at their best—when this stage is passed there is no true economy in their continued work." The committee have had the advantage of discussing this admirable experiment with Sir William Mather, and they are satisfied that his experience, and those of other employers who followed his enlightened example of inquiry and of reform, demonstrates the value to the workman, the employer and the community as a whole, of applying to industry the scientific method and the scientific spirit.

15. Secondly, alongside the ameliorative efforts of individual employers, sometimes guiding them, sometimes guided by them, there has been the ever-increasing intervention of the State. For a hundred years the movement has been slowly, with tardy steps, gaining ground. To-day, in the presence of a wide interest in "welfare," it is important to remember that the foundations have been laid for many years. It is no new discovery either as need or remedy. For a proper understanding of the present situation it is necessary to take cognizance of the past. For convenience the matter may be considered under four subheadings: (1) The hours of employment, (2) factory environment, (3) personal well-being, and (4) the effect of occupation on health.

(1) LIMITATION OF HOURS OF EMPLOYMENT.

16. When at the beginning of the last century public opinion first became seriously concerned with conditions of industrial employment interest was mainly concentrated on the excessive hours of employment of children and adolescents, and somewhat later of women. Though the hours of employment of men were the subject of continual agitation amongst the workers, legislation on the subject was never seriously contemplated, the action of the legislature being confined to limiting the hours of women, young persons and children, and to the provisions necessary to secure the effective enforcement of the limits decided upon. The earlier factory acts applied only to the textile industries, mainly because they were more highly developed, and regulations were consequently easier to enforce. It was not until limitations of hours, substantially as they exist to-day, had been established, that their extension to other industries was seriously considered.

17. The Health and Morals of Apprentices Act, passed in 1802, was concerned solely with apprentices. Their working hours were limited to 12 a day, and their employment was forbidden between the hours of 9 p. m. and 6 a. m. Except as a statement of principle this act was of but little effect. It did not apply to the large and increasing number of children who were employed otherwise than as apprentices, and even as regards apprentices its administration was lax. It was not, indeed, until 1819 that the agitations headed by Robert Owen,¹ himself a cotton manufacturer, led to the passing of a fresh act under which the employment of all children under 9 years of age was prohibited, and the employment of young persons between 9 and 16 years of age was limited to 12 hours. No further development of importance occurred until the agitation led by Richard Oastler and Michael Sadler commenced about 1830. These agitations were in a large measure concerned with the establishment of a 10-hour day for juvenile workers, though it was anticipated that any limitation of the hours of children would result in a similar limitation in the hours of employment of all workers. The opposition during this period was primarily based on the view that any restriction of the hours of employment must seriously prejudice the prosperity of the country. Even as late as 1844 the view that "the longer the hours, the greater the profit," was still being expressed in its crudest form.

18. In 1833 commissioners were appointed to inquire into the existing conditions and to consider the need for further legislation. They reported that children employed in the principal branches of manufacture throughout the country worked during the same hours as adults; that the effect of labor during such hours was, in a number of cases, permanent deterioration of the physical condition and the production of diseases wholly irremediable, and that at the age when children suffered injuries from the labor they underwent they were not free agents. The commissioners were accordingly of opinion that a case was made out for the interference of the legislature on behalf of children employed in factories.² The Factory Act, 1833, which resulted from the report of the committee, distinguished for

¹ Robert Owen stated in evidence that the reduction of hours in his own factory had not appreciably affected the output. He explained that "a larger quantity may be produced by a greater attention of the hands while the machinery is at work, in preventing breakages, and by not losing time in commencing in the morning, at meals, or when stopping at night."

² While they rejected the proposal of 10 hours a day they pointed out the fallacy underlying the arguments of the opposition. "It appears in evidence that the practice of working more than the ordinary hours a day in each branch can not be turned to account to any such extent. * * * When work is protracted beyond these hours the workmen become inefficient, the quality of the work is injured, the amount of waste augmented and, moreover, additional expense for light is incurred." Reports of commissioners on employment of children in factories, H. C., 1833, XX, XXI, and H. C., 1834, XIX, XX.

the first time between "children" and "young persons." Children between the ages of 9 and 13 were only to be employed for 9 hours a day and 48 hours a week, while young persons between the ages of 13 and 18 might be employed for 12 hours a day. No person under 18 years of age was to be allowed to work at night; that is to say, between 8.30 p. m. and 5.30 a. m. Owing to frequent abuses a medical certificate was required that a child was of "the ordinary strength and appearance" of a child of 9 years of age. Finally, the ineffectiveness (complained of by employers and workers alike) of earlier attempts to enforce the law through persons appointed by the local justices led to the appointment of factory inspectors.

19. The demand for factory reform and for a 10-hour day continued and was gradually enforced by the reports of the factory inspectors as to the difficulties experienced in administering the act of 1833. The Factory Act, 1844, which was largely supported by the employers as well as by the workers, contained numerous provisions for the better enforcement of the limitations already imposed and for preventing encroachment on meal times, but the most important innovation was the limitation of the hours of employment of all women to those permitted for young persons.¹ The struggle for a 10-hour day was practically ended by factory acts passed in 1847 and 1850, under which the hours of employment of women and young persons were limited to 10½ hours (with 1½ hours for meals) a day and 60 hours a week, while to prevent evasions of the law it was prescribed that the legal working day was to be from 6 a. m. to 6 p. m., thus coinciding in length with the legal period of employment.

20. The children's employment commission, the first commission of inquiry into the general conditions of industries other than textile, was appointed in 1840 as a result of representations made by Lord Ashley. The commission in their first report dealt with the mining industry; their second report,² which was published in 1843, showed that in the metal ware and other industries children were generally employed for as long as adults, sometimes for as much as 16 or 18 hours without intermission. Night work was also common. Though the reports of the commission resulted in legislation in regard to coal mines and the extension of the factory acts to certain textile industries not hitherto included, no action was taken to remedy the abuses shown to be existing in the metal ware and other non-textile trades.

¹ As one inspector pointed out, "12 hours' daily work is more than enough for anyone, but however desirable it might be that excessive working should be prevented, there are great difficulties in the way of legislative interference with the labor of adult men. The case, however, is very different as respects women; for not only are they less free agents, but they are physically incapable of bearing a continuance of work for the same length of time as men, and deterioration of their health is attended with far more serious consequences to society."

² House of Commons Report, 1843, XIII-XV.

21. It was not until 1862 that the second children's employment commission was appointed. The inquiries of this commission were conducted under circumstances widely different from those which had existed 20 years earlier. The extent of the restrictions on hours of employment to be imposed by the factory acts was no longer a matter of dispute. It was, moreover, generally recognized that the industries affected had benefited by the imposition of these restrictions. The old opposition to the factory acts had largely disappeared. It is evident from the reports¹ that the character of the metal industries had widely changed during the 20 years which had elapsed since the previous inquiry. The increased use of machinery and the regulation of hours in other trades had tended to secure to a far larger degree regular hours of work. The phrase "overtime" is now used in something approaching the modern sense of hours of work in excess of the normal day. In continuous processes regular day and night shifts, and occasionally the three-shift system, are found established. The commission quoted with approval the evidence of a number of witnesses who were opposed to overtime. The following, among others, were quoted:

If overwork lasts only for a short time 20 per cent increase of hours' labor gives only about 10 per cent increase of result in production. If overtime is continued for any length it gives no increase of result at all.

We find that those on piecework make as much in 10½ hours as they do when they know that they have 2 hours longer. If they have been working their full time well they have not the energy left to get through much more at the end of it.

Bad management and carelessness is the source of all overtime. When they work on till 8 p. m. they get wearied—men and boys. There is quite time enough from 6 a. m. to 6 p. m. for a man to do all he can do satisfactorily.

22. The commission recommended the inclusion of the metal trades within the provisions of the factory acts, and legislation followed in 1867. Sunday work was forbidden, and also night work except to a limited extent permitted for male young persons employed in iron mills and blasting furnaces. Overtime was not allowed in the metal industries.

23. The report² published in 1876 of the commissioners appointed to inquire into the working of the factory and workshop acts, with a view to their consolidation and amendment, did not recommend any change in the limitation of hours of employment then imposed, and no material change has since been made. The commission also considered in this relation the desirability of placing special restrictions upon the occupation of married women in the interests of themselves as well as of their offspring. They, however, regarded it as impracticable to place any prohibition on the employment of women imme-

¹ H. C., 1864, XXII; H. C., 1865, XX.

² H. C., 1876, XXIX and XXX.

diately before or after childbirth, and confined themselves in condemning their employment and to recommending the provision of public nurseries in factory towns. And it was not until the Factory and Workshop Act, 1891, that it was provided that an occupier of a factory or workshop shall not knowingly allow a woman to be employed therein within four weeks after she has given birth to a child.

24. The Factory and Workshop Act, 1901, so far as the limitation of hours of employment was concerned, was mainly important as consolidating the law on the subject and as setting out the law as it at present exists. A summary of the principal divisions is given in Section V.

25. In 1911 a departmental committee was appointed on the night employment of male young persons in factories and workshops. In their report (published in 1912)¹ they stated that they were strongly of opinion that the employment of boys under 18 years of age at night in factories was undesirable and ought not to be allowed to any greater extent or at an earlier age than was absolutely necessary. They considered that this applied especially to boys between 14 and 16 years of age, "when the rate of growth is most rapid and when the conditions of life ought to be rendered as favorable as possible for mental and physical development." This committee reluctantly came to the conclusion that the adoption of a system of three 8-hour shifts was not generally practicable. They recommended the prohibition of all night employment of boys under 18 years of age in blast furnaces, and of boys under 16 years of age in iron mills. They considered it important that provision should be made for the periodical medical examination of boys employed at night until they are 18 years of age, at least once in six months. They added that records should be kept at the works of any physical defects or other matters calling for watchfulness on the part of the occupier, the examining doctor or the inspector of factories.

26. Such, briefly, are the outlines of the story of the struggle for a standard of working hours which should not overstrain the workman. For upwards of a century the State has accumulated indisputable evidence that it is the conditions of employment rather than its character which undermine the physical strength and endurance of the worker. Apart from exceptional occupations which are in themselves injurious, the principal of the undesirable conditions, the most radical and persistent, the commonest, is that of long hours. It is a significant fact that all through the history of the industrial system of this country the dominant evil is not accidents or poisoning or specific disease, but the stress and fatigue due to long and unsuitable hours of labor, entailing inadequate opportunities for rest, rec-

¹ Cd. 6503, 1912.

reation and nourishment. In a word, it is not the work but the continuity of the work which kills.

(2) FACTORY ENVIRONMENT.

27. Though in the earlier controversies of the last century public attention was primarily concerned with the limitation of hours of employment, the necessity was also recognized of attention to the environment of the worker in the factory. The Health and Morals of Apprentices Act, 1802, required that in all cotton factories in which more than 20 persons were employed (whether as apprentices or not), provision should be made for limewashing and "for a sufficient number of windows and openings in such rooms or apartments to insure a proper supply of fresh air in and through the same." From the first, therefore, the importance of ventilation and cleanliness was recognized (unlike the limitation of hours of employment) as necessary for men as well as for women and young persons.

28. Various commissions called attention to the matter. The children's employment commission in their report, published in 1843, on the metal ware and other industries stated that—

In the great majority of instances the places of work are very defective in drainage, ventilation, and in due regard of temperature, while little or no attention is paid to cleanliness.

29. The reports of the children's employment commission (1862) show that, notwithstanding the great developments which had taken place during the previous 20 years in the organization of industry, conditions in these respects remained much as before. The factory acts (extension acts, 1864 and 1867) contained provisions in regard to cleanliness and ventilation. As a direct result of the inquiries of Dr. Greenhow provisions for the first time appear dealing with overcrowding and with the provision of fans or other mechanical means for the prevention of the inhalation of dust. The development of opinion in regard to public health matters led to the Factory and Workshop Act, 1878, incorporating certain provisions of the Public Health Act, 1875, and requiring that the factory should be kept free from effluvia and other nuisances.

30. With the development of machinery the prevention of accidents became a question of increasing importance. The Factory Act, 1844, first provided for the fencing of machinery, though its provisions were largely confined to machinery "near to which children and young persons are liable to pass," and it was only by the Factory and Workshop Act, 1878, that requirements as to the fencing of machinery were extended to all workers. The same act introduced for the first time restrictions as to the cleaning of machinery by women, young persons and children. Notification of accidents to the certify-

ing surgeon, first introduced in 1844, was now extended to cover notification also to the factory inspector. The Factory Act of 1901 consolidated the measures for the improvement of the environment, and included requirements regarding cleanliness, ventilation, lighting and sanitary accommodation.

31. The enforcement of legislative requirements in regard to the environment of the worker has inevitably been a gradual process. The difficulties were greater than in the case of limitation of hours, since in the main the requirements were couched in general terms, words such as "adequate" left many loopholes for evasion, and the raising of the standard was and is largely dependent upon the exertions of the workers, the employers and the factory inspectors. Nor must it be forgotten that *pari passu* with improvement in factory environment there has been an immense advance in general sanitation outside the factory.

(3) PERSONAL WELL-BEING OF THE WORKER.

32. Since the earliest developments of the factory system there have always been employers who have not felt their social and moral obligations satisfied by fulfillment of the minimum requirements of the law, but have actively concerned themselves in promoting the health and welfare of their workers, not only by providing clean and well-ventilated work places and moderate hours of employment, but by providing facilities for obtaining food and by other means outside the ordinary range of factory management. Thus one of the special commissioners appointed to make inquiries for the commissioners on the employment of children in 1833 reported that—

The greatest mills I have always found to be the cleanest, the machinery most securely fenced off, and the hands of the neatest and most respectable appearance * * *. In Messrs. Strutt's mill at Belper each hand is allowed a pint of good tea or coffee, with sugar and milk, for $\frac{1}{2}$ penny, and medical assistance gratis. A dancing room is also found for them in this establishment.

33. In one of the earliest reports of the factory inspectors it is stated—

In some cases an active and anxious interest in the welfare of those employed has been evinced by the establishment of institutions and different regulations for the improvement of their moral and social condition which have been productive of great advantage. Some of these institutions have in view the providing of medical advice and medicines when ill, and occasional pecuniary assistance during sickness.

Such cases were, however, exceptional, and there is no doubt that it was not usually considered a part of the duty of the employer to make any special provision in these respects.

34. The children's employment commission reported in 1843 that—

Even in those trades and manufactures in which deleterious substances are used there is in general no accommodation for the workpeople to change their clothes on leaving their place of work, or to wash themselves if they remain at meal times; and it is very uncommon for any means to be provided for workpeople to dress and warm their food.

35. In the report of the royal commission on labor,¹ there is considerable evidence as to the need for increased interest being taken in these matters, especially as regards women—

In ordinary employments the lady assistant commissioners call attention to various common causes of unhealthfulness such as the absence of place for drying outer clothes when wet, absence of dining rooms and provision of hot water, or means of cooking or obtaining proper food in or near works.

36. In this gradual development of opinion as to what is needful to secure the well-being and efficiency of the worker, the factory inspectors have played an important part; though primarily concerned with the enforcement of the law, they have inevitably developed a wider view of their responsibilities. Since the first appointment of women inspectors, in itself a significant fact, this movement has been increasingly valuable, and the annual reports of the chief inspector contain constant evidence of the interest shown in such matters as the provision of washing facilities, baths, cloakrooms, overalls, canteens and messrooms. The influence of these wider views has, moreover, not been limited to individual employers and factories, but has led to the insertion, with the concurrence of the employers concerned, in orders governing employment in certain "dangerous" trades of elaborate requirements binding upon the whole trade.

(4) EFFECT OF OCCUPATION ON HEALTH.

37. Though individual writers had already drawn attention to the effect of different occupations upon health, it was in the beginning of the nineteenth century the common view that all occupations were equally healthful, provided that the hours of employment were not excessive and the conditions of ventilation and cleanliness were reasonable. It was only gradually that the influence of occupation upon health became more fully appreciated. The commissioners on the employment of children in 1833 reported as follows:

That this excessive fatigue, prevention of sleep, pains in various parts of the body and swelling of feet experienced by young workers, coupled with constant standing, the peculiar attitudes of the body and the peculiar motions of the limbs required in the labor of the factory, coupled with * * * the impure atmosphere did sometimes terminate in the production of serious permanent and incurable disease.

38. About the same time Dr. Turner Thackrah² drew attention to the effects of the principal trades and professions on health and lon-

¹ H. C., 1893, XXXII-XXXIX.

² The Effect of Arts, Trades and Professions on Health, by C. Turner Thackrah, 1832.

gevity. He pointed out that mortality was greater in the manufacturing districts, and called attention to the effect on health, not only of atmospheric impurities and excess of labor, but also of dust and gaseous impurities, posture, muscular effort and other conditions of employment. He pointed out that in many occupations injurious conditions existed which might be immediately removed or diminished.

39. The children's employment commission (1840), which was the first commission to make investigations into the conditions outside the textile trades, reported that—

The work in which children and young persons are employed is seldom in itself oppressive, or even laborious; and very few indeed of the processes in the care and management of which children take any part are in their own nature injurious; but to this there are some lamentable exceptions in certain processes connected with the manufacture of metal wares, earthenware, and of glass.

40. In 1853 and 1854 were published two reports by Mr. A. G. Finlaison, the actuary of the national debt, on the subject of sickness and mortality among members of friendly societies. He showed that the demand for sickness allowances depended, not so much on difference of locality or on the density of the aggregation of the population, as upon the amount of the expenditure of physical force.¹

41. In 1857 Dr. H. Greenhow, lecturer on public health at St. Thomas's Hospital, made an elaborate investigation into the incidence of mortality from lung disease and other causes. He found that there existed no fixed relation between the prevalence of pulmonary affections and the size of towns. He suggested that various disturbing causes seemed capable of displacing the normal proportion and, of these, probably occupations and modes of life were the most influential.

It is well ascertained that the great mortality among grinders and cutlers arises from the irritation caused by the mechanical particles produced during the process of manufacture and received into the lungs with the air in respiration.

42. This report was published by the board of health, with an introduction by their medical officer, Sir John Simon. The public health act passed in that year led to the transfer of powers of the board to the privy council, and one of the earliest acts of Sir John Simon as the medical officer of the new central authority was to instruct Dr. Greenhow to investigate on the spot the conditions in

¹ "The only practical difference in the distribution of sickness that can be discovered was seen to turn on the amount of physical force called out by the occupation of the contributors; other features of the employment, the circumstances of the place, or of shelter or exposure under which that occupation was carried on, seeming to have but very minor influence on the question."

certain areas where lung diseases were specially prevalent.¹ Dr. Greenhow included amongst the conditions which his inquiry had shown to be direct causes of pulmonary disease, the inhaling of fine dust of metal and the breathing of air polluted by fumes or overheated. Other causes included habitual exposure to hot and exceedingly moist atmosphere, working in ill-ventilated and overheated factory rooms, vicissitudes of temperature, and strained posture.

43. The inquiries of the children's employment commission (1862) showed that, in spite of the general development of industry, many of the evils revealed by the children's employment commission, appointed in 1840, still existed and called for redress.² Though primarily concerned with the conditions of employment of children and young persons, the commission necessarily dealt with many conditions which affected all workers. The conclusions of Dr. Greenhow, which were fully confirmed by their own inquiries, were freely quoted. The Factory Acts (Extension Acts), 1864 and 1867, which followed, marked the end of a stage. Parliament had intervened to remove certain general conditions of employment obviously prejudicial to health. Though the reports of the registrar general have constantly drawn attention to the influence of occupation upon mortality, public interest and scientific inquiry have since been largely diverted to questions affecting the health and welfare of the worker outside the walls of the factory.

44. The Education Acts, 1870 and 1876, placed education within the reach of every child, and established compulsory attendance. The Sanitary Act of 1866 was followed by the Public Health Act, 1875, which is still the principal measure dealing with all questions of public health. That any further general intervention by Parliament was unnecessary in the trades already under the factory acts was the considered opinion of the commission on the consolidation and amendment of those acts, which reported in 1876. For the future legislation was to be largely confined to dealing with the special conditions of particular industries. It took two forms: First, acts were passed dealing with single industries, such as laundries; and secondly, the State was given power to confirm, or later themselves to make, codes of regulations specially designed to protect the worker against the effects upon health of "dangerous" trades or processes.

¹ Reports by Dr. Greenhow are included in the third and fourth reports of the medical officer of the privy council, which were laid before Parliament in 1860 and 1861.

² Thus of one center of the metal industry they report that—

Considering, therefore, the early age at which the children go to work, the injurious state of their places of work, the lowering and exhausting modes of their employment, the unreasonable and excessive hours of work, irregular and undefined hours for meals, late work on Saturdays, or extra work in the earlier part of the week to make up the time granted for relaxation on Saturday afternoon, and exposure to frequent accidents of all kinds from machinery, it will be acknowledged that on physical ground legislative interference is required as a protection to the young in this large and important department of manufacture.

45. Under the influence of Dr. Greenhow's reports the factory Acts (Extension Acts), 1864 and 1867, conferred upon employers the power, with the approval of the secretary of state, to make special rules to secure the requisite conditions of cleanliness and health. Further, where any process was carried on by which dust was generated and inhaled by the workman to an injurious extent the inspector was given power to require the provision of a fan or other mechanical means for the prevention of inhalation. Under section 8 of the Factory and Workshop Act, 1891, if the secretary of state certified any machinery or process as dangerous or injurious to health, the chief inspector might, subject to certain safeguards, make proposals and require the adoption of special methods. These rules, like those made under the Act of 1864, only referred to single factories. Section 28 of the Factory and Workshop Act, 1895, strengthened these powers and extended them to cover rules prohibiting employment, or modifying or limiting the period of employment for all or any class of persons.

46. Finally, the Factory and Workshop Act, 1901, consolidated previous legislation which had for its object the protection of the health of the worker. It conferred powers upon the secretary of state to make regulations applying to all factories where particular processes injurious to health were in operation. The regulations are normally divided into two parts—the duties of the employer and the duties of persons employed. They deal with such matters as the removal of dust or fumes, method of manufacture, certificates of fitness before employment, periodic medical inspection, suspension of affected persons, costume (overalls, respirators, clogs, gloves, etc.), provision of messrooms and cloakroom, provision for the partaking of food in work places, and washing and bath accommodation. The act also continued the power given by previous acts to the inspector to require the provision of a fan or other means for preventing inhalation. A provision first included in the Factory and Workshop Act, 1895, is also continued, under which the secretary of state may require the notification of certain diseases contracted in the factory or workshop, including those arising from lead, phosphorus, arsenic, mercury, or anthrax. By special order of 1916 this provision was extended to toxic jaundice.¹

47. In addition to dealing, as has been seen, with the hours of labor and factory sanitation, the act of 1901 carried further previous enactments for the safeguarding of personal health. Home work was brought under special control; notification of the occurrence of

¹ Under section 8 of the Workmen's Compensation Act, 1906, the secretary of state has power to make orders extending the provisions of the act to disease contracted in the course of employment.

industrial poisoning was extended; dangerous machinery had to be more strictly fenced, and certain dangerous employments were forbidden to young persons; and lastly, the provision of the act of 1891 that a woman might not be employed within four weeks of giving birth to a child received under the new act increased administrative attention.

48. In submitting their report the committee desire to make certain qualifications and reservations for the consideration of those who study its pages. First, they wish to express the view that a true understanding of the questions dealt with in the report is only practicable if the facts and findings set out in these pages are considered in relation to the history of industrial hygiene in England. There is no greater mistake than to suppose that care for the health of the worker and the introduction of welfare supervision are new and untried ideas invented, or at least patented, by the committee. In this matter, the committee enter into other men's labors; but to them has been given the opportunity of urging the application of previous knowledge in a great national emergency, rapidly and on a considerable scale. During the last 20 years immense progress has been made under the factory department of the Home Office in many of the essentials of health in the workshop. The reports of the chief inspector of factories have set out year by year the milestones of this advance. For several years before the European War there were not wanting signs that employers were beginning to recognize the importance of humanizing the life of industrial workers and providing for them better conditions, and the Police, Factories, etc. (Miscellaneous Provisions), Act of 1916, promoted by Mr. Herbert Samuel when home secretary (which passed parliament subsequent to the issue of the committee's first reports), is evidence of the desire of the central authority in the same behalf.

Secondly, the committee wish to point out that in spite of the great progress which had been made it remains true that up to 1914 relatively little attention had been paid by employers and others responsible to the steadily accumulating evidence of the influence of occupation upon health, and but little effort had been made scientifically to investigate its causes. Efforts to protect the health of industrial workers had been mainly based on the need of mitigating or removing admitted evils as they arose, rather than on the actual results of scientific inquiry and research. No doubt, partly as a result of the appointment of medical inspectors by the Home Office, increasing attention had in recent years been devoted to the critical examination of certain "dangerous" trades; but most trades are not "dangerous," and the vast bulk of industrial disease did not find its origin in dangerous trades. Yet there is the strongest evidence that rates of sickness and mortality amongst males had been

materially affected by occupation. In spite of this well known fact much remained to be learned as to what are its causes, whether they are peculiar to individual occupations or are common to many, whether they are the same for sickness as for mortality, to what extent they depend upon variable factors, and to what extent they are removable. Then as to the injurious effects of industry upon women and young persons, reliable data may be said to have been almost wholly lacking, as they are equally lacking in respect of the relation of fatigue to disease. Again, the proper length and distribution of hours of labor—spells, pauses, overtime—in relation to output is another problem which has never yet been scientifically explored. The committee here also found themselves without data. Once more, though attention is now being given to so-called “scientific management,” evidence is still wanting to show how far the speed of working can be increased or the method modified without involving an undue physical or mental strain on the worker, which counterbalances or even destroys the advantages claimed. In the absence of reliable data on these and other problems of industrial organization, the difficulties in the way of a wise handling of the special problems arising out of the war have been greatly increased. The committee mention these points with a view to laying emphasis upon the imperative need of a more accurate understanding and a firmer and more comprehensive grasp of the whole problem of health and physique in relation to industry. In the committee's view it is necessary to make arrangements, without delay, for a national scheme of industrial medical research, and to accord fuller recognition to the importance of industrial hygiene.

49. Thirdly, it is important to remember that the work of the committee has been concerned with an emergency. The situation to be explored was continually changing and expanding. It would have been improper and impracticable to undertake any investigation which delayed output or interrupted the arrangements of the factory. Consequently the committee have been debarred from making various experiments and inquiries which had suggested themselves as likely to contribute to the elucidation of the matters referred to them. Notwithstanding these limitations, there has been, during the period of the committee labors and owing to the public spirit and foresight of the ministry and of directors, proprietors, managers, foremen, and workpeople, a very remarkable advance in all that makes for industrial betterment. The munition worker is a type of all workers, and the principles of the present report concern, in fact, all forms of industrial labor. The committee earnestly hope that every effort will be made to secure this progress as a permanent gain to the whole nation.

50. Lastly, the committee recognize that the various questions raised in the present report are intimately related to larger social and industrial problems, which lie outside their reference, but as to which they are deeply concerned. First and foremost there is the fundamental question of shorter hours of labor from a political and economic point of view (as well as from a health point of view); the committee are convinced that this question lies near the root of the whole labor problem. Secondly, there is the far-reaching issue of the social and economic conditions of women's labor (over and above the issues of health with which the present report deals), a matter of vital importance to the future of the British race, for the health conditions of women are even more inseparable from the social condition than in the case of men. Thirdly, there is the question of the solidarity of industrial society, the interdependence between employer and workman, which is closely related to the whole issue of the status, health and physical equipment of the worker. And fourthly, there is the title of the worker to an effective voice in regard to the conditions under which he works. If industry be indeed a national service, the object of those engaged in it is the good of the community as a whole, and the worker should have a fair and legitimate share in the responsibility of the transaction. The committee are convinced that these four problems must be faced and solved if ever the State is to lay sound foundations for the health and physical efficiency of the industrial worker.

SECTION III.—RELATION OF FATIGUE AND ILL HEALTH TO INDUSTRIAL EFFICIENCY.

INTRODUCTION.

51. The personal health and physical efficiency of the munition worker, as of all industrial workers, are measurable by two standards—first, that of fatigue, weariness and exhaustion of the healthy physical faculties and functions of the individual; and secondly, that of disease. It is not possible always to differentiate these two departures from the normal, or to say when fatigue passes beyond the confines of what is physiological to that which is pathological. It is obvious there comes a stage in the processes of fatigue where recovery in any individual falls short of the diurnal rhythm of rest and work, and its degree or character is so severe as to be, in fact, a form of disease. Indeed, the truth of this proposition is one which is necessary to a sound understanding of the problem which presents itself. It is necessary to widen the whole view and apprehension of the subject of health and disease in relation both to industry and to the personal welfare and capacity for work of each workman. The science and art of medicine is not restricted to the diagnosis and cure of disease in its gross forms; it includes also a knowledge of how disease comes to be, of its earliest beginnings, and of its prevention. It is, in fact, the science and art of health, of how man can learn to live a healthful life at the top of his capacity of body and mind, avoiding or removing external or internal conditions unfavorable to such a standard, able to work to the highest power, able to rest to the fullest, growing in strength and in the *joie de vivre*. The new preventive medicine must not be understood to consist only of sanitation, of the isolation from the community of cases of infectious disease, of disinfection and outward cleanliness, and of the registration of births, deaths and other vital statistics. These are, of course, matters of the first importance. But much more is required. The individual man as an animal—the body in all its parts, the senses and their functioning; the nutrition of the body, its growth and development, its capacity for work, its powers of resistance—must receive practical consideration. The fight against disease is something more than the closing of its channels of communication, something more than an avoidance of the ways and means of its infection and invasion, certainly much more than a registration of its effects, a record of the

morbidity and mortality which follow in its train. The turning point of the battle is elsewhere. The first line of defense is a healthy, well-nourished and resistant human body. And to this end the whole man must be dealt with, for he is something more than animal. His body is in greater or less degree the instrument and expression of emotion, intellect and will. There is thus a psychological aspect of preventive medicine hitherto greatly neglected. Nor is the individual, taken at any one moment, the whole of the issue. There is his life history, his heredity, his family, his domestic life, his personal habits and customs, his home as well as his workshop. In short, preventive medicine to be effective must deal with the man, the whole man, as an individual as well as a member of the community. While this is true of preventive medicine generally it is particularly true in regard to that portion of it which has been referred to the committee for examination. The subject of industrial efficiency in relation to health and fatigue is thus in large degree one of preventive medicine, a question of physiology and psychology, of sociology and industrial administration. Before dealing with many of the practical questions involved the committee think it desirable to refer briefly to some of the principles underlying present knowledge of fatigue and personal health, for upon a right understanding of fatigue, its causes and its relation to efficiency, the practical solution of the problems raised seems to depend.

DEFINITION AND CAUSATION OF FATIGUE.

52. *Fatigue is the sum of the results of activity which show themselves in a diminished capacity for doing work.*—In ordinary experience fatigue is generally associated with familiar bodily sensations and these sensations are often taken to be its measure. It is of vital importance for the proper study of industrial fatigue, however, to recognize not only that bodily sensations are a fallacious guide to the true state of fatigue which may be present, and a wholly inadequate measure of it, but also that fatigue in its true meaning advances progressively, and must be measurable at any stage by a diminished capacity for work, before its signs appear plainly, or at all, in sensation.

53. In the animal body the performance of work depends on the activities of parts which are best considered under three groups:

First. The complex nervous mechanisms of the brain and spinal cord, which are concerned in the initiation and distribution of impulses to action.

Second. The nerves, which conduct the impulses to muscles.

Third. The muscles themselves, which by contracting finally perform external work.

Fatigue has been separately studied in all these parts. In its essential features the fatigue of all alike has been found, when it occurs, to depend not upon the simple using up—"exhaustion"—of the substances supplying the chemical energy which is liberated during work, but upon the accumulation within the living elements of the products of the chemical changes involved. Fatigue of the animal machine, that is to say, is not to be compared with the failure of fuel as in a steam engine, or with the running down of a clock weight, but rather with the clogging of the wheels in some mechanism by dirt.

54. The chemical products of activity in the nervous and muscular elements are removed by the blood, in part directly by irrigation and in part indirectly through chemical changes in the tissue itself produced by constituents of the blood. Rest after activity is not a passive state, therefore, but is itself an active process, or a series of active processes, leading to a restoration of the normal capacity for work. Time is required for these, and the time taken will be in proportion to the amount of restoration needed. There will be a definite relation accordingly between the degree of any given activity and the time necessary for the completion of the subsequent restoration process. If the activity is repeated too quickly to give time enough for restoration after each action, fatigue will become progressively more intense as the debit balance accumulates, and each repeated act in consequence will be more and more impeded, and will become smaller, until further action is impossible.

55. Of the three groups of organs just mentioned—the nervous system, the nerves, and the muscles—particular chemical and structural characters will decide in each case what time relation must exist between action and the rest needed for complete repair. In the tired man the symptoms of fatigue are referred to the muscles; they ache, or they may appear to "give way under him," but in reality the most severe bodily activity fails to produce any close approach to complete fatigue of the muscles. The fatigue is fatigue of the nervous system, though in sensation its effects may be referred to the muscles themselves. A hunted animal may be driven to intense muscular fatigue, but in this extreme case the blood becomes charged with chemical products of activity, for the elimination of which no opportunity is given, and the muscles, with every other organ of the body, become poisoned. Even in laborious work it is doubtful whether a man by voluntary effort can cause his muscles to approach advanced fatigue. It is well known that a man apparently "run to a standstill" in a race may upon some new excitement run freshly again, under augmented stimulus from the nervous system, initiated there perhaps in part along new paths. The problems then of indus-

trial fatigue are primarily and almost wholly problems of fatigue in the nervous system and of its direct and indirect effects.

THE RHYTHM OF ACTION AND REST.

56. The necessary time relation between an action and the recovery from it in rest has been mentioned already. For every acting element a given rhythm of activity will allow exact recovery after each act, and will maintain the balance between action and repair throughout a long series. The heart, for instance, in alternating contraction and relaxation, may continue to beat incessantly through the life of a man without any accumulated fatigue for 70 years or more. Among the great variety of nerve centers there will be found a great variety in these time relations. Some may allow a relatively rapid rhythm, as in the act of breathing, where the rhythm, which is a nervous rhythm, may be almost incessant for years, while at the other end of the scale there are slower rhythms like those shown in the need for diurnal sleep.

57. In connection with this natural pace of the animal machine, to and fro, from action to rest, reference must be made to the wide adaptability of the animal mechanisms, and especially to that of the nervous system, in response to training, use and habit. Complicated coordinations in the nervous system, at first easily fatigued, may by training, and, as it seems, by some improvement in the routes of connection due to the increase of traffic itself, become capable of maximum efficiency at a more rapid rhythm. A man will swing each leg, weighted with a heavy boot, as in walking, for 10,000 times in an unbroken march without notable fatigue, but he can not as an impromptu exercise raise his lightly weighted finger for more than a few score times at no faster rate before the movement comes to complete standstill.

58. The problem of scientific industrial management, dealing as it must with the human machine, is fundamentally a problem in individual capacity, physical and mental, and in industrial fatigue. The rhythms of industrial conditions required by the hours of labor, the pace of machinery or that of fellow workers, or otherwise, are imposed upon the acting bodily mechanism from outside. If these industrial rhythms are faster than the natural rhythms of the body they must produce accumulated fatigue, and cause an increasing debit, shown in a diminished capacity for work. It is therefore the problem of scientific management to discover in the interests of output and of the maintained health of the workers what are the "maximal efficiency rhythms" for the various parts and faculties of the human machine. These must be determined by the organized collection of experience or by direct experiment. They must be separately deter-

ruined, moreover, not only for the performance of relatively simple muscular movements, all of which depend on the action of "lower" nervous centers, but also for the manifold faculties of the various systems of the body, and for the "higher" coordinating centers, and for all of these the natural rhythms must be studied for the best arrangement of industry, the hours, shifts, spells, pauses, the periods of sleep and holiday on the one hand, and the conditions of factory environment on the other.

SIGNS AND SYMPTOMS OF FATIGUE.

59. It must be repeated that the bodily sensations of fatigue are not a measure, or even an early sign, of it. Real or objective fatigue is shown and is measurable by the diminished capacity for performing the act that caused it.

BODILY FATIGUE.

60. Fatigue following muscular employment is primarily nervous fatigue, as explained already, and it has been seen that no advanced degree of muscular fatigue as such can be obtained by voluntary action, for fatigue in the nervous system outstrips in its onset fatigue in the muscles. In accustomed actions, however, as in walking or digging, where there has been habituation, the activity may be so prolonged without great nervous fatigue as to give approaching "exhaustion"—that is, notable loss of chemical substance—in the muscles. Industrial work is habitual work, but the case in which muscular labor is so intense and prolonged as to give exhaustion in this sense need not be considered here, nor the causation of the special symptoms which arise. It must be noted, however, that practically the whole of the mechanical energy and heat yielded by the body during work comes from the chemical energy stored in the muscles. In proportion as this store is called upon, and quite apart from the question of fatigue, it must be made good by supplies from the blood and ultimately from the food. Practically the whole of the energy transformed in the muscles is derived from carbohydrate material, and the importance of this in relation to the diet of workers is well known.

61. While referring to this point of muscular fatigue, the committee wish to record the view that for work in which severe muscular effort is required it seems probable that the maximum output over the day's work and the best conditions for the workers' comfort and maintained health will be secured by giving short spells of strenuous activity broken by longer spells of rest, the time ratio of rest to action being here, for maximal efficiency, greater than that for the employments in which nervous activity is more prominent or more complicated than in the processes involved during familiar muscular work.

NERVOUS AND MENTAL FATIGUE.

62. It is under this head, as has been seen, that the special problems of industrial fatigue arise. The signs and symptoms of the fatigue will depend upon the nature of the particular work done, whether it be general bodily work of this or that kind, carried out in fixed routine, or whether it involve mental activity of a simple or of a more complicated kind. The fatigue may spring—(a) from the maintained use of intelligence and observation with varying degrees of the muscular effort necessary in every kind of work; or (b) from the maintenance of steady concentration upon one skilled task; or (c) of distributed attention, as when several machines are to be tended or other manipulations performed; or (d) it may depend upon the continued use of special senses and sense organs in discrimination, whether by touch or sight; or (e) upon other parts of the body acting upon the nervous system. It will be affected greatly according to whether the worker has opportunity for obeying his natural rhythms, or whether unnatural rhythm is imposed upon him by the pace of the machine with which he works or by that of his fellow workmen. Considerations so inexplicable at present in terms of physiology as to be called “psychological” will also arise; if the work is of a “worrying” or “fussy” kind, with a multiplicity, that is to say, of imposed and irregular rhythms, fatigue will be more rapid, perhaps on account of the more numerous, and “higher,” nervous centers which become implicated.

63. Monotonous work—and much industrial work is monotonous—presents some special problems. It has been seen that uniformly repeated acts tend to become in a sense “automatic,” and that the nerve centers concerned become less liable to fatigue—the time ratio of necessary rest to action is diminished. But when monotonous series are repeated fatigue may appear in what may be called the psychological field, and a sense of “monotony” may diminish the capacity for work. This is analogous to, if it does not represent, a fatigue process in unrecognized nervous centers. Conversely, “interest” may improve the working capacity even for a uniform monotonous activity, and the interest may spring from monetary incentives, emotional states, or, as some think, from states of anticipatory pleasure before meal time and rest (“end spurt”), or, again, from a sense of patriotism eager to forward the munitions output.

64. For practical purposes in industrial management two chief characteristics of nervous fatigue must be observed. First, during the continued performance of work the objective results of nervous fatigue precede in their onset the subjective symptoms of fatigue. Without obvious sign and without his knowing it himself, a man's capacity for work may diminish owing to his unrecognized fatigue. His time beyond a certain point then begins to be uneconomically

spent, and it is for scientific management to determine this point, and to determine further the arrangement of periods of rest in relation to spells of work or other body or environmental conditions that will give the best development over the day and the year of the worker's capacity. Second, the results of fatigue which advances beyond physiological limits ("overstrain") not only reduce capacity at the moment, but do physical or mental damage of a more permanent kind which will affect capacity for periods far beyond the next normal period of rest. It will plainly be uneconomical to allow this damage to be done.

65. For these reasons, chief among others, it is important to detect latent fatigue at the earliest opportunity, and since sensations of fatigue are unpunctual and untrustworthy, means must be sought of observing the onset of fatigue objectively.

TESTS OF INDUSTRIAL FATIGUE.

OUTPUT.

66. The true sign of fatigue is diminished capacity, of which measurement of output in work will give the most direct test. The output must be measured under the ordinary conditions of the work, and, in cases where from the nature of the work the output can not be automatically measured, it must be tested by methods which do not allow the workers to be conscious at particular times of the test being made. In this way the errors due to special effort from interest or emulation will be eliminated. The results of work expressed in output must be corrected by allowance for all variable factors save that of the worker's changing capacity; changes in supply of steam or electric power and of raw material, for instance, must be determined for correction and interpretation of the actual output returns. The output must be estimated for successive short periods (*e. g.*, each hour) of the day's work, so that the phenomena of "beginning spurt" and "end spurt" and other variations complicating the course of fatigue as such, may be traced and taken into account. Isolated tests of output taken sporadically will be misleading. The records must also extend over longer periods to show the onset of fatigue over the whole day and over the whole week, and under particular seasonal or other conditions, in order to detect and measure the results of accumulating fatigue.

67. Measurements of output must obviously be recorded at so much for each individual or for each unit group. The size of total output will be meaningless of course without reference to the numbers engaged. But it will also be important for proper management to take account of the output of particular individuals. This in many factory processes is easily possible, and when it has been done the re-

sults have shown surprising variations of individual output which are independent of personal willingness and industry, and have generally been quite unsuspected by the workers and their supervisors before the test was made. Information so gained is valuable in two respects. Good individual output is often the result of escape from fatigue by conscious or unconscious adoption of particular habits of manipulation or of rhythm. Its discovery allows the propagation of good method among the other workers. In the second place, these tests of individual capacity (or its loss by fatigue) give an opportunity for a rearrangement of workers and their assignment to particular and appropriate processes of work. Astonishing results, bringing advantage both to employer and employed, have been gained in this and other countries by the careful selection of individuals for particular tasks, based not upon the impressions of foremen but upon the results of experiment.

68. In passing it may be said that if the proper adaptation to particular kinds of labor of the relations of spells or shifts of work to rest intervals and to holidays is to be determined, as it can alone be, by appeal to experiment, it will of course be an essential condition for success that the workers should cooperate with the employing management and give their highest voluntary efforts toward the maximum output during the spells of work. It is not surprising that where employers, following tradition rather than experiment, have disobeyed physiological law in the supposed interests of gain—and for a century this has been almost universal—the workers have themselves fallen very commonly into a tradition of working below their best during their spells of labor. In so far as hours of work in excess of those suitable for maximal efficiency have been imposed, during the last two or three generations of modern industry, upon the workers a tradition of slowed labor must necessarily have arisen, probably in large part automatically, as a kind of physiological self-protection. Without some conscious or unconscious slackening of effort indeed during working hours of improper length in the past, the output might have been even more unfavorable than it is known to have been for the hours of work consumed.

ACCIDENTS AND SPOILED WORK.

69. An important and early sign of fatigue in the nervous centers is a want of coordination and failure in the power of concentration. This may not be subjectively realized, but may be shown objectively in an increased frequency of trifling accidents, due to momentary loss of attention. Such accidents may result in personal damage to the worker, trifling or serious, breakages of tools or materials, or the spoiling of work. In well-managed factories the incidence of accidents of this kind is recorded for unit periods throughout the day,

and these records may provide a good secondary index to fatigue, but only in so far as they are corrected by reference to the rate of work being done and other variables. The subject of accidents will be considered subsequently.

ASSOCIATED FATIGUE AND LABORATORY TESTS.

70. The primary sign of fatigue in a given function is diminished capacity. But there is evidence to show that accumulated fatigue in connection with a given act may affect adversely the condition of other parts of the nervous system not immediately employed. There is little experimental knowledge, however, as to whether this effect, shown in "associated fatigue," is more direct and definite in kind than the effect upon general health to be mentioned below. The appearance of associated fatigue will need for its detection and study the application of special tests, involving the use of suitable apparatus and laboratory accommodation.

71. It should be remembered, however, that experiments of this kind will have no validity unless the fallacies due to emotions and ideas, such as a sense of novelty, interest in the desired result, anticipation of release from experiment, unconscious suggestion by the observer, and so on, are eliminated by the most rigid attention to experimental conditions and by long series of control observations. The objects of experimentation must be trained for the purpose, and it is unlikely that tests of this kind will offer results of sufficient value to justify the special education of teams of selected workers for the prolonged studies which the method demands.

72. In view of the fact that the committee's sphere of experiment and observation comprised actual factories and workshops in all parts of the country, they have not engaged in any laboratory tests of fatigue, mechanical methods, experiments with the ergograph, etc. They have preferred to make their investigations of fatigue under conditions actually obtaining in the industrial world and comprising many individuals instead of few.

LOST TIME AND "STALENESS,"

73. The accumulated results of fatigue are damaging to general health, and they will be reflected in the sickness returns and in the returns of lost time. Many problems arise here which can not now be discussed in detail,¹ and they are complicated by the influence of other factors.

74. Reference must be made here, however, to a pronounced and common symptom of industrial fatigue, which appears to be the reflection in the workman of the results of accumulated nervous

¹ Further reference is made to this subject below and in the chapter on sickness and injury.

fatigue rather than a direct and measurable sign of it. In many munition factories the complaint has been made by workers, and not least by the most intelligent and willing of them, that they are feeling "done up" or "fair whacked," to use local phrases, and the evidence shows that this state of "staleness" has been common and obvious. By experienced managers and medical officers this condition of staleness is attributed almost wholly to persistent long hours and the deprivation of weekly rest. It has grave accompaniments, which paradoxically appear not only in a state of lethargy and indifference, but also in a craving for change and excitement. No doubt the restlessness of the condition must often predispose also to indulgence in the apparent alleviations given by alcohol. At all points the state is apt to set up a vicious circle in which the very need for change and rest prevents the proper use of such chances of rest as are given.

75. The committee hold the view that proper attention early in the war to the need for a weekly rest would have prevented a large part of the diminished capacity of this kind that was allowed to appear, and would have averted much costly and wasteful expenditure upon imperfect work. But stress must be laid here on a further point. For the avoidance of staleness in conditions of strenuous labor it is not enough to treat workmen in the bulk and to regulate daily and weekly rests upon a physiological basis devised for the average. Good management will consider always the individual workman as well. The committee have no doubt that in many cases, in which staleness is well marked or has even advanced to definite sickness, a single "day off," given occasionally at the right time, would have avoided much wasteful reduction of capacity and in the worst cases the total loss of many days work.

THE STUDY OF INDUSTRIAL FATIGUE AND ILL HEALTH.

76. By studies of industrial fatigue measured by tests of individual output a large body of valuable information has already been gained in various countries, and its application wherever management is scientific has become a commonplace of administration.¹ It must be admitted, however, that in England, and no doubt to the detriment of both health and wealth, management based upon the experimental science of industrial fatigue is far less common than in the factories and business concerns of America and of Germany. Hitherto there has been a surprising uncertainty commonly found in this country, even where professional knowledge is to be expected, with regard to the proper solution of some of the most elementary practical problems of labor management.

¹ References to published work may be found conveniently in *Fatigue and Efficiency*, by Josephine Goldmark, New York, 1913 (third edition), and in the Interim Report to the British Association (Manchester, 1915) by the committee upon the question of fatigue from the economic standpoint.

77. There is the most urgent need for the application of the results of experience scientifically acquired. Upon a sudden national emergency the accumulation of fatigue and its results on workers may well be temporarily disregarded, but when the race is to be a long one, a failure to conserve the maximum efficiency of the workers must be disadvantageous. Misguided efforts to stimulate workers to feverish activity in the supposed interests of industry or national welfare are likely to be as damaging to the desired result as the cheers of partisans would be if they encouraged a long-distance runner to a futile sprint early in his race. Even during the urgent claims of a war the problem must always be to obtain the maximum output from the individual worker which is compatible with the maintenance of his health, strength, and capacity. Life itself must not be sacrificed to output. In war time the workmen will be willing, as they have shown in so many directions, to forego comfort and to work nearer the margin of accumulating fatigue than in time of peace, but the country can not afford the extravagance of paying for work done during incapacity from fatigue just because so many hours are spent upon it,¹ or the further extravagance of urging armies of workmen towards relative incapacity by neglect of physiological law.

78. The committee have found an increasing number of instances in which the onset of industrial fatigue has been avoided (1) by intelligent observation of the output; (2) by regular study of the returns of sickness and of lost time; (3) by prompt initiative in adapting the hours and conditions of work to physiological need; (4) by providing proper facilities for the feeding, resting and recreation of the worker. These cases are, however, still far from universal. Taking the country as a whole, the committee are bound to record their conviction that conditions of reduced efficiency and lowered health have often been allowed to arise which might have been avoided without reduction of output by attention to the details of daily and weekly rests and other similar means of welfare and favoring conditions. The signs of fatigue are even more noticeable in the case of the managers and foremen, and their practical results are probably more serious than in the case of the workmen.

80. Finally, it must be remembered that when fatigue passes beyond physiological limits ("overstrain") it becomes ill health, which leads not only to reduced output but to more or less serious damage of body or mind. There is also, of course, much industrial sickness and disease which bears no exact relation to fatigue, though it may follow or precede it. Subsequent sections of the present re-

¹ On the question of Sunday work by exhausted men, one foreman said he did not believe in "a holiday on double pay." Another remarked that Sunday work gave "six days' output for seven days' work on eight days' pay."

port are concerned with general and special diseases associated with factory life, and an account of means for their amelioration. Here it is only necessary to draw attention to the primary and fundamental importance of maintaining a high standard of health in the industrial worker. For without health there is no energy, and without energy there is no output. The actual conduct of business is thus primarily dependent upon physical health. Moreover, health bears a direct relation to contentment, alertness, and the absence of lassitude and boredom, conditions bearing directly upon industrial efficiency. In this matter the interests of the employer and the workmen are identical. Nor are their respective responsibilities separable. The employer must provide a sanitary factory and suitable conditions of labor. The workplace must be clean and wholesome, properly heated and ventilated; there must be suitable and sufficient sanitary accommodation; dangerous machinery and injurious processes must be safeguarded; circumstances necessitate in many factories the establishment of industrial canteens, the provision of seats, suitable overalls, lavatories and baths, rest rooms, and first aid appliances. Owing to the factory employment of many workers for the first time, and of increased numbers of women, often at a distance from home, arrangements must be made for individual supervision and the maintenance of their health. The employment of boys also calls for special vigilance and attention.

Further, it has been recognized for many years that the wise employer considers the personal well-being of his workpeople. He can not be only satisfied with external betterment. He will have regard to the individual worker. Their nutrition, their rest and recreation, their habits of life, are all of interest and importance in relation to their health and efficiency.

81. The problems of industrial fatigue and ill health, already soluble in part by reference to an available body of knowledge well known and used in other countries, have become acute during the great recent development of the munitions industries of Great Britain. It is not too much perhaps to hope that the study of industrial fatigue and the science of management based upon it, which is now being forced into notice by immediate need, may leave lasting results to benefit the industries of the country during succeeding years of peace.

82. The national experience in modern industry is longer than that of any other people. It has shown clearly enough that false ideas of economic gain, blind to physiological law, must lead, as they led through the nineteenth century, to vast national loss and suffering. It is certain that unless industrial life is to be guided in the future—

(1) by the application of physiological science to the details of its management, and (2) by a proper and practical regard for the health and well-being of our workpeople in the form both of humanizing industry and improving the environment, the nation can not hope to maintain its position hereafter among some of its foreign rivals, who already in that respect have gained a present advantage.

SECTION IV.—THE INDUSTRIAL EMPLOYMENT OF WOMEN.

83. In considering the conditions of employment of women workers as compared with those of men, the committee have recognized that account must be taken not only of physiological differences but also of those contributions which women alone can make to the welfare of the community. Upon the womanhood of the country most largely rests the privileges first of creating and maintaining a wholesome family life, and secondly, of developing the higher influences of social life—both matters of primary and vital importance to the future of the nation. In modern times, however, many of the ideals of womanhood must find outward expression in industry, and in recent years hundreds and thousands of women have secured employment within the factory system. The problems thus raised are numerous, but broadly they may be considered as chiefly concerned with the wise and effective organization of women's industry, in such a way as to protect and safeguard their unique contribution to the State. The engagement of women in the manufacture of munitions in the present war presents many features of interest. Probably the most striking is the universal character of their response to the country's call for their help. Of equal social and industrial significance is the extension of the employment of married women, the increased occupation of young girls, and the revival of the employment of women at night. The munition workers of to-day include dress-makers, laundry workers, textile workers, domestic servants, clerical workers, shop assistants, university and art students, women and girls of every social grade and of no previous wage-earning experience; also in large numbers, wives and widows of soldiers, many married women who had retired altogether from industrial life, and many, again, who had never entered it. In the character of the response lies largely the secret of its industrial success, which is remarkable. The fact that women and girls of all types and ages pressed into industry, on account of the war, showed a spirit of patriotism which was as finely maintained as it was quickly shown. Conditions of work have been accepted without question and without complaint which, immediately detrimental to output, would, if continued, be ultimately disastrous to health. It is for the State to safeguard the devotion of its workers by its foresight and watchfulness lest irreparable harm be done to body and mind both in this generation and the next. More than ever in the past should consideration now be given to the well-being of young girls fresh from school, of the prospective mother, and of the working mother whose care is

especially claimed by her infant during the first months of its life; for more than ever is their welfare of importance to the nation, and much more than ordinarily is it threatened by conditions of employment.

84. Speaking generally, there are five principal matters which, apart from the question of wages, concern the health and industrial output of the woman worker, and which demand the careful and continuous attention of employers in regard to the employment of women in factories on any large scale, viz, (a) the physical condition and capacity of the woman worker, including the far-reaching issue of maternity; (b) the period of employment (including night work, length of hours, overtime, etc.), and its relation to home duties; (c) the necessity of rest pauses and the convenient provision of meals; (d) the sanitary condition of the factory and the hygiene of the worker; (e) questions of management and supervision. The committee recognize that certain collateral issues, such as housing, transit, and the means of recreation, are also intimately concerned in the welfare of women workers, although they may be somewhat outside the immediate sphere of the employer. The committee have given careful consideration to the subjects enumerated above, and they desire to offer some observations under each heading. They appreciate the exceptional importance of women's labor in the present emergency, and in the future, and they do not desire to suggest the imposition of conditions which are likely to embarrass employers or restrict the usefulness of women. They confine themselves, therefore, to matters which in their view are both necessary and urgent in the interest of the women themselves, and the industrial output of which they are capable.

THE PHYSICAL CONDITION OF WOMEN WORKERS.

85. In considering the physical ability of woman successfully to withstand the fatigue consequent upon continued heavy work in a factory it should be remembered that her body is physiologically different from, and less strongly built than, that of a man; that her muscular system is less developed; and that she may have lived a sedentary or domestic life without contracting the habit of taking active and regular exercise. The nature of her work should therefore be determined with due regard to its effect on her immediate and future health. Certain ailments and forms of physical disability to which women are liable are readily caused, or at least accentuated, by inattention to these matters. Among such conditions are: (a) Disturbances of digestion, due to unsuitable food, irregular and hurried meals or fatigue; (b) anemia with possibly associated disease of the heart and circulatory system; (c) headache; (d) nervous exhaustion; (e) muscular pain and weakness, flat foot, etc.; and (f)

derangement of special physiological functions. Though these conditions may not in all cases be immediately incapacitating, they frequently have a tendency to become chronic in nature and far-reaching in effect; they lead directly to malnutrition and a reduction of body energy; if allowed to persist they inevitably lay the foundations of ill health and disease in later years; and in some cases they may exert an injurious effect on maternal functions. With a view to the adequate consideration of this subject the committee made arrangements in 1915-16 and in 1917 for two medical inquiries to be carried out in various factories where women were employed. The committee were fortunate in securing the services of Miss Janet M. Campbell, M. D., M. S. (one of the senior medical officers of the board of education), in this behalf, and they have received from her most valuable assistance not only in the clear and comprehensive reports of these particular inquiries but in all their consideration of health questions in relation to the employment of women. The report of the first medical inquiry, in which 1,326 women and girls were examined, will be found in the Interim Report (published 1917), pages 110 to 121; the second inquiry, in which 1,183 women were examined, is reported in Appendix B to the present volume. The medical examination of these women workers could not be made as complete or exhaustive as might well have been wished, partly because suitable accommodation for the examination was not always available, partly because the time at disposal was limited (women being summoned from their work), but chiefly because presumably healthy women are naturally shy and hesitant of all medical examination. In estimating the physical condition and the amount of fatigue, reliance had to be placed to a large extent by the doctor on statements and descriptions of symptoms given by the women. The heart, lungs, and abdomen could not be fully examined as a routine in all cases. (For particulars of medical inquiry see Appendix B.) As in the previous inquiry the workers were classified into three groups: (A) Normal and apparently free from fatigue; (B) suffering from some fatigue; and (C) suffering from well-marked fatigue. The results in regard to fatigue in the second inquiry were as follows:

England.	Number of workers examined.	A (healthy).		B (slight fatigue).		C (marked fatigue).	
		Number.	Percentage.	Number.	Percentage.	Number.	Percentage.
Factory No. 1.....	193	110	56.9	70	36.2	13	6.7
Factory No. 2.....	264	199	75.3	53	20.07	12	4.5
Factory No. 3.....	116	63	54.3	46	39.6	7	6.03
Factory No. 4.....	157	112	71.3	41	26.1	4	2.5
Factory No. 5.....	199	77	38.6	114	57.2	8	4.02
Factory No. 6.....	73	45	61.6	19	26.02	9	12.3
Factory No. 7.....	67	35	52.2	30	44.7	2	2.9
Factory No. 8.....	114	51	44.7	52	45.6	11	9.6
Total.....	1,183	692	58.4	425	35.8	66	5.5

86. It is interesting to observe in the following table the results of the two inquiries which, in spite of different conditions of the examination, are surprisingly similar:

	Number of workers examined.	Class A (healthy).	Class B (some fatigue or ill-health).	Class C (marked fatigue or ill-health).
Inquiry No. 1.....	1,326	763=57.5 per cent..	451=34.0 per cent..	112=8.5 per cent.
Inquiry No. 2.....	1,183	692=58.5 per cent..	425=35.8 per cent..	66=5.7 per cent.

87. These tables indicate generally the amount and degree of fatigue observed among typical women workers chosen at random. The following points clearly emerge:

(a) The proportion of serious fatigue amounting to marked ill health and incapacity for work is relatively small, approximately 5 per cent to 6 per cent of the cases examined.

(b) There is a considerable amount of slight fatigue, which varies from 20 to 57 per cent.

(c) The total proportion of women exhibiting definite signs of fatigue is about 40 per cent of all cases. But this percentage does not represent the full burden of fatigue, for the following reasons: (a) Much earlier fatigue is latent and objectively unrecognizable; (b) the women most seriously affected tend to drop out of factory life before they have served for any long period, and therefore are not included; (c) women knowing themselves to be fatigued were not willing in all cases to subject themselves to examination; and (d) the examination was necessarily superficial and incomplete, and only such as could detect definite and obvious fatigue, amounting almost to sickness.

88. It might have been anticipated that the findings of the second series of examinations would indicate an increase of fatigue, overstrain, or sickness owing to the longer period of work undertaken (nine months or more). On the other hand, the hours of work had been shortened, there had been less overtime and no Sunday labor, and there had been an immense improvement in the conditions of factory life. Dr. Janet Campbell discusses in her report the relation to the health of the woman worker of: (a) the character of the work; (b) the length of hours of work; (c) her nutrition and physical health; (d) the tax imposed upon her by bad housing conditions and inconvenient means of transit; and (e) the "welfare" conditions surrounding her at the factory. The committee concur in Miss Campbell's view of the relative importance of these matters. In spite of long hours and arduous labor there is no doubt that much fatigue is reduced or removed by active incentives to labor, such as interest, a sense of patriotism, higher wages, and a great improvement in the conditions of labor.

89. It is evident that while, physiologically, fatigue may be measured by a diminution in the capacity for doing work, it may easily increase to such a degree that it affects the health of the worker. And to this point Dr. Janet Campbell and her colleagues turned their attention. The ailments most frequently observed were indigestion, serious dental decay, nervous irritability, headache, anemia, and disorders of menstruation. Something like a quarter of the women workers examined failed in one respect or another; 7 per cent had throat trouble; 8 per cent suffered from eyestrain; and 9 per cent from swollen feet (*see* Appendix B). The report states that—

The commonest causes* of *indigestion* among women are dietetic, *e. g.*, unsuitable or improperly prepared food, the persistent use of certain unwholesome articles of diet, such as unduly rich substances or food containing excess of carbohydrates. Alcohol may be a cause, especially in older women, but this was not observed in the present examination.

Headache was fairly common. It could often be attributed to one or more causes, such as fatigue in transit, noise in the factory, eyestrain, general tiredness, and was often associated with anemia, indigestion, or carious teeth. Neuralgia was complained of by a number of workers evidently suffering from nervous fatigue. Sleeplessness, especially among women on night shift, was frequently accompanied by headache.

Anemia is most common among ill-fed, overworked girls in industrial districts, who have to work in badly ventilated and badly lighted rooms, under conditions which prevent proper exercise, especially in the open air and sunshine. A large number of the workers classed C showed signs of more or less severe anemia, frequently accompanied by hæmic murmurs. A higher percentage was noted in one or two factories where it was mainly due to prewar rather than postwar conditions, such as chronic malnutrition or work in artificial light. The improved diet and the usually healthy factory environment have no doubt acted as preventives of anemia, and as far as can be judged on general grounds, munition workers compare favorably in this respect with young women workers in other trades and industries. Indigestion, constipation, anemia, and headache are so closely associated that it is often difficult to say which is primary and which secondary. That all depend in considerable degree upon environment and habits of life, and they are remedied less by drugs or direct medical treatment than by improved hygiene and nutrition. Sunshine, fresh air, exercise, good food, and sufficient sleep are the most potent factors in the restoration to health.

Muscular pains, including aching or stiffness of the neck or limbs, are naturally common during the early weeks at the factory until the workers become habituated to unaccustomed muscular exercise. Among more experienced workers muscular pains may be complained of toward the end of a shift or attributed to a particular operation. They may indicate the commencement of fatigue in the worker or that the work is unduly heavy or otherwise unsuitable.

Nervous symptoms, such as neuralgia, irritability, nervousness, sleeplessness, or an undue tendency to worry were complained of by many women who were beginning to feel tired and worn. The symptoms were dependent on the general state of health rather than upon any organic defect.

90. The committee are relieved to find that the results of these inquiries indicate that, although for the reasons given in paragraph 87 (c) above, the amount of existing fatigue and sickness probably exceeds in considerable degree that discovered by the investigators, the women and girls employed at these factories are as a whole bearing the strain of their munition work remarkably well. The committee concur in the conclusions stated by Dr. Janet Campbell, viz:

(1) That there is a definite burden of fatigue, which though relatively small in amount as regards severe fatigue is considerable as regards that of a less severe character;

(2) That the fatigue and ill health are less than might have been anticipated having regard to the hours of work and the nature of the employment, and that this is due, broadly speaking, to the greatly improved attention to the health and welfare of the workers;

(3) That fatigue and sickness are greatest where heavy work is combined with long hours at the factory and associated with onerous domestic duties after factory hours;

(4) That unless brought under control, the considerable amount of moderate weariness and ill health now present is likely to reduce immediate efficiency and also exercise in many cases an injurious effect on subsequent health and on capacity for maternity;

(5) That although there has been substantial improvement in the conditions and circumstances of women's work in factories, further action is necessary if the amount of fatigue is to be diminished rather than increased. In particular the findings of this inquiry seem to indicate the necessity—

(a) For further shortening of the hours of labor for women;

(b) For restricting women's work in the heavier branches of industry to those who are young, physically fit, and capable, and who have not arduous home duties to perform;

(c) For the continuation and development, wherever women are employed in factories, of hygienic conditions and especially "welfare" arrangements (including industrial canteens); and

(d) For making appropriate provision for effective medical supervision, both on entrance to the factory (in heavy and exceptional occupations) and subsequently, by means of the services of medical officers (women preferred) and nurses, and in the form of suitable accommodation as to rest rooms, first-aid appliances and well-equipped surgeries.

91. *Maternity*.—The employment of large numbers of women of child-bearing age has also raised the problem of maternity and, owing to causes associated directly with the making of munitions, it is apt to become acute and urgent in an unusual degree. The overcrowded condition of many munition areas and the abnormal influx

of women into these areas naturally strain to the breaking point the always inadequate provision for maternity which exists locally. The impression the committee have gained from inquiries at numerous factories and among many of those responsible for the supervision and welfare of the workers is that though the problem in an acute form is limited to a relatively small proportion of women workers, there is somewhat urgent need for immediate action in regard to the care of those expectant mothers, married and single, who are unable to make suitable arrangements for themselves.

92. The care of the mother naturally falls into three stages—prenatal, natal, and postnatal.

Prenatal.—The married woman with a home of her own usually leaves the factory in the early months of pregnancy, or at least as soon as her condition becomes obvious. No special provision is required for her apart from the provision for women as a whole. A certain number of women, however, are obliged to work almost until their confinement as they have no other means of livelihood. In filling factories it is usual, on account of the danger due to explosion or the handling of poisonous materials, to discharge a woman as soon as she is known to be pregnant. In engineering factories the practice varies. Where the work is heavy and it is not possible to transfer women to lighter processes they may be discharged as soon as their condition is recognized. Where lighter work is available and the general environment suitable they may be retained until, say, the seventh or eighth month. There is the further difficulty of suitable accommodation for the pregnant woman awaiting confinement.

Natal.—Again, the number of lying-in homes and hospitals is notoriously inadequate to the needs of the country as a whole. In many overcrowded munition areas the workhouse is the only institution to which women can go for their confinements, an arrangement naturally repugnant to most women. Nor is there always available sufficient or skilled midwifery and nursing attendance.

Postnatal.—Thirdly, the postnatal care of the mother's own health is complicated by the need for suitable arrangements for her child. Practical questions, as Dr. Campbell points out, soon present themselves: "Where is she to live?" "How is she to support herself until fit to resume factory work?" "What is to become of the child whilst she is absent night or day?" The only statutory provision which relates to the employment of pregnant women or nursing mothers is section 61 of the Factory and Workshops Act, which states that a woman must not be employed within four weeks of giving birth to a child. It is obvious that the mother's first duty is to her young infant and that in the interests of its health she should not return to the factory until the expiration of a much longer period than

four weeks. But she may have to choose between remaining with her baby without adequate means of support or returning to well-paid work as soon as possible, even though this entails virtual separation from the child. A breast-fed infant is more likely to thrive than one which is brought up by hand, but an ill-nourished mother is either unable to nurse her baby or continues to do so only at undue cost to herself. Until the State is prepared to recognize the claims of nursing mothers to assistance and financial aid the lesser of the two evils may be for the mother to go back to work as soon as she is physically fit to do so, provided that she can insure the care of the baby during her absence.

93. It appears that the practice in regard to the employment of mothers with young infants varies in different factories. In some, with a view to encouraging breast feeding, no woman is supposed to be employed who has a child under 9 to 12 months of age. In others, no general rule exists and cases are judged on their merits. In some, no attention is paid to the age of the child. It is, of course, impossible to investigate all cases fully, and a woman who is badly in need of employment has often little difficulty in evading inquiries. Children are thus commonly left with relatives or "mindere," or sent to a day nursery when there is one.

94. Dr. Janet Campbell has submitted for our consideration the following maternity scheme for the assistance of munition workers:

(a) Skilled supervision of pregnant women is necessary, both factory and domiciliary, by a qualified and competent officer, in order to ensure that suitable arrangements are made for the confinement at home or in lodgings (engagement of the midwife or doctor, antenatal care, postnatal care, etc.) and for the care of the infant after birth. Such an officer would be able to bring the woman into touch with local agencies for assistance. She would also encourage thrift and proper preparation for the confinement. This supervision might be arranged by the welfare staff of the factory, though in large factories an extra officer with midwifery qualifications might be desirable for home visitation, etc.

(b) The provision of light employment may be made available inside or outside the factory during the later months of pregnancy, say from the 4th or 5th to the 8th or 9th month, and also after the birth of the child. In some factories this might be arranged as part of the general organization, in other factories all the work is too heavy or the general conditions too unsatisfactory to admit of pregnant women being employed at least after the early months. In such cases separate workrooms would be necessary, which might serve more than one factory, where lighter work such as sewing and mending might be undertaken (e. g., the sewing of exploder bags, the making of lighter boxes, the manufacture of overalls, etc.). Such small separate departments might also be used by other women temporarily ailing from one cause or another.

(c) Favorable welfare conditions are essential for all pregnant women, including the abolition of night work and, where possible, reduction in the length of the day shift. Arrangements for an adequate supply of suitable food, including milk, through the canteen or otherwise, is also advisable.

(d) Maternity homes should be established for women who cannot be confined at home or in their lodgings. These institutions should also provide,

where necessary, for preconfinement residence and lying-in accommodation. Maternity homes might be organized—(i) As a branch of an existing lying-in hospital available for normal and abnormal cases; or (ii) as an *ad hoc* maternity home of six or a dozen beds in charge of a competent midwife.

In connection with these homes, but not necessarily under the same roof, there should be accommodation for women before and, if necessary, after confinement. Arrangements should be available for married or unmarried women, and as far as possible the schemes should be self-supporting. Exchequer grants would be necessary for the establishment of such homes and also to make good deficits in the cost of working and maintenance, but the greater part of the maintenance expenses should be met by payments from the women themselves.

(e) Lastly, in many districts a crèche or day nursery is necessary for the children where they may be cared for during absence of the mother. The number of available "minders" to whom children would ordinarily have been sent has steadily diminished, largely because these women have themselves sought regular employment. Mothers working long shifts are physically unable to devote as much attention as they would wish to the care of their homes and children. There is thus a substantial case for an increased provision of nurseries which would take charge of children under school age by day and, if necessary, by night.

95. Sympathetic administration is essential to the success of such a scheme, the aim and intention of which is to encourage the women to report their condition at an early stage and to afford them such advice and assistance as are needed without exercising a burdensome or inquisitorial supervision.

96. The committee consider this scheme valuable and suggestive. They are glad to know that in many munition works successful effort has been made on these lines, and they are satisfied that a similar scheme is feasible for industrial women workers generally.¹

¹ A woman welfare supervisor in a national ordnance factory has written to the committee as follows: "A pregnant woman in this factory is expected and encouraged to see me, that I may assure myself that her work is not harmful to her in any way. She is questioned as to her home circumstances, and permission to put her in touch with the medical officer of health is asked. This, if granted, insures her a visit from the inspector of midwives staff, who sees that a suitable midwife is, or will be, engaged. Provided that the work on which the woman is engaged is not injurious to her, she is retained as long as possible. In many cases a woman has worked on her lathe until the eighth month of pregnancy. Others require to be transferred quite early to lighter employment such as disk oiling and cleaning, hammerhead crane driving, or in the overall department.

"During enforced absence before confinement, if the worker's income is insufficient, her case is brought before a small subcommittee of the hospital and benevolent fund, and a grant made to her of 7s. 6d. or 10s. [\$1.83 or \$2.43] weekly. After the birth of the child in the case of a married woman, in consideration of the health insurance benefit of 60s. [\$14.60], the allowance from the fund stops for four weeks and is not resumed until the child is three months old, when the mother is reinstated at her old work. I have fixed that period of absence, as I find that once nursing is established during those months, it is possible it may be partially continued with good results to both mother and child. If not continued, the three months' nursing is of inestimable value to the child. Another reason I advocate these three months' absence is, that the work is heavy for a recently confined woman.

"The case of the unmarried mother presents greater difficulties, and more individual study and care is required. It is a great anxiety to me to obtain the necessary knowledge early enough to be able to assure the girl that care will be taken of her during her pregnancy and help given her in her trouble. My experience convinces me that serious consequences to the health of many girls have arisen from their fear of facing the situation. I have found that once her confidence is gained and the girl understands that for her child's sake she is entitled to every care, a much happier and healthier

97. The Ministry of Munitions decided, in 1916, to make special grants in aid of the establishment and maintenance of nurseries for the children of munition workers as follows:

(a) A grant of 75 per cent of the approved expenditure on the initial provision and equipment of the nursery.

(b) A grant of 7d. [14.2 cents] for each day or night attendance made by the child of a munition worker.

It has been arranged that the board of education, as the department charged with the administration of grants in aid of ordinary day nurseries, should be responsible for the inspection of munition nurseries and for advising the ministry in regard to the provision of schemes and payment of grant. The number of munition nurseries wholly or partly occupied by the children of munition workers is now 81. In most cases the nurseries are open by night as well as by day for the benefit of women working on night shifts.

98. It is sometimes suggested that the nurseries should be in or close to the factory, so that a mother may be able to nurse her baby during the dinner interval. On the whole the committee think that it is not usually desirable to have the nursery in close association with the factory, however, partly because this entails bringing babies and little children night or morning in trains or trams which are often already overcrowded. Further, the usual interval of an hour is scarcely sufficient for the mother to get her own meal and feed her baby unless a dinner can be provided for her at the nursery. Though arrangements have been made for a few individual cases nothing has been attempted in a general way. Probably in certain exceptional cases some provision is also needed for the younger children who are able to attend school but are too young to look after themselves during school hours while the mother is at work. A few children's "hostels" have been established through voluntary enterprise, to which such children may go for all meals and for play

state of mind and body exists. Should there be no home care available for the girl during her confinement, the only place for her in this town is the workhouse infirmary. Under these circumstances we generally manage to keep her at quiet work until very close to her confinement, and she is admitted to the infirmary immediately on application.

"I have never deviated from my rule regarding the three months' absence from the factory after confinement, even in the case of the homeless girl, but some arrangement has always been made for her care and well-being. Friends have been found for her and she has had a weekly grant from the hospital and benevolent fund, also advice and help given her as to putting her in the way of receiving maintenance from the father of her child. I have, at different times, brought in a girl, whose case has been difficult to deal with, to work as cleaner in the canteen on days only. The baby comes with its mother and lies (in summer) in a cot on the veranda. This works very well. The baby thrives and is a source of interest and joy to the factory girls. I have always found that the help given to a girl in her trouble has a wonderful result in improving her character and deepening her sense of maternal responsibility.

"The problems in work such as this are many and all different and have each to be considered under no very hard and fast lines, but I hope I have outlined the main points sufficiently clearly to show our aims and ideals."

and recreation, small payments being made by the mothers to cover the cost of the food.

99. In this connection the committee consider it is desirable that the lifting and carrying of heavy weights¹ and all sudden, violent, or physically unsuitable movements in the operating of machines should, as far as practicable, be avoided. Often a simple appliance, or the alteration of a movement, modifies an objectionable feature when it does not altogether remove it. By similar thought and care much may be done to mitigate the strain of prolonged standing, which should be restricted to work from which it is inseparable.² Prolonged standing has been found a highly provocative cause of trouble to women and girls. When standing is absolutely unavoidable, the hours and spells of employment should be proportionately short, and seats should be available for use during the brief pauses which occasionally occur while waiting for material, or for the adjustment of a tool. Where so much depends upon the character of a movement, upon the angle and position at which a weight is lifted or carried, it is not advisable to lay down a standard of prohibited weights. But serious accidents and injuries to health have been caused in factories in the past by the excessive carrying of weights, and it is trusted that employers will give this matter their earnest consideration, especially in view of the heavy work which now devolves upon women in factories.³

PERIODS OF EMPLOYMENT AND HOME DUTIES.

100. *Night work.*—The imperative necessity of war has revived, after almost a century of disuse, the night employment of women in factories, with its associated economic, physical and moral disabilities. In a working-class home, however, the difficulty in obtaining rest by day is great; quiet can not be easily secured; and the mother of a family can not sleep while the claims of children and home are pressing upon her; the younger unmarried women are tempted to take the daylight hours for amusement or shopping; moreover, sleep is often interrupted in order that the midday meal may be shared. The employment of women at night is, without question, undesirable; yet now it is for a time inevitable; and the committee have, therefore, directed their efforts to the consideration of those safeguards which would reduce its risks to a minimum.

101. In practically all factories where night shifts are worked it is customary to change the shifts weekly or fortnightly. The frequent

¹ For further observation on weights, see paragraphs 418-424.

² See medical evidence on the grave effects of long hours of standing on the health of women, given before the Select Committee on Ships, 1895 (p. 219, answers 5401 to 5406), and the effects of industrial strain on the working woman (Trans. Fifteenth International Congress on Hygiene and Demography, Washington, 1912, vol. iii., pt. 2, p. 933).

³ Report of Departmental Committee on Accidents, 1911 (Cd. 5535).

change of shift has proved more convenient and acceptable to the women than more prolonged periods of night or day duty. The importance of adequate pauses for rest and meals during the night is now fully realized; arrangements for the comfort of the women have steadily improved and most women have learned the advantage of suitable and substantial food when on night work.

102. While the urgent necessity for women's work remains, and while the mother's time, and the time of the elder girls, is largely given to the making of munitions, the home and the younger children must inevitably suffer. Where home conditions are bad, as they are frequently, where a long working day is aggravated by long hours of traveling, and where, in addition, housing accommodation is inadequate, family life is defaced beyond recognition. If the home is to be preserved from such processes of destruction reasonably satisfactory conditions of transit and housing must be secured, as well as the best possible hours of work by night and day. It has been far from uncommon to find some two or three hours spent on the journey each way, generally under the fatiguing conditions of an overcrowded train or tram, often with long waits, and a severe struggle before even standing room could be obtained. Often, far from offering a rest from the fatigue of the day, the home conditions have offered but fresh aggravation. A day begun at 4 or even 3.30 a. m., for work at 6 a. m., followed by 14 hours in the factory, and another two or two and a half hours on the journey back, may end at 10 or 10.30 p. m., in a home or lodging where the prevailing degree of overcrowding precludes all possibility of comfortable rest. Beds are never empty and rooms are never aired, for, in a badly crowded district, the beds, like the occupants, are organized in day and night shifts. In such conditions of confusion, pressure, and overcrowding, home has had no existence.

103. Though much has been now done to remedy these conditions, there is still a great need for improvement in means of transit, and this alone would help to relieve the unsatisfactory conditions of housing; but, however great the increased facilities of service, the journey between home and factory must still add, in many cases, a couple of hours to the working day. When considering hours in relation to efficiency and fatigue this influence upon the total length of day should be remembered; the factory day can not always stand by itself as the only contribution toward fatigue.

104. Happily there should be in the matter of hours of labor for women little conflict between the interests of the home and the interests of munitions, for the hours which conduce most to a satisfactory home life and to health conduce most to output. Long hours, particularly when they are worked during the night, are among the chief factors in fatigue, and the committee are of opinion that in

the interest of output and health alike they should be restricted within proper limits; that there should be suitable pauses for rest during the working period; and that there should be adequate cessation from work at each week end in addition to periodic holidays. It may be stated broadly that conditions which press hardly upon the average man press, because of her different constitutional development, with greater severity upon the average woman; while, similarly, though conditions of mental fatigue are probably equally injurious to boys and girls, conditions of muscular strain well borne by the ordinary boy may be highly detrimental to the girl of corresponding vigor and physique. It is therefore especially important that women and young girls should be relieved from those conditions of overstrain to which they have been so widely exposed.

105. Since the early days of the war the tendency has been toward the reduction of the weekly total of hours worked and the length of the shifts. The overtime system which was then common has now been practically abolished and the weekly hours for women limited to 60 or less. In order to avoid undue fatigue an increasing number of firms have three eight-hour shifts in the place of two of 12 hours. Though not always easy to organize from the factory point of view, when accompanied by an adequate minimum wage the system of eight-hour shifts appears to yield the best results in the long run. On the one hand the machinery is used for the maximum part of the 24 hours and effort is better sustained throughout the shift. On the other hand, less strain is put upon the worker, with a resulting reduction in the amount of ill health, disability, and lost time. The special strain of night work is imposed less frequently, and, partly for this reason, a class of labor is attracted which would otherwise be unrecruited. It has been suggested that in certain districts, and for certain industrial processes, it may be possible, during the stress of the war, to employ married women on half time, in two or more shifts daily of four or five hours each. The committee recognize that such a system possesses its own inherent difficulties, which may, however, not prove insurmountable.

ARRANGEMENTS FOR REST AND MEALS.

106. Pauses, well distributed and adapted in length to the needs of women workers, are of the highest value in averting breakdown and in giving an impetus to output. The factory acts permit in textile factories a maximum of four and a half hours continuous work; in nontextile the limit is five, but many managers believe that four hours is the longest period during which a woman can maintain continuous work at full vigor. Within this period a pause of 10 minutes has been found to give excellent results, and where the spell is continued for five hours some such pause should certainly be made for a cup of tea or cocoa. It is particularly valuable in the morning

spell in those numerous cases where breakfast has been hurried or omitted altogether. The proper arrangement of intervals for food needs special consideration in filling factories, where work on some of the high explosives seems to create a special feeling of hunger. Here there is the added reason that a well-fed person is the better able to resist the influence of poisonous materials. Facilities should be provided, especially during the night shift, for rest in cases of fainting or other temporary illness. Rest rooms are now frequently found in well-equipped works; they usually consist of a few comfortable chairs and a camp bed for the more serious cases, placed in the surgery or rest room now being provided by many employers. A nurse is generally in attendance, whose assistance may be claimed by men and women alike.

107. The week-end rest has been found to be a factor of such importance in maintaining health and vigor that it has been reinstated by employers who had taken it for work at the beginning of the war. The committee are strongly of opinion that for women and girls a portion of Saturday and the whole of Sunday should be available for rest, and that the periodic factory holidays should not, on any account, be omitted. Where women are employed on eight-hour shifts an interval of half an hour for a meal may be regarded as normally sufficient, but where longer hours are worked, it is important that they should be allowed an hour for dinner and for the principal meal during the night. Indigestion can not easily be avoided if a substantial meal is followed immediately by work without an intervening period for rest. Half an hour, especially in large factories, and in filling factories where the actual consumption of food in the danger area is prohibited, provides but scant time even for the eating of the meal. Ten minutes are easily spent in reaching the mess room and returning to work, certainly another five are occupied in washing the hands and the service of the dinner; and so but 15 remain for the meal. The provision of well-managed and suitably equipped canteens in convenient proximity to the workrooms has now been made in a large number of factories and the mess-room accommodation and arrangements for heating the workers' own food have been much improved. These are available both night and day at suitable hours. The committee desire once more to emphasize the importance of providing seats with backs and similar amenities with a view to securing the comfort and relaxation of the workers.

THE SANITARY CONDITION OF THE FACTORY.

108. The effect upon the health and energy of women and girls which results from clean, bright, and airy workrooms, well warmed in winter, can hardly be exaggerated. The factory act secures a mini-

imum of these essential things, but the highest standard attained in the best factories is not too high. Women desire these things in their working hours, and appreciate and respond to a good environment. Cleanliness and good order contribute to increased output as well as to the discipline and morale of the factory. The provision of washing accommodation has become increasingly important. The refreshing effect of washing and its influence on self-respect, especially where women are heated by their work, have been dwelt upon by many witnesses who have given their evidence before the committee. For those processes in which poisonous substances are used, such, for example, as the filling of shells and fuses with high explosives, special regulations for washing have been framed.¹ It is a great convenience when the lavatories and cloakrooms can be grouped with the canteens. The lavatories should be of sufficient size to accommodate all those workers from a room or department who cease work at the same time, and must be properly equipped and maintained. If suitable facilities are easily accessible and are sufficient to enable the workers to wash without undue encroachment upon their mealtimes, experience shows that they are much appreciated and fully used.

109. Cloakrooms should also be provided, and wherever possible should be near the canteens and lavatories. It is of importance that they should afford facilities for changing clothes and boots and for drying clothes. The cloakrooms should be kept scrupulously clean.²

110. The provision of adequate and suitable sanitary accommodation is a matter of special importance. The necessity for proper equipment and maintenance of cleanliness, privacy, and convenience of access should be borne in mind. It is the more necessary to call attention to this matter since in many instances women are now employed in factories where, until recently, there have been male workers only. The conveniences for women should be so situated as to be readily accessible at all times, with due regard to the privacy of the approach; they should be adequate in number, suitably planned, and of sound sanitary construction. A high standard of cleanliness must be maintained, and it is desirable that an attendant shall be in charge of the conveniences throughout the period of employment.³

MANAGEMENT AND SUPERVISION.

111. The committee have received abundant evidence of the necessity of wise and suitable arrangements for the management and supervision of women's labor. Their personal visits to large and small works where women and girls are employed, as well as the evidence

¹ For further consideration of the provision of washing facilities see paragraphs 392-404.

² For further suggestions as to cloakroom accommodation see paragraphs 411-412.

³ For further suggestions as to sanitary accommodation see paragraphs 388-391.

placed before them, have led them to the opinion that there is hardly any condition of greater importance than this, in respect both of smooth working and of maximum output. The modern development of commercial undertakings, not to speak of the vast size of many factories, precludes the personal oversight and interest of the responsible employer and makes it all the more necessary to appoint efficient substitutes. This is particularly important in regard to the occupation of women unaccustomed to the organized factory life, business methods, and discipline of large engineering shops often with unsuitable accommodation for women, difficulties of discipline, and long hours. Briefly the committee recommend that in all cases where women are employed consideration should be given by the management to the appointment of forewomen, nurses, and welfare supervisors, whose position and status should be properly assured and whose duties should be prescribed. In this way provision is made for each woman worker to have ready access to an officer of her own sex in case of difficulties occurring in regard to her work, her health, or the conditions of her employment. Surgeries for the treatment of minor as well as serious accidents, rest rooms for workers temporarily incapacitated, are of special importance where women are employed. "Welfare supervision," in its broadest sense, which has abundantly proved its value to both management and workers, is essential for women workers if their well-being is to be fully safeguarded.

112. The ultimate purpose of wise supervision is twofold. First, there is the purpose of securing sound and helpful conditions of labor, under which the employer obtains diligence and skill from those in his employ, and the worker is occupied, healthily and not unreasonably, to his own satisfaction and to the best of his capacity. Here, without doubt, the highest interest of employer and worker is one and the same. There is, or should be, satisfaction and advantage on both sides. A second purpose of supervision is economical management and the accurate adjustment of energy applied to the end in view. The committee have been interested to observe the diverse operation of these purposes in connection with the health of women workers, and have decided that it was desirable to investigate further a point which had much impressed them, namely, the apparently large amount of "wastage" of women workers in munition factories. It was reported to them that large numbers of women were drifting in and out of factories without sufficient reason, and they sought the aid of Capt. M. Greenwood, the statistician, in endeavoring to find an explanation of this phenomenon. Accordingly he made investigations¹ in 16 factories, or parts of factories, employing altogether

¹ Dr. Greenwood's memorandum on The Causes of Wastage of Labor in Munition Factories employing Women is being published, as a special report, by the Medical Research Committee.

some 40,000 women workers. An abstract of his report will be found in Appendix D. Briefly his conclusions are:

(a) That of 37,000 women workers under observation for at least a month, illness or physical unfitness or incapacity was given as a cause of leaving work in 1,651 cases, the lost workers owing to ill health being practically the same at all ages in "light" factories, but increasing at the age of 22 years in "heavy" factories. In other words, girls over 23 years of age have fewer sickness losses in "heavy" than in "light" factories;

(b) That in sum total the "wastage" is substantial, and such discontinuance of employment appreciably reduces output;

(c) That much of this "wastage" is inexplicable; of 11,000 women who left work as many as 6,700 gave no adequate reason for so doing;

(d) That, whilst prevention appears obscure, the remedy is organized welfare work, including intelligent and sympathetic following up of absentees.

The committee concur with Capt. Greenwood's recommendations that wherever any factory loses more than 20 per cent of its entrants within three months a special inquiry should be instituted, and that older women (who more usually have home duties) should be put on lighter work in order to reduce the double demand made upon them.

113. Clearly, everything possible should be done to reconcile the woman's conflict of interests between her duties to her home or children and her work in the factory. Wherever other labor is available the employment of mothers with infants is to be deprecated, as is also that of the mother of any young family, for it must be remembered that the mother's work is certainly not ended with her factory day. Her children make many claims upon her time and energy, more especially, of course, at the period of the midday meal and at bedtime. In some factories the majority of the women employed at night are married, and many of them express a preference for their work because it leaves them free for domestic work during the day. In thus undertaking double duties their zeal may easily outrun their strength, and factory and home equally may suffer. Where married women are indispensable every effort should be made to give them the preferential treatment common, in normal times, in some factory districts and also in France. It is the experience of managers that concessions such as half an hour's grace on leaving and arriving, or occasional "time off," is not injurious to output, as the lost time is made good by increased activity, and under the system of 8-hour shifts it might be arranged, without industrial dislocation of any kind, that married women are employed only in that shift which would cause least dislocation in their home. For organization of this kind, as well as for the care of young girls individually during the

first few months of their employment, the welfare supervisor has proved herself to be invaluable; she can secure short periods of rest or such interchange of occupation as tends to lessen either the spell of muscular fatigue or the continued exposure to an injurious process. Her supervision possesses particular value during night shifts, when ordinary supervision tends to become relaxed.

CONCLUSION.

114. Finally, the committee desire to state their considered opinion that, if the maximum output of which women are undoubtedly capable is to be secured and maintained for an extended period, the following essentials must be provided for:

- (a) Short hours of work with suitable shifts, pauses, and intervals;
- (b) Adequate and suitable medical supervision, including the provision of rest rooms, surgeries, and first-aid appliances, properly staffed;
- (c) The careful selection of women for work within their capacity, the heavier work being allocated to the younger women;
- (d) Good and sufficient food obtainable at convenient times; women appear to require food and refreshment more frequently than men and always before commencing work in the morning;
- (e) A suitable factory environment; women are probably more susceptible than men to the benefits of effective ventilation (including ample fresh, moving air), sanitary accommodation, and convenient washing facilities;
- (f) Sympathetic management and tactful supervision.

115. The committee recognize that emergency conditions must obtain in many cases, but they are satisfied that every effort should be made to organize women's labor effectively and promptly. The committee take the view that to use up or damage its women by overstrain in factory work is one of the most serious and far-reaching forms of human waste which a nation can practice or permit. It may be that in the entanglement of problems new and old the coming of the new and their imperative claim for solution will help the solving of the old. There is impulse now as there was impulse long ago when the cause of the children in the cotton mills of Lancashire won the early factory acts for the generations that followed. There is need now as there was need then. There is need for the work of women in industry; there is need also for safeguarding that service. Happily there is manifest a public spirit and a devotion able to overcome difficulties and solve problems. There is also a fuller recognition of the claims of women and of their children and of their vital importance to the State, which is reward for the sacrifice and courage of those women now working steadfastly in the ranks of labor.

SECTION V.—HOURS OF LABOR.

LEGAL RESTRICTIONS ON HOURS OF LABOR.

116. The Factory and Workshop Act, 1901, imposes certain restrictions on the hours of employment of protected persons; that is, of women and young persons (i. e., boys and girls between 13 and 18 years of age who are legally exempt from attendance at school). The following are the principal provisions bearing on employment in non-textile factories:

(a) The hours of employment of protected persons on the first five days of the week are not to exceed a fixed daily period of 12 (including 1½ hours for meals), and on Saturday 8 hours (including one-half hour for meals). The period of work may commence at 6 a. m., 7 a. m., or 8 a. m. That is to say, the maximum weekly hours of employment, exclusive of mealtimes, are 60. (Sec. 26 (i), (ii); (iii).)

(b) Sunday labor is forbidden. (Sec. 34.)

(c) Protected persons may not be employed continuously for more than 5 hours without an interval of at least one-half hour for a meal. (Sec. 26 (iv).)

(d) Women may be employed in certain industries for 2 hours overtime in addition to the ordinary hours on any day except Saturday: *Provided*, That an additional one-half hour is allowed for meals after 5 p. m.; that no woman is so employed for more than 3 days in any 1 week, and that the number of days in the year on which any woman is employed on overtime shall not exceed 30. (Sec. 49.) No similar exception is allowed for young persons.

(e) Night work is not allowed for women and girls, but is allowed for boys over 14 if employed in certain specified trades, e. g., blast furnaces and iron mills. (Sec. 54.)

No restrictions are placed upon the hours of employment of men.

117. Section 150 of the act provides that—

In cases of any public emergency the secretary of state may, by order to the extent and during the period named by him, exempt from this act any factory or workshop belonging to the Crown, or any factory or workshop in respect of work which is being done on behalf of the Crown under a contract specified in the order.¹

118. Under this provision orders have been made by the Home Office allowing relaxations of the limitations set out above. These orders are of two kinds—(a) General orders setting out the conditions under which women and young persons may ordinarily be employed

¹ By regulations made under the Defense of the Realm Act, and dated June 10, 1915, and October 3, 1916, the power of the secretary of state is extended to any factory or workshop in which he is satisfied that by reason of the loss of men through enlistment or transference to Government service, or of any other circumstances arising out of the present war, exemption is necessary to secure the carrying on of work and that it can be granted without detriment to the national interests.

in munition works (the last general order was issued in September, 1916); (b) Special orders authorizing variations of the general order in particular cases.

119. Under section 6 (i) of the munitions of war (amendment) act, 1916—

The Minister of Munitions shall have power by order to give directions * * * (subject, so far as the matter is one which is dealt with by the factory and workshops acts 1901 to 1911, to the concurrence of the secretary of state) as to hours of labor or conditions of employment of the female workers so employed.

120. No order has as yet been issued under this section, hours of employment continuing to be dealt with under the factory acts. A committee, including representatives of the Ministry of Munitions, of the Home Office, and of other departments concerned, has been established at the ministry to consider special applications for permission to work on Sundays or for exceptional hours.

WEEKLY HOURS OF EMPLOYMENT.

121. Prior to the war the weekly hours of employment of women and young persons were as a rule substantially below the limits imposed by the factory and workshop act. This was due, partly to the action of employers who believed that shorter hours were desirable from the point of view of health and output, and partly to the action of the trades-unions in regard to the hours of adult male workers. In the engineering trades the normal weekly hours of adult male workers were, as a rule, about 52 to 54, though in a few instances they were as low as 48. These normal hours were generally liable to extension (overtime) to meet special emergencies. Since if overtime were to become a regular practice the value of the normal day would largely be lost, it was usual to restrict overtime by requiring wages at a higher rate for the additional hours and by limiting the additional hours which might be worked in a given period. Thus the agreement existing at the outbreak of war between the Engineering Employers' Federation and the engineering trades-unions concerned provided that overtime should not exceed 30 hours a month.

The establishment of the normal working day for engineering trades is not entirely a modern development. As early as 1836 the London engineers secured the normal 60-hour week with additional wages for overtime, and more than 50 years ago the principle of a normal day and overtime was already widely recognized.

122. At a very early stage of the war the ordinary restrictions on hours of employment were widely relaxed. Sunday labor, previously forbidden for women and young persons, and practically unknown for men except in a few continuous processes, became common. Night employment, which for 50 years had been abolished entirely

for women and in the main for boys became regular. The strain of these hours, in itself severe, was increased through large numbers of men and women taken into employment, being unaccustomed to such labor, or being physically less able to bear the strain than the selected body of workers previously employed. The difficulties of housing and transit became accentuated and the conditions of employment were frequently makeshift and inconvenient. The employment of men for 70 to 90 hours a week was common, for over 90 hours was not infrequent, and there were even cases of hours in excess of 100. The highly skilled workers (tool and gauge makers, tool-setters, etc.) were generally the most difficult to obtain and were thus most frequently employed for long hours. These hours were defended on the ground that—

(a) The dearth of workers and other causes prevented any general adoption of the shift system;

(b) The demand for output was urgent and immediate, and had to be met even at some risk of future breakdown;

(c) Patriotism introduced a new incentive which rendered unreliable all previous experience as to the number of hours which could be successively worked;

(d) Even though the rate of output might be reduced, and the cost of working increased, these long hours did result in a larger output than short hours would have done.

123. The evidence, however, showed that the long hours are open to certain serious objections:

(a) They are liable to impose too severe a strain on the workers;

(b) At any rate, after a period, the rate of production tends to decrease, and the extra hours produce proportionately little or no additional output; moreover, the quality of the output may be adversely affected during the whole period of work, and not only during the hours of overtime;

(c) A large proportion of the hours gained may be lost through broken time; the workers become exhausted and take a rest; sickness tends to increase, at any rate among the older men and those of weak constitution;

(d) They lead to an undue curtailment of the periods of rest and sleep available for those who have to travel long distances to and from work;

(e) The fatigue entailed increases the temptation of men to indulge in the consumption of alcohol; they are too tired to eat, and therefore seek a "stimulant."

(f) A very serious strain was imposed upon the management, the executive staff, and the foremen, both on account of the actual length of the hours worked and of the increased anxiety over the main-

tenance of the output and quality of the work; the staff can not take days off like ordinary workers.

124. Whatever may have been the justification for the long hours worked, they undoubtedly imposed a severe strain on the workers, as evidenced by the following statements made by trades-union representatives:

Some of his men had been working from 6 a. m. to 9 p. m. These hours were undoubtedly a severe strain and some men were just at the limit of their powers. They stayed away for a day or two to rest, but did not see a doctor if they could help it.

The men were reaching the "fed-up" stage. They were getting nervous and irritated through working long hours. They could not keep up their physical efficiency; he could see it in their faces. Men on overtime were more tired. They were liable to have time for only about five hours' sleep.

The excessive hours now being worked were too much for the men. They led to a diminished output per hour. Men were continually having to stop working; they were obliged to rest, it was not a question of slackness. For fear of being called slackers they hesitated to get a doctor's certificate.

125. Though, as stated, the long hours thus undoubtedly placed severe strain upon the workers, the committee did not find that they had caused any serious breakdown among workers. This was in some measure due to the tendency, after a time, to reduce hours. Further, there was good reason for believing that the increased pay and better food which workers were able to enjoy helped to counteract the strain of long hours. There is little doubt, too, that workers were stimulated to make special effort by an appreciation of the national importance of their work. These influences have been thus summarized by a trades-union official:

(1) Will power: Men have continued at work in a condition that under ordinary circumstances would have put them off for a week or two. Even when a man comes off for a time he is anxious to get back again as quickly as possible. I have had one or two cases of serious breakdown. The main factor is that practically all the men want to do their best.

(2) Better wages mean better food for a large number of men with families, and they mean a little better provision for those families, which again reacts upon the man's health and his work. In these cases it is not so much the saving or possibility of saving money, but the satisfactory spending of it, which is the factor of importance.

(3) The possibility of getting more money has also its effect. You read much about the slacker. There is quite a large proportion of workmen really too anxious for overtime—employers will corroborate—even under normal conditions.

126. It would, however, have been a mistake to depend too largely on the operation of influences of these kinds, or to hope that they could continue indefinitely to be effective against fatigue. The committee was satisfied that if workers were to be asked to work for anything approaching 15 hours a day for weeks and months on end, one

of two results must follow—either the health of the worker would break down, or they would not work at full pressure.

127. While the committee, at an early stage of their inquiries, were convinced as to the urgency of recommending some limitation of hours, it was a matter of serious difficulty to determine what limitations to recommend. Not only was there an almost complete absence of any scientific data as to the relation of hours of employment to output, but the evidence of witnesses differed widely as to the limits which might properly be imposed.

128. *Men.*—This conflict of opinion was specially marked as regards hours of adult male workers. On the one hand, those who had been employing their workers for 15 hours a day, sometimes with Sunday work in addition, stated with confidence that such hours were not excessive, that they had been worked in times of peace, and that they could not be reduced without loss of output. Amongst those who favored the longer hours were to be found some of the largest employers of labor, and whatever their views might be as to the ultimate gain from the reduction of hours, they hesitated to incur the responsibility for any reduction of output, since such reduction, even though temporary in character, might, owing to the large number of workers involved, prove serious in bulk while it lasted. As a representative of one of the largest firms in the country said:

Once a reduction was made it was impossible to go back to the previous position. In consequence one must be sure of the ground before making experiments. Previous experience is not a complete guide on this occasion, because patriotism is a new and important factor.

129. On the other hand, witnesses, many of whom had devoted a close study to questions of industrial fatigue and scientific management, were emphatically opposed to overtime, except for quite short periods.

As regards overtime, he did not consider it efficient, nor was it profitable, if paid for at one and one-half rates. It did not induce any increased output, except when working for a short spell to attain a definite object. If continued for a long period the tendency of overtime is to reduce rather than to increase output. The strain caused by the work is a mental rather than a physical one. The monotony of always being at one job was also productive of fatigue.

In his opinion, the greatest economical efficiency of engineering labor is obtained with a week of 48 to 55 hours. Longer hours, in the long run, meant a diminished output, inferior quality of work, and much greater cost of production. Though attending to heavy machinery might involve periods of rest from physical strain, it involved mental strain, owing to the amount of damage caused if anything went wrong.

130. Between these two extreme views a middle course was also advocated. It allowed a maximum of 10 to 12 hours of overtime a week. Thus a large employer of labor, who was also engaged in organizing national factories, expressed the view:

Definite restrictions should be placed on overtime. No workman ought to work for more than 80 hours in any one week, or to maintain an average of more than 65 hours a week.

131. Similar views were expressed by trades-union representatives:

Where there is overtime beyond two hours daily there is evidence of fatigue and men can not be employed economically, from health and production point of view, on continuous overtime of three and four hours daily. Fatigue is rarely reaching the point of breakdown, but does affect health and production, and in my opinion will manifest itself later. In some cases where such overtime is worked, apart from night shifts, men are allowed one early night per week, and I think this is wise and economically sound.

The witnesses were inclined to think that, to meet the present abnormal circumstances, men should be able to work as much as 60 to 65 hours a week over a long period. The exact length of hours would necessarily depend on the character of the work. Thus 65 would certainly be too high for gauge makers. The hours at night involve greater strain and should not exceed 60. Even these hours were justified only by the present crisis, and were no criterion of what was reasonable and proper in ordinary times.

132. In the agreement between the Engineering Employers' Federation and the engineering trades-unions already referred to a similar limit was adopted.

133. *Boys.*—In the case of boys the evidence showed that the hours of employment were largely determined by the fact that they frequently worked with men. The Home Office had found it necessary to sanction the employment of boys for 67½ hours a week, and for even longer periods in special cases, the period of the working day being extended to 14 or even 15 hours, as compared with the 12 hours allowed by the factory and workshop act. Though as in the case of men no substantial breakdown occurred there was no doubt that the hours worked in many cases involved a serious strain. Dr. Agnew, as a result of a medical examination of 1,500 boys employed in all parts of the country and under varying conditions of employment, reported as follows:

My general impression is that hours tend to be too long for the proper preservation of health and efficiency. Large numbers of boys are working a net average of 68½ hours per week. Under certain conditions the effect upon their health is not so deleterious as in others, but, whatever the conditions, where more than one hour has to be spent in going to and from the factories, in my opinion, 68½ hours are too many. Many of these boys are just over 14 years old, and they spend considerably more than two hours per day in traveling, thus having very little time for recreation or for rest. The natural bent of most of us is to revolt against a yoke of any kind in modern times. This is just what happens. The boys have found from experience that they can not comfortably work over 60 hours per week, and as evidence of this—in one shop where 600 boys worked, 500 of them on a Saturday afternoon did not return to work.

The same state of affairs, with a few exceptions, is found up and down the country. On the night shifts, boys do not tolerate well long hours, and in one factory a very large percentage of the boys complained of sleepiness and disinclination for work. It has to be borne in mind that the average age of the

boys examined would certainly not exceed 15 years, and it makes one consider very seriously the future of the rising generation.

134. A social worker with considerable experience of boy labor in munition works informed the committee that—

So far as he knew, there had been no general breakdown, but then he did not expect to see immediate effects, notwithstanding the long distances that some boys had to travel. He suggested, however, that the boys are drawing on their strength, and pointed to the fact that the boys fall asleep in the trains and trams, and often travel on beyond their stations. They have no leisure, no recreation, and no classes, and he was very anxious as to what would become of the boys after the war. He suggested that too big a price was being paid for output. Even the hours allowed under the factory acts were very lenient. The granting of relief at the week end was a great boon.

135. In considering what hours of employment are reasonable for boys, it is necessary to distinguish between boys under 16 years of age and those over. A witness with wide experience expressed the view that—

Boys between 16 and 18 were quite different from boys under 16; they were much stronger. Boys under 16, on the other hand, were probably more delicate than girls of the same age, and more likely to break themselves up. The essential safeguards were the reduction of hours and welfare work. Apart from the strain on the health involved, long hours had disastrous effects upon the characters of boys. They also might make an adequate amount of sleep difficult and, perhaps most important, they prevented adequate facilities for recreation. Such facilities were of primary importance both for the physical and the moral welfare of the boys. This latter danger was accentuated by the monotonous character of their work, which afforded no intellectual interest. In the absence of healthy recreation the boys' minds and conversation were likely to become unhealthy and to lead to a general deterioration in character. Eight hours of sleep at least were essential, nine hours would be better. Unfortunately many boys got only six or seven hours.

136. *Women.*—Important as it is that the hours of work for men should be kept within reasonable limits, it is essential that hours of work for women and girls should be even more closely safeguarded. Admittedly women and girls are unable to bear the strain of long hours as well as men. Conditions which press hardly on the average man, press, because of difference in constitutional development, with greater severity upon the average woman. Under the general order issued by the Home Office in September, 1915, women and girls over 16 years of age were allowed to be employed up to 67½ hours a week. While this order applied to the great majority of munition works, permission was granted in special cases for between 70 and 80 hours a week. The maximum hours of daily employment was extended to 14 hours as compared with 12 hours allowed under the factory acts.

137. Though, as in the case of men and boys, no serious breakdown of health can be pointed to, the committee were left in no doubt as to the strain involved.

A medical examination¹ which was conducted of over 1,300 women selected from varying types of work in different parts of the country showed that though for various reasons no general breakdown had then occurred, there undoubtedly existed a serious amount of strain. Only 57 per cent were classified as healthy as compared with 78 per cent in the case of a similar examination of men; even if full allowance is made for variations in the standard adopted by different medical officers, the difference between these two percentages is still significant. In one factory where the women were employed for 77 hours weekly, 15.5 per cent of the workers showed evidence of marked fatigue and it was reported that the workers were practically unanimous that the hours should be shortened.

138. Many witnesses expressed the opinion that the hard work was telling on the women though they were keen to work, feeling that they were performing a patriotic duty. Though some employers sought for permission and used to the full power to employ women for more than 65 hours a week, the majority limited their application to that figure. Moreover inquiries showed that in many factories the maximum hours were not worked continuously. Employers sought permission for a wider limit of hours than was ordinarily necessary or desirable in order that they might have latitude for dealing with special emergencies.

139. The nature of the evidence available made it clear to the committee that any recommendations they put forward in regard to the limitation of weekly hours of employment must necessarily be tentative and provisional in character. Moreover, if the recommendations were to be of practical value, and secure any wide measure of acceptance, it was necessary that they should satisfy two essential conditions. First, they had to be such as would be regarded as reasonable and moderate by the great mass of employers and workers, and secondly, while taking account of the probable duration of the war, they had to have regard to the immediate urgency of output at that time. Any recommendations which might involve even a temporary diminution of output would have been doomed to failure. It was evident in fact that any reduction of hours proposed must be gradual, and the committee accordingly based their recommendations on what appeared to be immediately practicable, rather than on what was ultimately desirable, or might be defensible on a physiological basis. Further, they found it necessary to confine themselves to suggestions as to the maximum limits within which weekly hours of employment should be restricted, and they did not endeavor to set out the extent to which, in their opinion, it was necessary or desirable to reduce these limits to meet varying industrial conditions.

140. The limits of the weekly hours of employment provisionally suggested in their Memorandum No. 5 (Hours of Work), which was prepared in January, 1916, were:

¹ See Committee's Interim Report (Cd. 8511), pages 110-121.

(a) For men, that the average weekly hours of employment should not exceed 65 to 67 (exclusive of mealtimes), i. e., a 13 to 14 hour working day.

(b) That boys under 18 should be allowed to work the same hours as men, provided that—

(i) The hours of boys under 16 should be limited to 60 so far as possible;

(ii) Substantial relief at the week ends should be insisted on;

(iii) Night work should be limited as far as possible to boys over 16.

(c) That for women and girls employment should be restricted within the normal legal limit of 60, i. e., a 12-hour working day, though within these limits moderate daily overtime might be allowed, and that the employment of girls under 18 at night should be limited as far as possible.

141. These recommendations were generally accepted as fair and reasonable and were widely adopted. In September, 1916, the Home Office, after consultation with the Ministry of Munitions, issued a new general order reducing the maximum hours of work for women and young persons which had been allowed in the previous general order. Under this order which was based upon the recommendations of the committee—

(a) The employment of women was limited to the 60 hours a week permitted under the factory and workshop act, though within this limit night work was allowed and work for not more than 14 hours (including mealtimes) instead of 12 on any one day. The employment at night of girls between 16 and 18 was only allowed in special circumstances where the superintending inspector of factories was satisfied that the work was suitable and of a specially urgent character. The employment of girls under 16 at night was not permitted at all.

(b) The hours of employment of boys over 16 were limited to 65 by day (excluding mealtimes) and 63 by night. Night work for boys under 16 and their employment for 65 hours by day was only permitted where the superintending inspector of factories was satisfied that the urgency of the work and other circumstances made it imperative that they should do so.

142. The order made the relaxation of the requirements of the factory act subject to the fulfilment of the following general conditions:

(a) Employment on night shifts shall be subject to the provision, to the satisfaction of the factory inspector, of proper facilities for taking and cooking meals, and in the case of female workers, for their supervision by a welfare worker or a responsible forewoman.

(b) No woman or young person shall be employed continuously at any time for more than five hours without an interval of at least half an hour, except that where not less than one hour is allowed for dinner, an afternoon spell of six hours may be worked, with an interval of quarter of an hour only for tea, if the factory inspector is satisfied that adequate provision is made for the workers to obtain tea in the works and for tea to be actually ready for them as soon as they stop work.

(c) If work commences before 8 a. m. and no interval is allowed for breakfast, an opportunity shall be given to take refreshment during the morning.

(d) A woman or young person shall not be allowed to lift, carry, or move anything so heavy as to be likely to cause injury to the woman or young person.

(e) Different schemes of employment may be adopted and different intervals for meals fixed for different sets of workers.

143. In a covering circular the Home Office stated that—

The order which fixes the maximum limits of hours does not discriminate between the various forms of work carried on in munition factories, and subject to these limits it is for the occupier to decide, having regard to the nature of the work, the time taken by the workers in getting to and from the factory, and other circumstances, what are the best hours to be adopted at his particular works in order to secure the maximum efficiency and output over a long period; and he is empowered by the order to fix different schemes of hours for different sets of workers. Further, it will be necessary for occupiers to instruct managers and foremen to watch closely how each scheme works in practice. Experience shows that some slight alteration or adjustment in the hours of work, such as, for example, the rearrangement or extension of the meal intervals or, in cases where overtime is worked, a short cessation occasionally from overtime, may be sufficient to check staleness or fatigue and cause a marked improvement in the workers' efficiency.

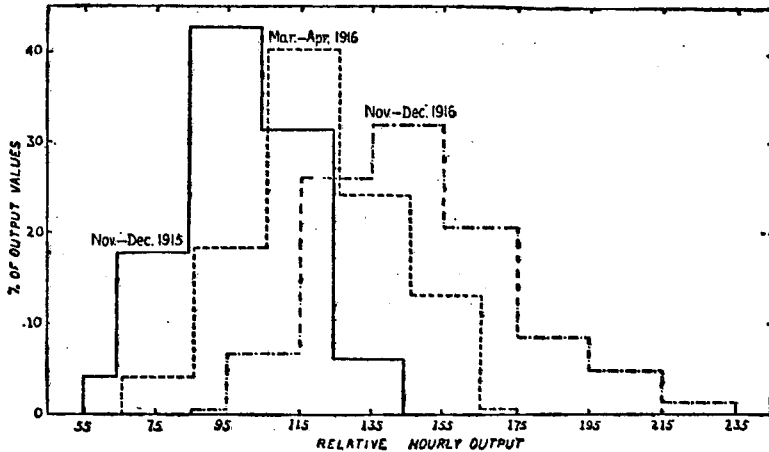
144. Since the issue of the order the Home Office and the ministry have taken other steps to reduce hours. Special concessions have been withdrawn notably as regards the employment of women for more than 60 hours a week and the employment at night of girls between 14 and 16. In addition action is being taken which is resulting in the steady abolition of the employment at night of girls between 16 and 18. Special concessions as to the employment at night of boys between 14 and 16 are also being reduced.

145. As already stated the recommendations originally put forward were only provisional, and the evidence which has since accumulated has shown the necessity for their revision. From the commencement of their work the committee have attached the highest importance to the collection of exact data affecting the problems at issue. The field to be covered is a very wide one, while the process of collection has been slow and laborious. The committee, however, consider that the data which have already been collected on their behalf by Dr. Vernon and others are of great practical value and demand the most serious attention. The results of these investigations are the more valuable in that they have been undertaken in the workshop and not in the laboratory, solely in a spirit of scientific investigation and with no preconceived opinions. The selection of factories for inquiry was based entirely on the likelihood of reliable data being forthcoming. Further, in none of the operations studied was there any change in the nature of the operation or the type of machinery during the period under review.

The data were so chosen as to eliminate any possible disturbance due to increasing skill. There is no reason to suppose that the data were vitiated by any artificial restriction of output. On this last point Dr. Vernon reports—

When the hourly outputs of individuals are plotted on a diagram, the distribution in the majority of operations is roughly symmetrical, persons who exceed the value reached by the largest group being about as numerous as those who fall short of it. In certain operations ("drawing" and "rectifying" cartridge cases) where the machine itself places an upper limit upon the possible speed of production, the shape of the diagram was different, the number that exceeded the output most frequently attained—what may be termed the fashionable or "modal" value—being much smaller than that which fell short of it. A corresponding result was obtained for women sorting cartridge cases, when paid at time rates, but for similar operatives when paid at piece rates the symmetrical distribution was once more observed. It is accordingly contended that the form of distribution, whether approximately symmetrical or asymmetrical, may be a useful test as to the existence of limitation of output, and that in the majority of the operations here studied no such limitation occurred.

The following diagram was prepared by Dr. Vernon to show the variation in output of women turning fuse bodies:—



146. The result of Dr. Vernon's investigations, which covered a period of over a year, are set out in memoranda Nos. 12 and 18,¹ but it appears desirable shortly to set out again the principal results of his investigations in so far as they concern the relation of weekly hours of employment to output. The following are the four sets of data which bear on this subject:

147. During the period November 14 to December 19 Sunday work (eight hours) was done on five out of six Sundays; during the

¹ Cd. 8344 and Cd. 8628.

eight weeks ending on July 2 on three Sundays, the nominal weekly hours in these three weeks being 66.5 instead of 58.5, an average of 61.5. During the period ending December 16 the timekeeping was bad, the normal weekly hours of work averaging about 55. Dr. Vernon accordingly suggests that with good timekeeping a nominal 50-hour week ought to yield the same actual hours of work (namely, 45.6); that is to say, that for women engaged in moderately heavy lathe work a 50-hour week yields as good an output as a 66-hour week, and a considerably better one than a 75-hour week.

TABLE I.—NINETY-FIVE OR 80 WOMEN¹ TURNING ALUMINUM FUSE BODIES.

Week ending—	Nominal hours of work per week.	Per cent of time lost per week as—				Actual hours of work per week.	Relative output per working hour.	Hours of work × relative output.	Remarks concerning output.
		Broken time.	Short weeks.	Absent weeks.	Total.				
Nov. 14—Dec. 19	74.8	8.2	2.1	1.3	11.6	66.2	100	6,620 (= 100)	Total output only 1 per cent less than in pre-Christmas period, though weekly hours of work are 12.3 less.
Feb. 27—Apr. 16	64.3	5.9	6.0	5.1	17.0	53.4	123	6,568 (= 99)	
May 14	58.5	5.4	2.6	3.0	11.0	55.8	130	7,343 (= 111)	Total output reaches a maximum 11 per cent greater than that of pre-Christmas period, though weekly hours of work are 11.4 less.
May 21	66.5					58.5	128		
May 28	66.5					56.1	132		
June 4	66.5					59.1	136		
June 11	58.5					51.0	137		
June 18	58.5	50.3	142	54.8	134				
June 25	58.5	53.1	133						
July 2	58.5	54.2	133	50.0	132				
July 9	62.5	56.0	126						
July 16	52.5	4.6	3.9	1.1	9.6	48.5	134	7,343 (= 111)	Workers went on to night shift for three weeks.
July 23	51.0					45.6	135		
July 30	66.5	7.1	7.1	3.3	17.5	56.2	128	124	Fall of output may be due to slackness resultant on deprivation of usual holiday. No more Sunday labor after Aug. 6. Holiday for a week (to compensate for loss of Whitsuntide and August holidays).
Aug. 6	62.5					48.6	122		
Aug. 12	49.5					40.3	126		
Aug. 19	49.5					43.0	121		
Aug. 26	29.5								
Sept. 2	58.5	5.8	5.5	2.6	13.9	48.0	130	6,737 (= 102)	Hourly output rises again to that of the May-June period, but abolition of Sunday labor has not yet had any obvious effect. Further four days' holiday (general holiday, by Government order).
Sept. 9	58.5					51.3	133		
Sept. 16	58.5					52.6	128		
Sept. 23	56.5					47.2	143		
Sept. 30	29.5					24.0	136		
Oct. 7	58.5	6.0	7.5	2.8	16.3	43.5	137	6,955 (= 105)	Further rise of hourly output due to holiday and to abolition of Sunday labor.
Oct. 14	58.5					49.2	146		
Oct. 21	58.5					52.0	153		
Oct. 28	54.5					46.9	132		
Nov. 4	58.5					50.0	132		
Nov. 11	53.5	6.5	8.3	2.0	16.8	44.1	143	7,205 (= 109)	Influence of shorter hours and of abolition of Sunday labor now well established. Total output 9 per cent greater than it was a year ago, though weekly hours of work are 20.6 less.
Nov. 18	58.5					48.8	141		
Nov. 25	50.0					41.8	156		
Dec. 2	49.5					41.0	152		
Dec. 9	58.5					48.8	174		
Dec. 16	58.5	48.8	179	149					
Dec. 23	29.5					24.5			

¹ The figures shown in the table do not represent the output of the same number of women. In November the number of women whose output was being studied was 95, but by August, 29 had dropped out. To the remaining 66 women were added 14 others, making the total from that time on 80, instead of 95. (See Health of Munition Workers Committee: Memorandum No. 18, p. 4.)

TABLE II.—FORTY WOMEN MILLING A SCREW THREAD.

Week ending—	Nominal hours of work per week.	Per cent o. time lost per week as—				Actual hours of work per week.	Relative output per working hour.	Hours of work × relative output.	Remarks concerning output.
		Broken time.	Short weeks.	Absent weeks.	Total.				
Nov. 21-Dec. 19.....	71.8	5.9	1.3	2.4	9.6	64.9	100	6,480 (= 100)	
Feb. 27-Apr. 16.....	62.9	5.9	4.1	1.7	11.7	55.4	109	6,039 (= 93)	
May 28.....	66.5	4.9	4.3	1.6	10.8	62.5	113	6,224 (= 96)	
June 4.....	66.5					63.1	111		
June 11.....	55.0					46.6	118		
June 18.....	55.0					46.3	113		
June 25.....	56.5					51.9	118		
July 2.....	66.5					56.8	114		
July 9.....	62.0					54.8	109		
July 16.....	66.5	59.8	118	6,631 (= 102)					
July 23.....	66.5	53.6	122						
July 30.....	66.5	53.5	119						
Aug. 6.....	59.0	50.5	127						
Aug. 12.....	33.5	29.5	123						
Aug. 19.....	44.5	38.1	122						
Aug. 26.....	57.0	51.1	121						
Sept. 2.....	51.0	47.5	128	5,506 (= 85)					
Sept. 9.....	44.5	38.5	117						
Sept. 16.....	48.5	45.0	121						
Sept. 23.....	29.5	26.4	119						
Sept. 30.....	54.5	44.8	110						
Oct. 7.....	54.5	49.3	132						
Oct. 14.....	54.5	48.7	132						
Oct. 21.....	59.5	49.5	130	6,397 (= 99)					
Oct. 28.....	55.5	49.9	130						
Nov. 4.....	58.5	43.1	134						
Nov. 11.....	58.5	48.3	129						
Nov. 18.....	58.5	48.3	129						

HOURS OF LABOR.

148. Dr. Vernon explains that the reason why a reduction of hours did not lead to an improvement of total output similar to that in the fuse-body turning operation is that for four-fifths of the total time required to mill the screw thread on the fuse body the operative had no opportunity of quickening her working speed, since she had merely to stand idly watching her machine, whereas the lathe worker had to apply seven different cutting and boring tools in succession to each fuse body, and could quicken up her speed of work at almost every stage.

TABLE III.—FIFTY-SIX MEN SIZING FUSE BODIES.

Week ending—	Nominal hours of work per week.	Per cent of time lost per week as—				Actual hours of work per week.	Relative output per working hour.	Hours of work × relative output.
		Broken time.	Short weeks.	Absent weeks.	Total.			
Nov. 14-Dec. 19.....	66.7	4.4	5.6	2.8	12.8	58.2	100	5,820 (=109)
Feb. 27-Apr. 16.....	62.8	5.2	8.6	5.8	19.6	50.5	122	6,181 (=106)
May 28.....	66.5					54.9	117	
June 4.....	63.5					55.8	122	
June 11.....	58.5					49.9	118	
June 18.....	53.5	5.2	8.3	.9	14.4	46.0	119	6,200 (=107)
June 25.....	58.5					51.2	122	
July 2.....	58.5					48.3	118	
July 9.....	61.0					51.7	112	
July 16.....	60.5					59.1	120	
July 22.....	65.5					47.6	119	
July 29.....	58.5	5.2	9.0	2.7	16.9	45.9	121	123
Aug. 5.....	53.2					46.3	126	
Aug. 12.....	31.0					27.8	130	
Aug. 19.....	39.5					33.0	136	
Aug. 26.....								
Sept. 2.....	58.5					51.6	131	
Sept. 9.....	58.5	5.6	4.8	1.1	11.5	49.2	135	6,426 (=110)
Sept. 16.....	44.5					40.1	133	
Sept. 23.....	53.5					49.4	139	
Sept. 30.....	29.5						135	
Oct. 7.....	54.5					51.3	133	
Oct. 14.....	54.5					51.4	142	
Oct. 21.....	55.3	4.1	1.6	.9	6.6	50.2	137	7,028 (=121)
Oct. 28.....	51.8					47.7	133	
Nov. 4.....	58.5					55.7	138	
Nov. 11.....	58.5					53.3	138	
Nov. 18.....	56.0					50.6	136	
Nov. 25.....	55.2	4.2	5.0	.7	9.9	50.7	135	7,117 (=122)
Dec. 2.....	54.5					49.1	140	
Dec. 9.....	58.5					50.6	141	
Dec. 16.....	58.5					53.0	140	
Dec. 23.....	29.5					27.1	136	

149. During the period ending December 16, the nominal weekly hours were substantially less than during the period ending April 16, but owing to the cessation of Sunday labor the timekeeping was so much improved that the actual hours of work were greater than during the earlier period.

TABLE IV.—FIFTEEN YOUTHS BORING TOP CAPS.

Statistical period.	Weeks in which Sunday labor was performed.	Nominal hours of work per week.	Per cent of time lost as—				Actual hours of work per week.	Relative output per working hour.	Hours of work X relative output.
			Broken time.	Short weeks.	Absent weeks.	Total.			
Nov. 15-Dec. 19.....	5 out of 5..	78.5	3.6	.....	4.0	7.6	72.5	100	7,250 (=100)
Jan. 3-Feb. 13.....	4 out of 6..	75.5	5.8	1.7	1.0	8.5	69.1	106	7,325 (=101)
Feb. 21-Apr. 16.....	6 out of 6..	63.4	5.4	5.8	2.3	13.5	54.8	108	.....
May 1-May 28.....	2 out of 4..	61.5	5.8	2.3	3.0	11.1	54.7	117	6,400 (= 88)
May 29-July 2.....	0 out of 5..	51.1	1.9	5.3	.....	7.2	47.4	124	.....
July 3-Sept. 23 (day shift).	2 out of 6..	59.7	5.5	3.9	2.2	11.6	52.8	129	.....
July 2-Sept. 23 (night shift).	0 out of 6..	61.6	2.6	4.8	1.4	8.8	56.2	128	7,030 (= 97)
Sept. 25-Dec. 16 (day shift).	0 out of 6..	54.8	3.7	7.3	.....	11.0	48.7	126	.....
Sept. 24-Dec. 16 (night shift).	0 out of 6..	58.2	2.7	.....	3.3	6.0	54.7	126	6,514 (= 90)

150. This process is largely automatic; increase of output could only be attained by a more continuous feeding of the machines throughout working hours.

151. Speaking generally, the above data show that a reduction in the weekly hours of actual work, varying from 7 to 20 hours per week, in no case resulted in more than an insignificant diminution of total output, while on the average it produced a substantial increase. As Dr. Vernon points out, the classification of the operations according to the possibility they offer for speeding-up production demonstrates anew the self-evident fact that the alterations of hours may have very different effects in different operations. The exact measure of such alterations can not be predicted; it can only be ascertained by observation and experiment. It appears evident, however, that for processes similar to those examined by Dr. Vernon the weekly hours can advantageously be reduced to a total of from 50 to 55 hours, and he suggests that even lower limits might give an equally good output.

152. Two further points of importance emerge from consideration of these data. In the first place the rate of production changed gradually, and frequently four months elapsed before an equilibrium value was reached. This gradual change appears to nullify the suggestion that the effect upon output of the change of hours was a mere consequence of the desire to earn the same weekly wages as before the hours were shortened. The explanation is rather to be traced to the worker finding unconsciously and gradually by experience that he can work more strenuously and quickly for a short-hour week than for a long-hour week. In the second place the evidence suggests that a considerable increase in the average hourly output is possible, quite apart from any increased rapidity of working. Thus, as the result of special investigations, Dr. Vernon found that in the case of the first body of workers mentioned above the time lost in commencing and stopping

work during the first period averaged 37 minutes as compared with only 26½ minutes during the third period. (See Cd. 8628.)

153. Prof. Loveday, in his memorandum on *The Causes and Conditions of Lost Time*, which is included in the committee's interim report on *Industrial Efficiency and Fatigue*,¹ also supplies valuable data, though of a somewhat different character. In the first place, he points out that the proportion of lost time that is due to sickness and other unavoidable causes is, as a rule, greatly underestimated in factory records, and the proportion due to slackness consequently overestimated. In the second place, he expresses the view that long hours, much overtime, and especially Sunday labor, exert a pernicious effect upon health, particularly of persons occupied in heavy trades. In paragraph 33 (5) of that memorandum he gives two tables, the first dealing with a body of about 180 men, and the second with between three and four hundred men employed on heavy work, their normal hours being from 65 to 70. In both these cases, when comparison is made with the figures of lost time for June, 1915, and for a year later, the fact emerges that there was a material increase in the amount of lost time, and that by far the larger portion of the increase was due to recorded sickness. In both cases, throughout, recorded sickness represented a noticeably high proportion of the total amount of time lost.

154. Prof. Loveday also devoted considerable study to the examination of figures concerning the amount of time lost before breakfast. He concludes—

(a) That if early hours be worked, the loss is likely to decrease if the start be later than 6 a. m.

(b) That when the total hours of the day-shift week are the same, there are likely to be more hours actually worked without than with work before breakfast, other conditions being similar.

(c) That a reduction of hours may be compensated for or even outweighed by the abolition of early hours, partly owing to reduced absences, partly owing to reduced waste of time, and partly to the greater vigor of work after taking food.

155. He quotes figures for a number of different factories which confirm these conclusions. He strongly presses the view that food should precede work. He points out the undesirability of hunger work, its bad effect upon health and the temptation to lose time in the short early spells.

156. There can be little doubt that there is an increasing recognition on the part of both employers and workers of the broad fact which emerges from the investigations of Dr. Vernon and Prof. Loveday, namely, that substantial reduction of hours can be effected without any reduction of output. Whereas at the beginning of

¹ Cd. 8511.

the war there was a general belief that longer hours necessarily produced larger output, it has now become widely recognized that a 13 or 14-hour day for men and a 12-hour day for women, excepting for quite brief periods, are not profitable from any point of view. Few, probably, would disagree with the statement contained in the summary prepared by the Right Hon. G. N. Barnes, M. P., of the recent report of the commissions on industrial unrest¹ that—

There is a general concensus of opinion that Sunday and overtime labor should be reduced to a minimum, that holidays should not be curtailed, and that hours of work should not be such as to exclude opportunities for recreation and amusement.

157. It must be recognized that the conditions are not the same now as they were in the early days of the war; not only have large numbers of the youngest and strongest workers been withdrawn for military service, but those who remain have undergone the strain inseparable from a continuous period of long hours of employment. To this must be added the strain caused by family and other anxieties arising out of the war. While much has been done to improve conditions of employment they are still in many cases far from ideal, notably as regards housing and transit. Further, large numbers of women are now employed on heavy work and on skilled operations which were considered two years ago to be quite beyond their capacity. It may be true that no serious breakdown of health has as yet been observed among the great mass of the workers, but it can not be assumed that this condition will continue indefinitely. The effects of the strain may even have been already more serious than appears on the surface, for while it is possible to judge roughly the general condition of those working in the factory to-day, little information is available concerning the large number of workers who, for one reason or another, and often because they find the work too arduous, are continually giving up their employment. This is an important point which is liable to be overlooked, since the supply of labor has hitherto been adequate to fill their places. The irritability and nervousness mentioned by the commission on industrial unrest are moreover well-recognized symptoms of fatigue, while it must not be forgotten that the effects of fatigue are accumulative. How great is the burden imposed upon women by a 12-hour shift is shown by the following extract from a report recently prepared for the committee upon an inquiry amongst individual women as to the conditions of employment in a factory, where much of the work was heavy in character:

¹ These reports (eight in number) have been published and can be purchased through the usual channels.

It appears that out of 140 women 99 were having under eight hours' sleep to fit them for a night of 12-hour shift plus traveling time. Moreover, out of 146 women only 16 felt that they were able to go out at all during the week. Where replies were not given it was in general because of the obvious absurdity of asking the women what they did in their spare time, after having heard their account of domestic responsibility.

It may therefore be very strongly urged that these hours of work, coupled with the distances to be traveled, are such as to preclude the women taking any outside interests if they are to get sufficient rest. It is obvious that the majority of the women recognize this and are content to save themselves only for their work. Such a sacrifice may be with justice demanded for a short period through the exigency of a great and unexpected emergency, but should certainly not be enforced for a longer duration than is absolutely necessary. It may again be noted that already many of these women have worked on these long hours for 13 months.

158. After careful consideration of all the circumstances, the committee are convinced that the maximum limits of weekly employment provisionally suggested are too high except for quite short periods, or perhaps in cases where the work is light and the conditions of employment exceptionally good. In the great majority of cases, however, the hours of work should now be restricted within limits lower than those quoted in paragraph 140 above. It is impossible to lay down a single rule as to the best hours in all cases; the best scheme can only be determined after a careful consideration of a number of different factors, e. g.:

(a) The strain involved in the work, its character (heavy or light, continuous or intermittent), the mental demand which it makes upon the worker, and the length of process.

(b) The extent to which the pace of the work is governed by the machine.

(c) The factory environment—temperature, ventilation, etc.

(d) The individual physical capacity of the workers, and their age, sex, and experience.

(e) The organization of the factory (including welfare supervision).

(f) The sufficiency and suitability of the workers' food, canteen accommodation, etc.

(g) The arrangements of the hours of work (spells, breaks, and pauses).

(h) Conditions outside the factory—e. g., housing and transit.

159. In arranging the hours of work for a factory allowance should be made, as far as discipline and organization permit, for the fact that the best hours of employment will not be the same for all processes, even in the same factory.

160. Though no exact statement is possible as to how far the reduction of hours can advantageously be carried out, either now or in the near future, it is not without significance that so experienced an

employer as Lord Leverhulme should be now advocating the establishment of a six-hour day. Though many will not be prepared at the present time to agree as to the feasibility of so radical a proposal the ground on which the proposal is advocated, as stated in a memorandum submitted to the committee, appears worthy of quotation:

But under the present system of hours of work the thorough education of our children is practically impossible. An absolutely essential step in the direction of a more efficient educational system is the shortening of the hours of labor and the improving of the conditions of living for the worker.

We are only just beginning to make a considered study of the inefficiency and resulting waste that is produced by fatigue. We can not claim even yet that we have any very profound knowledge on the subject, but the wastefulness of fatigue has been abundantly proved by the researches already made. Therefore it is essential that work in the factory, the workshop, and the office should be so arranged as to avoid fatigue, and by maintaining the general health of the workers, to prolong their activity and increase their skill and efficiency.

Moreover, modern conditions of production requiring costly plant, machinery, and factory buildings make it obvious that such division of the 24 hours must be made as will (whilst utilizing the mechanical utilities to their utmost capacity so as to get as large an output from plant, machinery, and mechanical utilities as possible) tend to relieve the human element from fatigue. Only by so doing can we reduce to a minimum all overhead charges for interest, depreciation, and rent, etc.

It is obvious from the above that when our modern industries are run on a less fatiguing system of say two shifts each of six and a half hours with half an hour off for meals (making six working hours in all per day), the efficiency of the worker by thus avoiding fatigue can be increased by at least 33 per cent, and consequently that as much work can readily be done in six working hours as under present conditions is done in eight. But in addition to the ability of the employee to produce as big an output in six hours as is now produced in eight, there would be the added advantage that the plant, machinery, etc., would be running for 50 per cent longer time, viz, 12 hours instead of eight, which running of machinery would reduce the overhead charges proportionately and increase the output enormously.

At the close of the war we shall be in a unique position to try this experiment as a Nation. We shall want all the output of manufactured goods we can produce. We shall not have immediately the power largely to increase our plant and machinery. We shall have the return of our heroes from the field of battle; therefore we shall have ample supply of labor to test the experiment. The world's demand for manufactured articles after the war will be overwhelming and unprecedented.

The six-hour working day does not mean some hours gained for loafing. It is not intended to produce a loafer's paradise within the United Kingdom, and I say, without hesitation, that there is not a single man or woman of those who would be benefited by a six-hour working day who would not feel themselves to be insulted if he or she were thought capable of viewing the proposal in that light.

161. Though the extent to which hours of labor can be advantageously reduced must necessarily vary, the committee desire strongly to emphasize their opinion that the time is now ripe for a further sub-

stantial reduction in the hours of work. If this be effected with due regard to the varying conditions prevailing in different branches of industry, they are satisfied that reductions can be made with benefit to health and without injury to output. It is highly significant in this connection that the Government should have recently announced their decision to introduce an experiment in some Government national factories of a week of 50 hours. It is to be hoped that the experiment will be closely watched and its results accurately recorded.

162. It must be obvious that any reduction of hours which can be accomplished without loss of output is profitable not only to the employer, in that it reduces running expenses, but to the worker since even if his or her daily measure of work involves the same amount of fatigue a longer period is left for recovery, for the enjoyment of adequate sleep and rest, and for the necessary opportunity for recreation, exercise, and the discharge of the ordinary duties of citizenship and domestic life.

SECTION VI.—SHIFTS, BREAKS, SPELLS, PAUSES, AND HOLIDAYS.

SHIFTS AND DAILY HOURS OF EMPLOYMENT.

163. If weekly hours of employment are limited, as suggested in the last section, it necessarily follows that average daily hours of employment will also be confined within moderate limits. The special questions which arise in regard to them can therefore be dealt with briefly.

164. The daily employment of workers is organized in single shifts, in double shifts, or in three shifts. From the point of view of output single shifts are open to objection owing to the large number of hours out of the 24 during which the machinery lies idle. In the earliest stages of the war, when it was frequently found impossible to organize a second shift owing to the dearth of workers, and especially of skilled operatives, an endeavor was made to secure larger output by prolonging the hours of employment, men, and even women, being employed over long periods for 14 or even 15 hours a day. For reasons already explained it is now generally recognized that these long hours are unprofitable, and that much shorter hours can be worked without any loss of output. Many munition employers, as a result of recent experience, now take the view that for women and young persons a 12-hour day is too long, and hours are now frequently limited to a 10-hour or even a shorter day, longer hours being only worked occasionally to meet special emergencies.

165. Double shifts are the form of employment now most commonly adopted. Though for reasons to be stated in a later section, night work is in itself open to serious objections as a permanent part of the industrial organization of the country—at least, so far as women are concerned—it must for the present be regarded as inevitable, at any rate, for adult workers, since it enables the machinery to be employed for the greater part of the 24 hours; and so long as the hours of work are not unduly long, and due attention is paid to the environment of the worker, it is undoubtedly productive of increased output.

166. For men the two shifts are most commonly each of 12 hours' duration, though occasionally to meet local conditions the night shift is of 13 hours, as compared to 11 hours of the day shift. Such an arrangement can hardly be economical, in view of the greater strain involved by night work, and the arrangement should certainly be avoided wherever possible. Where the nature of the work does not render it essential that the end of one shift should coincide with the

commencement of the next, it is unquestionably advantageous to leave an interval between the two shifts. The shorter hours thus rendered possible are beneficial from the point of view of both the health of the workers and of output. Apart from this, opportunity is afforded for cleaning and ventilating the shops—a matter of much importance. This point was emphasized in the circular issued by the Home Office with their general order of September, 1916. They stated:

The Secretary of State desires to emphasize the desirability of allowing an interval of half an hour or more between the two shifts unless the process is one which must necessarily be carried on continuously. Such an interval is of great value in affording an opportunity for cleaning and ventilating the shops.

167. Men are occasionally employed on a system of three 8-hour shifts. Of the operation of this system in certain steel works a prominent trades-unionist spoke as follows:

While it is too early to make any definite statement as to the effect of the change upon the health of the workers, employers had borne testimony to the great success of the change; bad men had become good and good men better. Under the old system a worker was completely worn out by his work; under the new system he was able to take up hobbies such as allotments, bowling, or fishing, which kept him out of the public house. Thus at one place it was reported that among a population of over 30,000 people there had not been during the last year a single conviction for drunkenness; the shorter hours enabled the worker to get home and get dressed and generally encouraged self-respect.

168. If only on account of the dearth of male workers the system, whatever its advantages, is not capable of general adoption at the present time.

169. The three-shift system, especially for women, has much to commend it where it can be organized. It imposes little or no strain upon the workers, while the periods for which the machinery stands idle are much reduced. Difficulties in regard to an alternative supply of labor do not arise to the same extent as in the case of men, and there is no doubt that the three-shift system yields the best results where it can be arranged for. The strain of night work, indeed, the strain of work generally, is sensibly diminished. Greater vigor of work is maintained throughout the shift; less time is lost by unpunctuality or illness. In the eight-hour shift each hour has a sustained value in contrast to the diminishing value of the later hours in a longer shift. The night shift, which is the most trying, recurs every third instead of every other week.

170. On the other hand there are certain difficulties of organization which have to be surmounted:

(a) Male tool setters have ordinarily to be employed on two 12-hour shifts. Difficulties consequently arise in combining the hours of men and women workers, notably as regards meal hours and the supervision of work.

(b) The break for meals being limited to half an hour may afford an inadequate time for refreshment, especially at night.

(c) Time may be lost at the change of shifts.

(d) Workers may object through fear that shorter hours will mean smaller wages.

(e) The benefit of shorter hours of employment in the factory may be lost through misuse of leisure time, or by its devotion to household duties. Difficulties are also sometimes experienced in the home and in lodgings through meals being required at times inconvenient for other workers.

171. Experience shows that these difficulties, though substantial in particular cases, are seldom insurmountable; there are numerous instances throughout the country where the three-shift system has been successfully organized. Thus, it was reported of one firm—

The firm believe the three-shift system to be the best for output and health. They are satisfied that the difficulties are not substantial and that they can all be met by reorganization and shop management. They consider there should never be a shortage of material, loss of time, friction in taking over shifts, or any of the other difficulties alleged against the three-shift system. In their opinion * * * all the alleged difficulties can be overcome.

BREAKS.

172. The ordinary daily hours of work are organized under the "two-break" system or the "one-break" system. Under the former work usually commences at 6 a. m., and the ordinary breaks are half an hour for breakfast and one hour for dinner. Under the "one-break" system work commences after breakfast at 7 or 8 a. m., and there is generally only a single break of one hour for dinner, though a break for tea is provided where it is necessitated by the hours of working. This break is generally of half an hour's duration but is sometimes reduced to 15 or 20 minutes in order to permit the workers to return home earlier. In the case of women and young persons this limitation of the interval for tea is only allowed where adequate provision is made for the workers to obtain tea in the works and for tea to be actually ready for them as soon as they stop work.

173. Prof. Loveday has devoted considerable attention to investigating the conditions of the "one-break" system, and the results of his inquiries are set out in his memorandum on The Causes and Conditions of Lost Time, which is included in the committee's interim report on Industrial Efficiency and Fatigue. He suggests that the system has the following advantages:

(a) A large number of "quarters" are lost before breakfast. To some extent this loss is no doubt unavoidable and due to the workers being fagged, to minor ailments (colds and rheumatism) or to transit

difficulties; but much of the loss is avoidable. In his opinion the shortness of the spell before breakfast increases the temptation to miss it. He says:

The regularity with which a greater number of quarters is lost on certain days indicates deliberate choice of those days, and the preference for "sleeping in" on Monday even when there has been no Sunday shift disproves any direct connection between overtime and much of the loss of early hours.

(b) The amount of time lost before breakfast is often sufficiently large to cause serious disorganization.

(c) It is only a minority of workers who can put in their best work before having a proper meal in the morning.

(d) There is less interruption of work. Dr. Vernon, in his first report (see Memorandum No. 12), has called attention to the large amount of time which is lost in starting and finishing work.

174. Prof. Loveday, in paragraphs 51-54 of his report, gives particulars of a number of factories in which work before breakfast has been abandoned with good results. Even where the change has involved a small reduction in the number of weekly hours this reduction has frequently been more than compensated for by the reduction in the amount of time lost. Apart from a conservative feeling against any change objection has been made to the adoption of the "one-break" system on the ground that—

(i) Where a reduction of hours is involved a loss of wages is feared.

(ii) Domestic inconvenience may be caused through the worker requiring his breakfast before he leaves home.

(iii) A later start may involve a later hour of finishing work.

(iv) The workers do not in fact always get a good breakfast before they start. On this point a representative trades-unionist stated that—

In some cases the "single break" system is in force under which work generally starts at 7. This arrangement is based on the assumption that the worker will have had breakfast before he comes. Where, as is frequently the case, workers have to travel an hour or more to reach the works, this involves a very long period without food, in addition to the fact that an early start frequently involves at any rate a hurried breakfast and, in some cases, none at all. Even the men get a sinking feeling and can not work properly. It is worse for women.

175. Prof. Loveday is doubtful as to the force of the first three of these objections. As regards the last he suggests that, where the workers live far from home, work should commence at 8 a. m. rather than at 7 a. m. Where the earlier hour is adopted it is generally desirable that a short break for refreshment should be provided in the middle of the morning, and the Home Office general order of September, 1916, requires in the case of women and young persons that—

When work commences before 8 a. m. and no interval is allowed for breakfast an opportunity shall be given to the workers to take refreshment during the morning.

176. Prof. Loveday's view that the "one-break" system is preferable to the "two-break" system is confirmed by the evidence of employers who have practical experience of it. Thus Sir William Mather, as a result of his great experience, informed the committee that—

The two hours before breakfast were practically wasted owing to the long walk to the works, the absence of breakfast or the temptation to get a drink on the way to work in order to keep warm. Both morally and physically the worker was a better man if he had a good breakfast with his family before leaving for work. His firm tried the experiment for a whole year and the results were such as to leave them no hesitation in adopting the system permanently and nothing had since occurred to modify their views. The change had proved salutary as well as profitable. Thrift and sobriety had been encouraged. The worker was a better individual. Even now that owing to the war they were working two 12-hour shifts they still attached great importance to the day shift only starting work after breakfast.

177. Dr. Vernon, in his memorandum (see Appendix C) on A Comparison of the Systems Employed for Dividing Up Working Hours into Spells and Breaks, gives the results of inquiries into the output of workers before breakfast; he thus summarizes his conclusions:

Day-shift workers on the one-break system were found to work up to their maximum output each morning rather more quickly than the night shift worked up to their maximum; but day-shift workers on the two-break system, in which work was begun at 6 a. m., and was followed by a breakfast interval at 9 a. m., had 7 per cent to 18 per cent less output in these three prebreakfast hours than the night-shift workers had in their first three working hours. This was presumably due to the night shift having had a good meal before starting work.

SPELLS AND PAUSES.

178. Attention has already been drawn to the importance of the proper distribution of rest pauses in providing against fatigue. In America, much attention has been devoted to the proper length and distribution of pauses, and this is one of the most important aspects of "scientific management." In this country, as yet, the subject has received but little attention. Experience has indeed proved that under present circumstances many women and young persons can not profitably be employed for the full spell of five hours on continuous work as allowed by the factory act, and even where the spell is somewhat less than five hours, there is a general tendency among employers to allow short intervals for refreshment in the afternoon, and frequently in the morning also. These pauses not only provide an opportunity for refreshment, but a period of rest and recovery from fatigue, and a break in the monotony of the work.

179. Dr. Vernon, in paragraph 31 of his report on Statistical information concerning output in relation to hours of work (Memorandum No. 12), draws attention to the importance of this subject. He says:

The custom in many munition works is for the operatives to work for a spell of five hours, and then, after an hour's interval, for another spell of four and a half to five hours. Such spells are undoubtedly too long in many types of munition work, but if a second break is introduced in the working day much extra time is lost in starting and stopping work. If the operatives are left to themselves, they take rests at irregular and often unsuitable times. Hence it would be much better if the rest pauses were chosen for them. For instance, a 10-minute break in the middle of the morning and afternoon spells, during which the operatives remain at their machines, but take tea or other nutriment brought them by boys or by traveling canteens, has been found a valuable aid to output in some munition works. Some types of work need longer and more frequent rest pauses than others, and the best times can be determined only by experiment. After being fixed they should be made compulsory, and rest pauses at other times be checked so far as possible.

180. In his memorandum on A Comparison of the Systems Employed for Dividing Up Working Hours into Spells and Breaks, Dr. Vernon records the results of certain inquiries into the output on five hours' spells; he concludes that—

Five-hour spells of work are too long, for it appeared that by cutting up the 10-hour day into three spells of, e. g., 4, 3 and 3 hours, separated by two breaks (the first of which is too late to function as a breakfast break) the output might be increased 5 per cent to 12 per cent above that experienced when two 5-hour spells were worked. What is probably a better system still of avoiding 5-hour spells is to stop work for a quarter of an hour in the middle of each spell and provide the workers with refreshment by means of traveling canteens. The introduction of one such extra $\frac{1}{4}$ -hour break in a cartridge factory, together with the abolition of the breakfast interval, increased the hourly output 5 per cent.

181. In the same memorandum Dr. Vernon also records certain data he collected as to rests voluntarily taken by workers. In the case of some men engaged on hand-tapping fuses he found that—

On an average they took seven to nine minutes of voluntary rest pauses in all except the first full hour of work; and as they were all of them men who had been engaged for many months on the operation and were paid at piece rates, there can be no doubt that they found by experience that such pauses improved their total output. It was curious to note, however, that they worked on no sort of system, but often took rests in a most irregular manner.

182. Dr. Vernon expresses the opinion that rest pauses are essential in active work for both men and women, though as might be anticipated he found that the extent of these voluntary rests varied greatly according to the extent to which the nature of the work involved enforced periods of inactivity.

183. So far as the committee are aware, but few firms have made any endeavor to investigate scientifically the particular distribution of rest pauses needed to secure the best output in their own works. The following case of the advantage of such pauses may be quoted

from the memorandum on Incentives to Work, included in the committee's interim report:

A group of workers, men and women, paid on a time wage, were found employed from 6 a. m. to 6 p. m., with two half-hour meal intervals, at the process of emptying and filling a series of presses. Each press, after being filled, has to be left under hydraulic pressure for 35 minutes, during which time other presses in the series are emptied and filled. The management calculated the number of presses to each series, which would allow the work to be done in 35 minutes at a reasonable pace; but the workers on their own initiative have adopted a different method. They work with a rapidity so organized that the series of presses is emptied and filled in less than 25 minutes, after which they rest for 10 or 12 minutes until the time comes to begin again. The work entails the expenditure of a fair amount of physical energy, and it was interesting to watch these operatives swing into their labor in order to obtain their rest pause.

HOLIDAYS.

184. The committee consider it most important that the ordinary factory holidays should be maintained. As a trades-unionist put it—

If once in every two or three months a man could have two or three days off it would prove the finest medicine, much better than a bonus as extra pay.

185. The evidence leaves no doubt as to the beneficial effect of such holidays both on health and output. Dr. Vernon, in his further report on output in relation to hours of work (Memorandum No. 18), thus describes one case which he investigated:

In the February-April period * * * the hourly output had risen to 123. * * * Though the hourly output during the February-April period was fairly steady, the workers had not become completely adapted to the reduction of hours from a normal 12-hour to a normal 10-hour day which had been effected four weeks previously. After Easter, when they had a full week's holiday, their relative hourly output went up to 134 on the average and remained fairly steady for the next eight weeks, although the actual hours of work were slightly greater than before Easter. * * *

After a week's holiday at the end of August the hourly output went up again to its May-June level, but it was not until October or after another holiday (the four days ordered by Government) that a marked rise of hourly output set in. This rise continued in subsequent weeks until, in the fortnight before Christmas week, it reached the astonishing figure of 177.

186. In commenting on these figures Dr. Vernon points out that—

The workers, refreshed and more vigorous, unconsciously start work on a higher level of speed and maintain that level permanently, whereas a reduction of hours unaccompanied by a holiday, i. e., by a change of breaking through settled habits of work, is generally very much slower in conducting to the desired reaction.

187. Prof. Loveday, in his memorandum on The Causes and Conditions of Lost Time (see the committee's interim report, pp. 52, 53), draws attention to the beneficial effect of a holiday in reducing the amount of broken time due to sickness. He quotes an instance in

which the sickness rate for the three weeks immediately following a considerable holiday at the end of August and beginning of September, 1916, was 4.2 per cent as against 5.4 per cent in the week immediately preceding the holiday, and 8.6 per cent in the week before that. The rate had not been so low for many months previously.

188. Another aspect of the question of holidays is that they afford much needed opportunities for carrying out repairs to plant and machinery; in the absence of such opportunities the defective conditions may become so serious as materially to affect output.

189. The committee desire specially to emphasize the need for giving periodic holidays to members of the management and to foremen. They can not take odd days off like the ordinary worker, and cases of temporary breakdown have been regrettably common.

SECTION VII.—SUNDAY LABOR AND NIGHT WORK.

SUNDAY LABOR.

Man, man is the great instrument that produces wealth. The natural difference between Campania and Spitzbergen is trifling when compared with the difference between a country inhabited by men full of bodily and mental vigor, and a country inhabited by men sunk in bodily and mental decrepitude. Therefore it is that we are not poorer but richer, because we have, through many ages, rested from our labor one day in seven. That day is not lost. While industry is suspended, while the plough lies in the furrow, while the Exchange is silent, while no smoke ascends from the factory, a process is going on quite as important to the wealth of nations as any process which is performed on more busy days. Man, the machine of machines, the machine compared with which all the contrivances of the Watts and Arkwrights are worthless, is repairing and winding up, so that he returns to his labors on the Monday with clearer intellect, with livelier spirits, with renewed corporal vigor. Never will I believe that what makes a population stronger, and healthier, and wiser, and better, can ultimately make it poorer.—(Macaulay, speech on the 10-hour bill, House of Commons, May 22, 1846.)

190. The most urgent problem awaiting the consideration of the committee at the time of their appointment was that of Sunday labor. Partly on account of the heavy demand for output and partly through the attraction of the higher rate of wages payable, Sunday labor for men was common. Sometimes the hours were the same as on weekdays; sometimes they were shorter, work commencing later or finishing earlier. Elsewhere they were longer than on ordinary days as when the transfer from the 12-hour day shift to a 12-hour night shift was made by working for a continuous period of 18 hours, one shift working (say) from 6 p. m. on Saturday to 12 noon on Sunday, and the other from noon on Sunday to 6 a. m. on Monday.

191. The employment on Sundays of women and boys was much more restricted and was only allowed on special application to the Home Office. In October, 1915, for the whole of the United Kingdom there were in operation about 50 orders allowing the employment on Sundays of women, girls, and boys, and also about another 30 for boys only. As a rule such employment was only sanctioned when hours of work on other days of the week were limited, and even when it was allowed it was usual to impose restrictions, such as—

(a) That women and young persons should not be employed on two consecutive Sundays;

(b) That they should have time off on Saturday;

(c) That they should only be employed on Sunday in cases of emergency;

(d) That they should be employed for a portion of Sunday only.

192. *Sunday labor is in itself unpopular.*—There exists a large body of opinion that the seventh day, as a period of rest, is good for body and mind. Employers object to it on the ground that supervision is difficult, and that it imposes a severe strain on foremen, substitutes being difficult to obtain. In the early days of the war high rates of pay made Sunday labor popular with many workers, but this popularity has steadily decreased and any difficulties involved have generally proved capable of adjustment. High rates of pay on the other hand have been another objection raised by employers who have also complained of increased cost of running their works. Sunday labor is in fact only defensible if it can be shown to be productive of greater output over a longer or shorter period.

193. *But Sunday labor is uneconomical.*—As has already been pointed out, fatigue may be mental as well as physical. Account has to be taken not only of the hours of labor, factory environment, and the physical strain involved but also of monotony, which may prove as serious an obstacle to good output as physical fatigue. The cure for fatigue, whether physical or mental, lies in adequate periods of rest, and the problem of Sunday labor is primarily one of the extent to which the worker requires weekly or periodic rests if he is to retain his health and energy over long periods.

194. The evidence is conclusive that Sunday labor by depriving the worker of his weekly rest offers him no sufficient opportunity for recovering from fatigue, and is not productive of greater output except for quite short and isolated periods. Employers stated in evidence, that though attendance on Sunday is generally good it is not always accompanied by a satisfactory individual output; not infrequently a holiday spirit is apparent. Moreover, attendance at work on Sunday is often accompanied by bad timekeeping on other days of the week. Statements have been made that seven days' labor only produces six days' output, and that reductions in Sunday work have not in fact involved any appreciable loss of output. Trades-union officials have complained that their members were getting tired and needed more rest. In several instances they pressed for the reduction of Sunday work.

195. Evidence in the form of statistics of output in regard to Sunday labor is not easily obtainable. Even when the output of work has been such as would in normal circumstances permit of the collection of exact data, the rapid growth in the number of persons employed, the greater employment of women, the increased efficiency of inexperienced workers, and other similar causes have generally

rendered comparisons difficult, unreliable, and impossible. Even where the data was available the management have not generally found it possible to arrange for its collection and tabulation. The representative of one important firm, however, informed the committee that in one of their shops where heavy machine work was done by men of good average trade-union type they had by extending the relief at the week end reduced the average weekly hours from $78\frac{1}{2}$ to $65\frac{1}{2}$. Though the normal hours were thus reduced by 13, the average number of hours (60) actually worked during the three months succeeding the change exceeded the average number of hours ($59\frac{1}{2}$) worked during the six months preceding the change. Moreover, in his opinion the output per hour was improved.

196. Prof. Loveday, who conducted certain inquiries into lost time, states in paragraph 11 of his memorandum (see the committee's interim report on Industrial Efficiency and Fatigue)—

In so far as long hours lead to loss of time by fatigue and sickness, insistence on them is most deplorable. The keenest men are not always the most robust, and it is the keenest who have most strain to bear. The hours gained are more costly than the hours lost. * * * The effects of Sunday labor are, as has now been recognized, still worse than those of overtime hours in the evening or on Saturday afternoon.

197. Dr. Vernon, in the course of his investigation² concerning output in relation to hours of work, has shown that in the case of a body of 80 to 100 women that the reduction of the hours of employment by the stoppage of Sunday work involved no reduction of output, though the full effect of the change took a few months to operate. A similar investigation in regard to a body of 56 men, sizing and fuse bodies, showed that though the number of nominal hours of work were by the cessation of Sunday labor reduced by six, the time-keeping was so much improved that the actual hours of work remained the same. The withdrawal of Sunday labor seems to have led the men to observe much more regular hours and during their regular hours to increase their ordinary output some 16 per cent above its previous level. The abolition of Sunday labor has sometimes been demurred to on account of the low Monday output, which frequently follows a week-end rest. Dr. Vernon, however, pointed out that in the cases quoted, though the Monday output was low compared to other days of the week, it reached a considerably higher level than was ever obtained in the absence of a week-end rest.

198. The committee, in their Memorandum No. 1, submitted in November, 1915, to the ministry, on Sunday labor, expressed their conviction that if the maximum output was to be secured and maintained for any length of time a weekly period of rest must be allowed. Except for quite short periods, continuous work, in their view, is a

² See paragraphs 146-150 above.

profound mistake and does not pay. Output is not increased. On economical and social grounds alike this weekly period of rest is best provided on Sunday. Speaking generally, the relief from work on Sunday is more urgent for women and young persons than for adult men and for men on overtime than for those on double shifts. The need may also vary somewhat according to the number of hours worked during the week and the environment and character of the work, but the committee consider that the discontinuance of Sunday labor should be of universal application and should extend to all classes of workers, except that where the work must necessarily be continuous special arrangements will be necessary.

199. Acting on the recommendations of the committee, the ministry in December, 1915, issued a circular on Sunday labor to all controlled establishments, in which the following opinions were expressed:

The minister is of opinion that it is necessary in the interests both of the workers and of production that a weekly rest period—preferably Sunday—should be secured to all workers.

This recommendation applies equally to all classes of labor, male and female, adult and juvenile, though there must be certain necessary exceptions in the case of labor such as that employed upon furnaces which could not be discontinued without grave dislocation. Even in these cases, though it may not be possible to arrange for a general rest on any particular day in the week, it would still be desirable so to arrange the work that all persons engaged upon the work had, if on different days, a regular period of rest.

It is in the opinion of the minister preferable to work a moderate amount of overtime in the week, allowing a break on Sunday, rather than work continuously from day to day. It is still more strongly his view that where overtime is worked in the week Sunday labor is not desirable.

200. The ministry subsequently appointed in consultation with the Home Office a committee to consider demands for Sunday labor and to secure its discontinuance wherever possible. In April, 1917, a further letter was issued by the ministry, in which it was stated that—

The minister, after further consultation with the various departments concerned, is of opinion that it is advisable that Sunday labor, with the exception of shifts beginning on Sunday night or ending on Sunday morning, or of work in connection with the necessary repair of plant machinery, should be discontinued as far as possible from the beginning of May, and would be glad if you would make arrangements in your establishment to that end.

201. During the past two years there has been a steady and continuous reduction of Sunday labor. From reports of the various commissions appointed in July, 1917, to inquire into the causes of industrial unrest it is evident that what Sunday labor still remains is unpopular and more than one commission urged its discontinuance:

The temptation to engage on Sunday labor so as to earn higher rates of pay has been pointed out to us as being conducive to overstrain, and we believe that it will be generally recognized that Sunday labor (which still prevails to

some extent) should be discontinued except to meet absolute emergencies. (Northeast area.)

We consider that overtime and Sunday work should be reduced as much as possible. We do not believe that they increase production in the long run. We recognize that things are much better in this respect than they were, but there is still room for improvement. (West Midlands area.)

The amount of overtime and week-end and Sunday work should be reduced to a minimum, subject to the exigencies of the national requirements. (London and Southeastern area.)

202. The committee recognize that the amount of Sunday labor at any moment must necessarily vary to some extent according to the nature and degree of the urgent demands for the immediate delivery of particular types of munitions. Figures, however, collected by the Ministry of Munitions show that in controlled establishments engaged on noncontinuous processes the numbers of men and women employed on Sunday were, in January, 1918, very substantially smaller than they had been 12 months earlier.

203. As regards orders made by the Home Office authorizing the employment on Sunday of women and young persons (other than volunteer workers not employed during the week), the position on January 31, 1918, was shortly as follows:

General Orders.—(i) The general order (Munitions of War) allows the Sunday employment of workers employed on the three-shift system, and also (where authority is granted by the superintending inspector of factories) of workers on the two-shift system, if a day off is given in lieu of Sunday. No information is available as to the number of firms taking advantage of these concessions.

(ii) An order for national filling factories authorizes the employment of women and young persons over 16 years on alternate Sundays, with a weekly limit of 60 hours (excluding mealtimes). Little use is made of this alternative.

Special orders for individual works.—Particulars of these orders are set out in the following table:

Extent of Sunday work.	Total number of factories.	Number of orders affecting—		
		Women (over 18).	Girls ¹ (14 to 18).	Boys (14 to 18).
A.—Every Sunday.....	1	1		
B.—In special emergency.....	6	5	3	5
C.—Cases in which a day off is allowed in lieu.....	33	29	4	8
D.—Cases under 8-hour shift systems.....	17	16	4	0
E.—Other cases:				
Two Sundays in three.....	1			1
One Sunday in two.....	9	7	2	4
One Sunday in three.....	5	5		
One Sunday in four.....	6	6	2	3
Total.....	73			

N. B.—The above statements take no account of course of cases where night work ends on Sunday morning or begins on Sunday night.

¹ Only one of these allows the employment of girls under 16 on Sunday.

² In this case the women work not more than six hours on Sunday, and only three hours on two Mondays in three—the third Monday being free from employment.

³ In five instances the same factory is represented twice under the headings A to E.

204. Subsequent experience has fully confirmed the original recommendation of the committee that it is essential for health and output alike that Sunday labor should be confined to—

(a) Sudden emergencies, including the making up of arrears in particular sections; and

(b) Repairs, tending furnaces, etc. (the men so employed being given a corresponding period of rest during some other period of the week).

205. Such temporary concessions as may be unavoidable should be confined within narrow limits and terminated as soon as practicable.

NIGHT WORK.

206. There is no legal restriction upon night work for men. It is only legal for boys in certain specified continuous processes. The employment of women at night has been prohibited for more than 70 years in the textile trades, and has never been allowed in nontextile trades since they were brought under the provisions of the factory acts 50 years ago. It was finally abolished by international agreement from 12 European countries which signed a convention drawn up at the international conference held at Berne in 1906. These countries included, in addition to Great Britain, Austria and France, Germany, Belgium, Italy, Portugal, Spain, and Switzerland. The agreement was based upon the results of inquiries into the effects—economical, physical, and moral—of night work for women.

The objections to night work may be shortly summarized as follows:

(a) It is uneconomical owing to the higher cost of wages, lighting and heating.

(b) Supervision at night is not always so good as by day owing to less effective lighting or to the employment of fewer or less experienced foremen.

(c) The inferiority of lighting may make work and especially fine work more difficult.

(d) The workers may be unable to obtain adequate sleep by day. This may be the result of the dislocation of the ordinary habits of life or of social causes, e. g., noises and disturbances, or the care of children. Workers are tempted to curtail their period of sleep through rising to join the family midday meal or to obtain some recreation and amusement.

(e) Social intercourse, recreation and amusement may be seriously interfered with. Suitable opportunities for attendance at instruction are impossible, unless special facilities are allowed.

(f) Finally it is not natural to turn the night into day and to deprive the body of the beneficial effects of sunlight.

207. Under existing conditions night work at any rate for men and women is inevitable. It is the means by which the machinery is employed for the greatest proportion of the 24 hours and so long as the hours of work are not unduly long and due attention is paid to the environment of the worker, it is undoubtedly productive of increased output. Night work must therefore continue for men and women while the present emergency lasts, however conclusive may be the arguments against its introduction as a permanent part of the industrial organization of the country.

208. The committee are not satisfied that there is the same justification for the employment at night of girls and boys. The objections to night work for women are greatly accentuated in the case of growing girls and the committee are strongly of opinion that all night work for girls under 18 should be terminated. As already stated in paragraph 144, steps have already been taken by the Home Office and the Ministry of Munitions to terminate all night employment of girls under 16 and to restrict within very narrow limits the employment of girls between 16 and 18. For boys also, and especially those under 16, night work is highly undesirable, and the committee fully indorse the recommendation contained in the report of the departmental committee¹ on 'The Night Employment of Male Young Persons' that—

We are strongly of opinion that the employment of boys under 18 years of age at night in factories is undesirable and ought not to be allowed to any greater extent, or at an earlier age, than is absolutely necessary. This applies specially to boys between 14 and 16 years of age, when the rate of growth is most rapid, and when the conditions of life ought to be rendered as favorable as possible for mental and physical development.

209. A question of considerable importance in connection with the shift system is how long the workers should remain on night shift at any one time. A week is the most common period. Changes are sometimes made fortnightly or monthly and in some instances there is no alternation at all, the workers remaining continuously on day or night work, except for occasional changes amongst individuals carried out for the convenience of the persons concerned. On physiological grounds infrequent changes are to be preferred. The question is, however, one that is largely influenced by the social conditions under which the worker lives and works. In the Home Office general order of September, 1916, no requirement is made as to periodical changes. The matter is left to the individual employers to settle with their workpeople.

210. In view of its importance the committee directed their investigators to pay special attention to this subject. The data collected by them has been brought together in the memorandum on 'The Comparative Efficiencies of Day Work and Night Work' included in the

¹ Cd. 6503, 1912.

committee's interim report. An examination of the data suggests the following conclusions:

Women.—(i) In monotonous processes which call for little physical effort, such as those concerned with cartridge making, discontinuous night work of women gives an output which rarely falls much more than 10 per cent below, and usually approximates closely to that obtained by day.

(ii) Continuous night work is productive of definitely less output than is the discontinuous system; and the committee have failed to obtain evidence that the output of the continuous day shift balances this inferiority.

(iii) The timekeeping of girls and of women of 19 years of age and upward, working for alternate weeks of day and night shifts, is even better maintained than when they work on permanent day shifts.

(iv) Timekeeping of girls of 14 to 18 is practically the same whether they work on permanent day shifts or on day and night shifts.

The committee, basing their opinion upon these conclusions, consider it undesirable to adopt for women continuous night shifts in any factory not at present so working or not yet open, and suggest that wherever practicable this system should be discontinued.

Men.—The conclusions arrived at with respect to women are true, with slight modifications, for men.

(i) There is no significant difference between the rate of output in night and day shifts managed on the discontinuous system.

(ii) With men, as well as with women, the discontinuous system is preferable to continuous night work.

211. The inferiority of continuous night work can probably be referred to a failure to secure proper rest and sleep in the daytime. Women on continuous night work are likely to perform domestic duties, which when they work alternately in the two shifts, is impracticable. Evidence, indeed, exists of women employed in permanent night shifts who still carry on their ordinary daytime avocations, though it is not sufficiently extensive (statistically) to be offered as a proof of the suggestion just made.

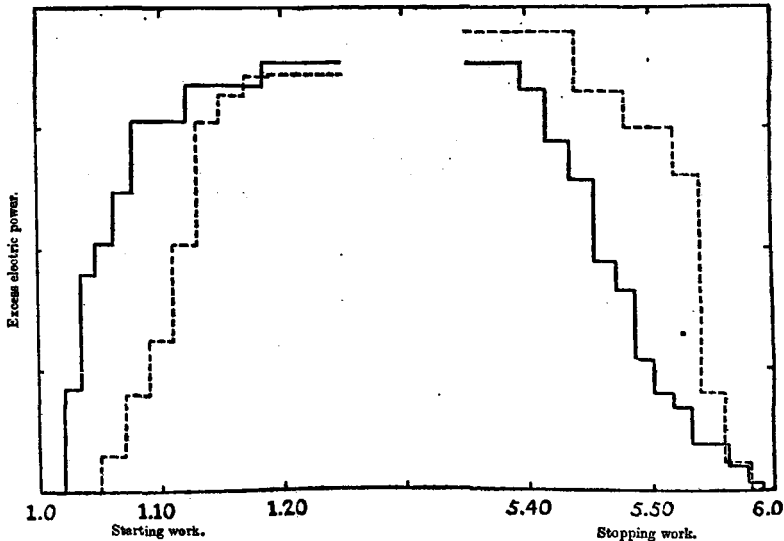
SECTION VIII.—LOST TIME AND INCENTIVE.

212. The amount of time lost in industry varies widely in different forms and processes, and in accordance with varying conditions and circumstances of labor, environmental and personal. It rises in the bulk often to as much as half a day per week, though it varies in occurrence both in the day and in the week, being greatest as a rule at the two ends of the day and the two ends of the week, varying in relation to the length of the working day. It is for this reason that it is necessary, in the consideration of lost time, first to ascertain the time worked. It is of no value to determine the time lost unless it be correlated with the time worked, whether normal or overtime. The mere record of so many hours lost or such and such a percentage of lost time is valueless and even misleading.

213. Speaking generally the committee have found that the whole subject of lost time calls for much more careful consideration and determination than it has hitherto received. The term is one which covers varying conditions. First, there is what may be described as gross lost time, namely, actual absence from work, for whole days or weeks, or substantial portions of days or weeks, a degree of broken time which gravely interferes with the management of a factory, and which is due to various dominant factors, social or industrial. Secondly, there is what is known as loss of "quarters," and particularly of the "morning quarter." In his investigations for the committee, Prof Loveday examined this point in 14 classes of work—light, medium, and heavy (including approximately 17,000 persons)—working a normal day shift of 53 hours, commencing at 6 a. m. or between 6 and 7 a. m., with the result that he found that the percentage of lost time before breakfast varied from 20 to 58. Without deciding whether this loss was "avoidable" or not, the fact is that it occurred, and it occurred in the morning quarter, and was greatly in excess of any similar loss in factories which started work later than 6 a. m. All over the country munition works have had this experience of lost time in the "morning quarter" under the two-break system (which begins before breakfast and so involves two meal breaks during the day). The magnitude of this common experience, the actual number of absences, the futility of working before having had a morning meal, and the waste of time incurred in two breaks daily, have led many employers to the view that the two-break system might well be abolished. Thirdly, there is time lost in starting work, even by the good timekeeper, and similarly time

is lost in ending work. A statement¹ made to the committee by Dr. Vernon may be quoted:

In most works the motive power is electric, and in some the power supplied to each section is registered by a separate wattmeter. The machinery is started running shortly before work begins, and as the operatives get going, one after another, the power consumption steadily rises to a maximum, which is attained when all the operatives have started. By means of these power records the rate of starting and stopping work can readily be ascertained in many instances, though not in factories where time is spent in a preliminary collection of necessary tools and material, and in their adjustment. The accompanying figure records the increments of electric power, over that required to drive the free-running machinery, on starting and stopping the afternoon spell of work. The continuous line represents the power supplied to a large shell shop which turned out 30,000 3-inch shrapnel shells per week. We see



that the power supplied started mounting up two minutes after starting time, and reached half its full value in four minutes. The dotted-line curve, representing the power supplied to a section of 200 women turning fuse bodies, did not begin to rise till five minutes after starting time, and did not attain half its maximum value until 11 minutes after starting time. In other words, the operatives wasted about seven minutes more in starting than did the operatives in the shell shop, most of whom were men. On the other hand, the fuse turners finished more strongly than the shell-shop operatives, as can be seen by comparing the two curves given on the right side of the figure, and it was found that both sets of operatives lost, on an average, about the same aggregate of time in starting and finishing during the course of the whole day, viz, 34 minutes. The shell-shop operatives did not start much more promptly than the fuse turners in the morning, partly because there was more delay in the arrival of their material, but in spite of this, if the operatives of both shops had started equally promptly and finished equally strongly, 9 minutes out of the 34 would have been saved. There was no inherent reason why work should

¹ See Memorandum No. 12 (Cd. 8344).

have been started promptly in one shop and not in the other. It was merely a custom of the particular shop, and even then the custom was not a fixed one. A series of meter readings of the women's section were taken for several days before and after the Easter holiday, and 9 days before the holiday the average amount of time wasted in starting after dinner was found to be 11 minutes; 2 days before it was 14 minutes. Two days after the holiday it was 16 minutes; 3 days after it was 15 minutes; and 5 days after it was 12 minutes. That is to say, it increased with the slackness of the operatives caused by the immediate approach of the holiday, and still more with their postholiday lassitude.

There can be no necessity for the waste even of 25 minutes in starting and finishing work. Ten or 15 minutes should be an ample allowance, and the 20 minutes thereby saved could be deducted from working hours without any reduction of output. At one large works the manager informed me that he made a point of going into the various shops at starting time, and seeing that the operatives began work promptly. In this way a considerable amount of time was saved.

214. Subsequently¹ Dr. Vernon was able to report a further investigation in regard to women turning aluminum fuse bodies. The machinery was started up a few minutes before normal starting time, the power (recorded by wattmeter) required for this purpose being deducted from subsequent readings. The results were:

TIME LOST IN STARTING AND STOPPING WORK.

Time of year at which power records were taken.	Average number of minutes lost when—				Total number of minutes lost.	Relative hourly output.
	Starting work in morning.	Finishing work in morning.	Starting work in afternoon.	Finishing work in afternoon.		
Apr. 13-May 1, 1916.....	14.0	1.5	12.3	9.3	37.1	126
June 8-7, 1916.....	12.5	2.5	10.0	8.0	33.0	137
Jan. 10-18, 1917.....	10.0	.5	7.0	9.0	26.5	158

In an adjoining section, consisting mostly of women turning small brass time fuses and primers, but including also the women engaged in milling a screw thread, the total times lost in starting and stopping were 34.7, 33.5 and 28.3 minutes in the April, June, and January periods, respectively. In the next two sections, occupied by men engaged in tool making and in controlling automatic machines, the average times lost were nearly the same throughout, but this may have been due to the fact that most of the workers were paid at a time rate and not at a piece rate. However, in two other sections of lathe workers, mostly women, which were situated in a different part of the factory, there was likewise no appreciable reduction in the time lost, though these workers were paid at a piece rate and must have had a bigger hourly output in January, 1917, than in April, 1916. It is very likely that they wasted less time by taking fewer and shorter rest pauses during the progress of their work, but on this point I made no observations.

215. It is of interest to note in passing that Dr. Vernon claims that the increased hourly output resultant on a reduction of hours is dependent, as a rule, on two factors. First, a speeding up of many or

¹ See Memorandum No. 18 (Cd. 8628).

all of the actual movements required in the mechanical process; and secondly, the avoidance of lost time by starting work promptly, by taking few pauses during the progress of the work, and by continuing the work more nearly to the nominal stopping time. This observation leads up to a fourth kind of lost time, namely, that due to unregulated rest pauses, absence of pauses, too long spells and other similar points in factory organization of hours. The custom in many works is for operatives to work for a spell of five hours, and then after an hour's meal interval for another spell of four and a-half to five hours. Such spells, in the view of the committee, are too long for most workers, and yet, if a second or third interval were introduced, extra time would be lost in starting and stopping. Under present circumstances, however, much time is often lost by the operatives taking rest at irregular or unsuitable times. The committee recommend a properly recognized system of rest pauses. A definitely fixed ten-minute break in the middle of the morning and afternoon spells, during which operatives remain at their machines (and possibly take light refreshment conveyed to them), has been found in practice a valuable aid to the reduction of lost time and increase in output. Some types of work need longer and more frequent rest pauses than others, and the best times and occasions can be determined only by experiment. Lastly, there is the lost time due to too long hours of work and excessive overtime. "Overtime may act," writes Prof. Loveday, "either as final or efficient cause of lost time." Employees may deliberately miss normal hours, or work slack, in order to make the better-paid hours of overtime more expedient or even necessary. Or, again, overtime or too long hours, by their exhausting effect, result in lost time as a consequence. The prolonged hours and the Sunday labor during the early period of the war pressure on industry actually resulted after a time in many cases in reducing staying power and increasing lost time, owing to increase of fatigue and sickness, of decreased briskness and resilience among the workers. "There can be no doubt," according to Prof. Loveday, "that for the average man high wages earned by long hours are too dearly earned."

THE CAUSES OF LOST TIME.

216. A consideration of the character of lost time makes manifest its principal causes. Some of them are inherent in the circumstances of the present time, arising out of the war or the exceptional conditions of industry; others are relatively more "avoidable." The more, however, that the causes are examined or considered in relation to the varying local or other circumstances, the less is it possible to classify with any degree of precision, or say of any given cause that

it is inherent and uncontrollable, or that it is controllable and avoidable. It will be found in practice to be sometimes one and sometimes the other. It should be understood therefore that the following classification is merely made for convenience.

(i) Causes mainly inherent:

(a) Necessity of employing persons of inferior physique, irregular habits, and without experience of factory life or discipline;

(b) In many districts inadequate housing accommodations and insufficient transport facilities, both conditions made more acute by abnormal congestion of industrial population;

(c) Wintry weather, darkened streets, and inequalities of food supply;

(d) Insufficiency or irregularity of supply of raw material, machinery, or tools coming to the factory;

(e) Domestic duties of married women and war preoccupations and exigencies of all workers;

(f) Sickness and disease caused by conditions external to the factory.

(ii) Causes mainly controllable:

(a) Fatigue, sickness, and accident of factory origin;

(b) Insufficient wage incentive;

(c) Faulty internal organization, leaving the employee without work, leading to temporary and sporadic breakdown or delay in management, or failing to provide for the reasonably comfortable conditions (lighting, heating, rest, feeding, etc.) for maximum and sustained effort;

(d) Indifference, slackness, laziness, discontent;

(e) The practice of early morning "quarters" or dislocation between shifts;

(f) Prolonged hours, overtime, insufficient rest periods or holidays;

(g) Excessive consumption of alcoholic beverages.

217. Other causes of less importance undoubtedly occur, and even those mentioned differ considerably, both in effect and in locality. Whilst the committee decline to generalize or draw final conclusions, they are satisfied that the loss of time, directly and indirectly, due to fatigue and ill health is substantial, and is, as a rule, greatly underestimated. On the other hand there would seem to be a tendency to overestimate that due to slackness, laziness, or willful idling. On the whole, evidence from all parts of the country shows, beyond question or dispute, that a very remarkable and entirely exceptional effort has been made by all grades of workers to meet the industrial demands of the national emergency. This long-sustained will to serve the common weal has played, in the committee's view, a prominent

part in the maintenance of output under difficult circumstances and has contributed to reduce the lost time due to ill health. In spite of the prolonged and heavy strain the committee's medical investigators have found an unexpectedly large measure of good health among both men and women, due, as far as the evidence goes, to the powerful impetus of a sense of patriotism, to increased sobriety, to high wages and their resultant home comfort, to the restriction of hours, adopted none too soon, to division of labor, and to a vast improvement in the conditions of factory life, especially the arrangements for "welfare" supervision and the provision of canteen facilities. Without the operation of these favoring contributory factors the committee believe that there would have been much heavier loss of time and widespread breakdown of health. Even as it is, the committee can not escape the conclusion that the immense industrial effort of the war is likely to leave behind many serious physical disabilities.

218. The causes and conditions of lost time are matters of national importance for the future, and the committee hold strongly that the past neglect of this subject should be removed once and for all. They advocate shorter hours, improved conditions of labor, and a higher standard of efficient workmanship if industry is to come into its own and workers of all grades are to obtain their full reward, without let, hindrance, or impairment. To this end the committee recommend that managers and other responsible authorities in factories should keep careful records—

- (a) Of lost and broken time;
- (b) Of absence or broken time due to sickness; and
- (c) Where practicable, of the output per worker per hour.

The regular study of these records can not fail to prove valuable as a guide to the causes and conditions of lost time and the means of its reduction or removal in individual workers. It is important to remember that the man or woman is not a machine, and should not be treated as such. What is needed is not a cast-iron system of employment, but a sympathetic and correct understanding of the physical and mental capacities of each worker and their most satisfactory and economical application.

INCENTIVES TO WORK.

219. Closely related to the question of lost time is that of incentive to work, and in the course of their investigations the committee have observed a relation existing between such incentives and the health of the worker. Indeed, they are disposed to place the health and physical fitness of the individual worker as the first necessary condition of output, and to that end they desire to lay emphasis upon the extreme value of all factory conditions which contribute to such

health—good lighting, effective ventilation, sufficient heating, cleanliness, rest rooms, proper canteen accommodation, protection from industrial poisoning and dangerous machinery, surgeries, suitable welfare work within and outside the factory—all these are conditions of first and fundamental importance from the point of view of health and incentive to work. A hygienic environment at home and in the workshop is indeed the first necessity for securing a healthy population of wage earners to whom a wage system may appeal as an incentive to work. Secondly, the committee would place a properly organized factory, good order and discipline, and suitable hours of work (combined with proper rests and pauses, and a minimum of night employment) as conducive to efficient workmanship. “When once industrial life has been entered upon,” writes Prof. Loveday, “the ordered and systematic routine of a modern factory is a direct stimulus during every 24 hours to the rhythm of activity and rest; the better the organization, and the better the hygienic environment the greater is the stimulus to activity.” The third incentive, though probably the only one thought of by many employers, is that of wage. To be an incentive in actual practice, however, the wage system adopted must be equitable, well adjusted and clearly understood. The committee have been the witnesses of not a few misunderstandings leading to lost time, reduced output, and discontent which arose not on the amount of wage, but on the system or manner of its payment. Fourthly, under conditions of repetition work, especially if monotonous, piece rates appear to provide better incentive than time wages, and time wages with a bonus than a flat time rate. Finally, in relation to incentives to labor it is necessary to remember the serious effect upon time keeping and output of hours of labor, which preclude attention to health and recreation and domestic life, and of a scale of wages which places the wage earner above or beyond the ordinary and customary requirements of his standard of comfort. The committee have seen lost time directly resulting from both of these conditions and they have no doubt that much of the present labor unrest is due to the interrelationship obtaining between wages and the standard of comfort. It is, of course, obvious that such conditions raise far-reaching and complex social issues which lie outside the scope of the present report. But they are matters which must be borne in mind in contriving schemes for reducing lost time and encouraging steady work.

SECTION IX.—FOOD AND CANTEENS.

220. There is now an overwhelming body of experience which proves that productive output in regard to quality, amount, and speed is largely dependent upon the physical efficiency and health of the worker. In its turn such physical fitness is dependent upon nutrition. The purpose of nutrition is to secure the health, the proper development and growth, the repair and vital energy, of the human body. Food energy is spent in maintaining the tissues of the body and the body heat and in doing work. Nutrition is stimulated by the cooling effect of fresh air, and by bodily exercise, and its needs must be met by a food supply suitable in character and sufficient in amount to meet the expenditure on body heat and work.

221. The human body calls then for a constant supply of food, first for its growth, for the building up of its tissues and for repair, and secondly as fuel for the production of heat and energy. Both requirements are indispensable, and from the necessity for these there is no escape. Though no hard and fast line of division can be drawn, it may be said that certain kinds of food which are relatively rich in protein and mineral matter (meat, cheese, milk, herrings, dried peas, beans, bread, oatmeal, flour) contribute both to the formation of the body and its repair and supply it with fuel for the production of heat and energy; other kinds such as fat (lard, butter, dripping, margarine), sugar, sago, and tapioca, afford an abundant supply of fuel, but can not maintain growth and repair. Still other kinds of foods (fresh fruits, green vegetables) contain a small proportion of nutriment, but insure the provision of the body with certain important principles conducive to good health.¹ The constituent parts of a dietary are important if the highest value is to be obtained, but, speaking generally, fresh, digestible and appetizing food is more important than chemical composition or proportion. It will be understood that digestibility is dependent partly upon the food itself being of a nature which is easily digestible and partly upon the organs of digestion being healthy and in good working order. Further, it

¹ When work is nervously exhausting, e. g., night work, the food of the worker requires to be particularly light and digestible, well cooked and appetizing, for the organs of digestion then lack an adequate supply of nervous energy, and can not deal successfully with heavy indigestible and unappetizing meals. The warmth of the food is of great importance. Hot drinks stimulate the tired worker. The proper adjustment of the food to the expenditure of nerve energy saves a great deal of indigestion and the minor complaints and lost time which result.

should be noted that a variety of factors affect the relative value of food to the individual consuming it. For instance, there is the nature of the employment, whether sedentary or active, and the amount of energy called for. With increase of work there must be proportionate increase in quantity and in nutritive value of the food eaten. Ill-paid laborers and others whose food amounts only to a bare minimum can not either put forth the same energy or work at the same speed as a well-nourished man. The man who has to work hard, long, or rapidly needs a proportionately ample food supply, composed of highly nutritive ingredients, to withstand the strain. Fatigue both prevents digestion and demands food. Age, sex, weight, and constitution likewise exert influence. Women require on an average about four-fifths of the food supply of a man and an adolescent about seven-tenths. Season and climate also affect the question. Lastly, the predisposing influence upon the alcoholic habit of malnutrition, bad feeding, and long periods of work without refreshment should be borne in mind. There can be no doubt that "industrial alcoholism" is, in part, due to the lack of cheap, good food.

222. What, then, in general terms, is the necessary dietary for a worker? Broadly, the answer is a dietary containing a sufficient proportion and quantity of nutritive material, suitably mixed, which is easily digestible, appetizing, and obtainable at a reasonable cost.

Character of food required.—The amount of physical force expended in daily work and the environment of the work have a great effect on the requirements of the body for food. Hard labor and exposure to open air together call for increased food supply; sedentary work in an artificially heated and confined atmosphere, on the other hand, reduces the output of energy and less food is required.

Natural foods yield the essentials required to replace the energy expended and for the repair and growth of the body. They contain these essentials in the form of protein, fat, and carbohydrates, and also supply salts and certain substances of unknown nature, called vitamins, which exist in minute quantities in fresh foods and are necessary for the growth and health of the body. Vitamins are removed by some of the processes of milling, e. g., in the preparation of white flour, and polished white rice. They are destroyed by prolonged cooking, and are absent from foods preserved in tins; they are present in butter, dripping, and margarine when made from beef fat, though absent when it is made from vegetable fat. For the preservation of good health it is essential that fresh natural foods should be eaten in sufficient amount. Fortunately, the potato affords such a cheap natural food and makes a good diet with bread and tinned food. Protein is the chief solid constituent of lean meat; it is also present in milk, cheese, and eggs and occurs in all vegetables, particularly in flour (bread), peas, and beans; it is not only a source of energy, but it is also a body builder, and no dietary can be complete without it. The body requires protein in the food in order to build up its own living substance, and can not do so with the aid of fat and carbohydrate alone. Protein stimulates the body to a greater expenditure of energy than does an equivalent value of carbohydrate or fat. There is reason to believe that more protein is required by those who work forcibly and rapidly than by those who work in a slow, steady manner, e. g.,

soldiers in the front line require more protein than agricultural laborers. Fat is chiefly derived from animals; nuts (from which one kind of margarine is made) also are rich in fat, but other vegetables only contain fat in a much smaller degree. Carbohydrates are mainly derived from vegetables in the form of flour, potatoes, or sugar.

Fat and carbohydrate can replace one another in a diet, but the body digests and deals best with a certain proportion of each. Fat, however, yields weight for weight more than twice as much energy as carbohydrate, and so in cold climates and cold weather more fat is naturally eaten. Experience shows that the diet should include raw food, fruit, or salads, in order to secure the vitamins which prevent scurvy. Fruit which is not overripe is particularly valuable.¹ Potatoes, cabbage, onions, carrots, and turnips also contain the vitamins which prevent scurvy. Eight ounces of potatoes a day will supply sufficient. Particularly in times of scarcity, when there is any restriction of diet, it is advisable that vegetable food, such as potatoes, should form a large proportion of the available diet, for the vegetables contain salts which neutralize the acids formed in the vital processes of the body.

Fortunately, the cheaper foods (bread, margarine, porridge, milk, herrings, cheese, beans, onions, cabbages, swedes, and the cheapest cuts of meat) provide all the requisite nourishment, and are probably better adapted to maintain health than are more highly flavored and expensive foods which artificially stimulate the appetite. The drinking of strong tea many times in the day is physiologically unsound, as also is the consumption of sweetmeats between meals, especially by boys and girls. Sugar is not a natural food, but an artificially separated foodstuff. It should not be allowed to lessen the appetite for the natural complete foods.

Calculation of energy value of foodstuffs.—The energy value of a foodstuff can be determined by burning a weighed quantity of it in a suitable apparatus called a calorimeter and ascertaining how much heat it gives off. The large calorie, which is used as the unit of energy value, is the amount of heat required to raise 1 kilogram (2.1 pints) of water from 15° to 16° C. through 1° C. (1.8° F.). Calculation has shown that, when dried, foodstuffs possess the following energy value:

One gram² of—

	Calories.
Protein is equivalent to.....	4.1
Carbohydrate is equivalent to.....	4.1
Fat is equivalent to.....	9.3

The energy expended in mechanical work can also be expressed in calories, for 1 calorie has been found by experiment to be equivalent to the energy ex-

¹ It should, however, be remembered that at the present time fruit, with few exceptions, is a prohibited import, and that foreign fruit is consequently in very short supply. Supplies should, therefore, as far as possible, be drawn from home-grown fruit or salads and vegetables. Raw fruit can be replaced by raw swede turnip. Children will eat this raw, or it can be grated down and eaten on bread.

² To express in terms of calories per pound it should be remembered that one pound is equal to 453.6 grams; one ounce is equal to 28.35 grams.

Example.—Suppose 1 pound of roast beef contained—

	Per cent.
Protein.....	26.75
Fat.....	12.90

In this case there would be $(26.75 \times 4.1) + (12.90 \times 9.3) = 229$ calories per 100 grams.

In the pound of meat there would, therefore, be $229 \times 4.536 = 1,040$ calories.

For fuller information reference should be made to *An Inquiry into the Composition of Dietsaries, with Special Reference to the Dietsaries of Munition Workers*, by Viscount Dunluce and Capt. M. Greenwood, R. A. M. C. (T), published as a special report by the medical research committee.

pended in lifting 1 kilogram through 425.5 meters, which is about the energy expended by a man 70 kilograms (11 stone) in weight in walking up a staircase 6 meters (about 20 feet) in height. Such a man would require 1 extra calorie in the energy value of his food to make good this expenditure of energy. Even in walking on the level the body is raised at each step, and the calculation has been made that to walk 2.7 miles in an hour on a level road calls for the expenditure of 160 calories in a man of 11 stone.

Investigations made by a number of scientific workers indicate that about 15 per cent of the energy expended is derived from protein, and about 80 per cent from fats and carbohydrates combined; that is to say, that normally protein supplies only one-fifth of the total energy expended. Numerous investigations have shown that the energy daily required by a man engaged in moderately light munition work is about 3,500 calories of food as purchased. Where calculations are based on food as eaten, the minimum diet may be taken to be about 3,000 calories when balanced among the three classes of foodstuffs in the following proportions of dried weights:

Protein.....	grams...	100
Fat.....	do....	100
Carbohydrate.....	do....	400

Such would be contained in the following diet:¹

Lean meat.....	ounces...	5
Fat.....	do....	1
Butter.....	do....	1
Bread.....	do....	16
Potatoes.....	do....	16
Oatmeal.....	do....	3
Milk.....	pint....	$\frac{1}{2}$

An average adult woman worker requires rather less (about 0.8 or 0.9) than a man.

Men engaged in hard physical work, especially in the open air, require a good deal more energy-producing food, and may consume as much as 4,500 calories with advantage. On the other hand, the energy required from food by a man clothed, lying at complete rest, at ordinary room temperature, in a still atmosphere, is about 1,600 calories of eaten food; while for a man engaged in a sedentary occupation, tailor or clerk working in warm room, as little as 2,200 calories may suffice.²

A STATEMENT OF THE PROBLEM.

223. Though there is little doubt that workers, on the whole, are getting a better type of food than a generation ago, it must be admitted that large numbers of workers of both sexes are not getting an effective dietary day by day. Much evidence is forthcoming that this is being increasingly recognized both by employers and workers. The difficulties in the way of adequate feeding arise mainly where the worker must have his meals away from home. In past

¹ Temporary shortages of supplies of particular articles of food may, of course, involve modifications of this diet.

² There is evidence that the workers in Germany are not getting more than this value in their ration, and the remainder of the civil population considerably less, receiving, in fact, a ration which has not been regarded hitherto as sufficient for maintenance.

years, and even now in normal times, the worker lived fairly close to his work, and was frequently able to return home for his meal. At present (apart from food shortage) the difficulties of securing adequate food are increased owing to the prevalence of night labor, and to the fact that the large number of men and women have to travel a considerable distance to their work.

(a) In such cases the simplest alternative is for the worker to bring or receive from his home or lodgings food ready prepared for eating. The objection to this arrangement is the limitation in the kinds of food suitable, and that it is necessarily cold, and liable to be stale. There is a special danger of its being confined to what can be most quickly prepared the night before, without much regard to its nourishing character. When the weather is warm, or the food is kept for any length of time in a hot workshop, it readily undergoes degeneration.

(b) A second alternative is for workers to bring food which can be either warmed up or cooked at the factory. This is sometimes done by the worker himself, or facilities for the purpose are provided by the employer. Arrangements on these lines are probably better than those under which the worker brings his food with him ready prepared. On the other hand, it is to be remembered that warmed-up food is generally not so nourishing as freshly cooked food, that if a large amount of food is to be warmed up it is always difficult to deal satisfactorily with widely varying kinds of food, and that valuable time is lost if the worker is compelled to cook his own meal.

(c) In some districts workers can obtain a substantial meal at public houses, cookshops, or other proprietary establishments in the neighborhood, but the accommodation in these places is often inadequate and unsuitable.

(d) Lastly, there is the industrial canteen at or near the works.¹

224. This then is the problem—to supply suitable food at a low price for large numbers of persons at specified times. The modern progress of factory management reveals a variety of efforts to find a solution. There has been, it is true, considerable development in the provision of proprietary concerns in the form of improved coffee-houses and refreshment rooms. Philanthropic movements have also been initiated with a similar purpose. But by far the most hopeful enterprise has been the establishment by employers of industrial canteens, or workpeople's dining rooms in or near the factory itself. Hitherto there has been no statutory obligation upon the employer,

¹ In Memorandum No. 19 (Cd. 8798) will be found the results of a number of analyses made by Dr. Leonard Hill, F. R. S., of the caloric value of various workpeople's dietaries. Canteen meals yielded 806-1,433 calories (163-305 dry weight in grams); "carried food," 683-1,719; and women's dietaries, 397 (tea shop) to 1,143 (carried food). Particulars are also given of caloric value of hostel dietaries, food substitutions, and rations

though action in this direction has received the whole-hearted commendation of the factory department of the Home Office and the Ministry of Munitions. The earliest and best examples of such restaurants in factories are to be found in the food industry, but makers of soap, paper, cloth, tobacco, and tin boxes have followed suit, and now in all parts of the country accommodation of greater or less degree of suitability and attractiveness is being provided. This pioneer practice has abundantly justified itself from a business and commercial point of view, and in the opinion of the committee the time has come for a large extension of this method of solving the problem.

225. Speaking generally, it may be said that the accommodation provided accords with one or other of the following types:

- (a) An available room for the workers to eat their prepared food;
- (b) A room furnished with a "hot-plate" or "warming cupboard"¹ and provided with hot water;
- (c) A refreshment barrow to perambulate the workshops at appointed hours (particularly useful for light refreshments during long spells or night shifts);
- (d) A fixed refreshment bar or buffet;
- (e) A dining-room or canteen supplying cheap hot and cold dinners;
- (f) Such a dining room associated with an institute or club, with facilities for rest and recreation (e. g., rest rooms, recreation or reading rooms, portable gymnasium, baths, roof garden, or educational classes, etc.)

226. Some of these types may be suitably combined, and although arrangements indicated in (c) and (d) may prove sufficient and satisfactory in certain circumstances, the provision of proper meals seems obtainable only in the types (e) and (f). The committee recognize that the necessity for, and character of, an industrial canteen are dependent upon the nature of the need and its degree in each factory. They are, however, convinced that in the highest interest of both employer and worker, proper facilities for adequate feeding arrangements should be available in or near, and should form an integral part of the equipment of, modern factories and workshops.

ESSENTIAL CHARACTERISTICS OF THE INDUSTRIAL CANTEEN.

227. In order to insure effective results from the establishment of industrial canteens, certain conditions seem to be essential. Speak-

¹ "Warming cupboards" can be installed in or near the mess-room and heated by steam. The cabinet may be constructed of sheet iron (finished off with asbestos and wood covering), with shelves of perforated sheet iron. Employees deposit their food in basins or dishes when they come to work, the cupboard is closed and steam applied under regulation for a specified time. At the dinner hour the employees fetch their food.

ing generally, these conditions concern—(a) establishment and (b) management, the former including questions of site, building, and equipment.

ESTABLISHMENT.

SITE.

228. The first important consideration in the erection of a new canteen is the question of a site for the building. The site should, if possible, have a pleasant, open outlook and southern aspect, and should be central and easy of access for the workers. With high buildings adjoining and mess rooms looking out upon blank walls not many yards distant, the canteen may prove unattractive and its success be to a great extent impaired. The canteen should, if practicable, be placed where water, gas, and electric mains are adjacent, as well as drainage capable of carrying off the discharge of soil and rainwater pipes and of sinks and lavatory wastes. An appropriate proximity to the works must also be considered.

BUILDINGS.

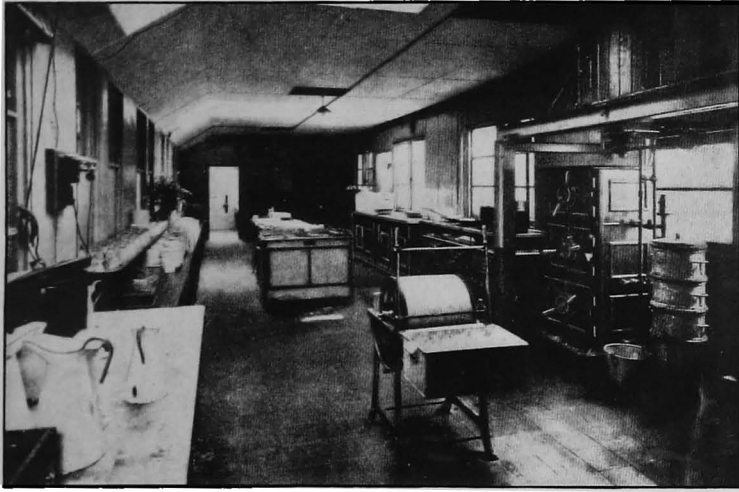
229. Much will depend on the nature of the scheme adopted, whether it is (a) a mess room, with or without hot closet, hot plates, or hot water; (b) a buffet bar; or (c) a full restaurant canteen with kitchen, scullery, larder, stores, etc. There may be a combination of the three types. The amount and character of the accommodation necessary depends—

- (1) On the situation of the factory and the opportunity for all or any of the workers to go home for meals;
- (2) On the proximity of outside restaurants;
- (3) On the hours of work (day or night) and the meal intervals;
- (4) On the character of the work (heaviness, exposure, poison, or danger zones);
- (5) On the usual customs of the district and the particular food necessities of the workpeople.

The seating accommodation must also be considered from the point of view of shifts and relays.

230. The attached plans have been prepared showing canteens suitable for 200 and 500 diners (pages 341 and 344). The question which immediately arises is whether the building shall be of (a) temporary or (b) permanent construction. During the early stages of the war there was much to be said for the erection of a temporary building, mainly on the ground of cost, rapidity of erection, and the smaller demands made upon labor.

231. Permanent buildings naturally take longer to erect, the cost



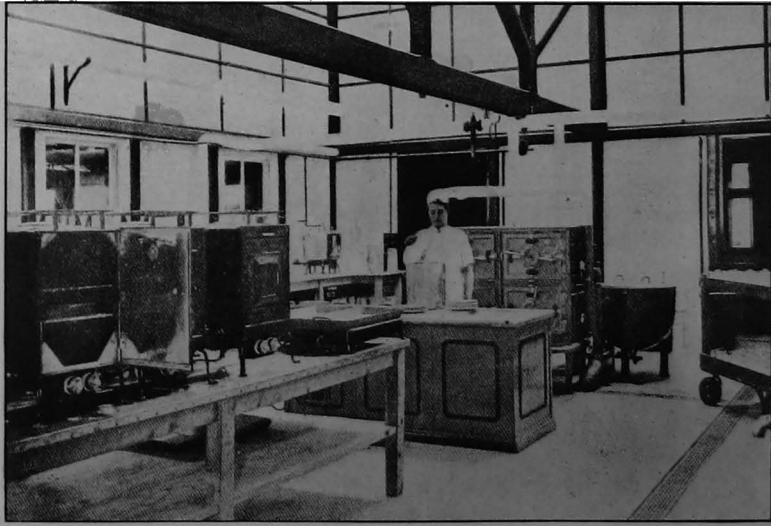
CANTEEN KITCHEN.



KITCHEN OF A LARGE CANTEEN.



CANTEEN SCULLERY.



CANTEEN KITCHEN.

varies from 25 to 40 per cent more than in the case of a temporary building, and the demands made upon labor are greater. On the other hand, a permanent building is, of course, more satisfactory, and costs proportionately less than the temporary building for maintenance. In normal times the case for the permanent building is a strong one, but at the present time for canteen purposes the temporary building should be considered, though it may be found in practice that even now a permanent building is preferable.

232. The construction of suitable buildings is indicated in sufficient detail on the drawings. It should not be overlooked that the wear and tear of the floors is considerable, whether in the mess rooms or in the kitchens, and, in view of this, the floors generally should be of concrete, finished with a granolithic face. This type of floor is smooth, hard, durable, and impervious, and is easily washed down after meals. Advantage should, wherever possible, be taken of using local material to save carriage, etc.

233. In a large number of canteen proposals it may be found that the dimensions of available sites will not admit of the buildings being erected in accordance with the suggested designs, but the principles are the same. The canteen or dining hall, being the principal apartment, should be arranged with the most convenient methods of egress and ingress for the workers and with direct approach to the serving counter, so that traversing the whole or any great portion of the dining hall to obtain food is avoided. Short barriers in front of the counters are advisable to allow of each diner obtaining his or her food in the order of arrival and to prevent congestion and disorder. Adequate gangways or passageways for each diner to proceed to the dining tables without interruption to other diners are essential. From 8 to 10 square feet superficial area should be allowed per person seated. Separate dining rooms are usually provided for men and women, but they may be so designed as to be thrown together for social, recreative or educational purposes. The kitchen should be situated as centrally as possible with regard to the dining room, which it should adjoin in order to facilitate counter service. It may be "central" or "terminal." The wash up or scullery should open out of the kitchen and should abut immediately upon the main dining hall. A counter or shelf with communicating hatch should be provided to admit of dirty crockery being handled direct to the sinks. In addition to the sinks in the scullery, such accommodation is also required in the kitchen for the use of the cook in the preparation of food. The sinks should be supplied with hot water from an independent boiler, which should be placed as near as practicable to the sinks. The larder and store should open upon a yard with easy access for tradesmen's carts. They should be fitted with shelving of deal, 1 inch thick supported on 2-inch by 1½-inch framed bearers

and uprights. The shelving should be kept 1 inch away from the walls. The larder should, if possible, face north and be permanently ventilated by perforated zinc panels. The sanitary accommodation for the canteen should preferably be situated in an isolated block of buildings adjacent to the canteen, but the requirements in this respect depend upon the sanitary accommodation already existing in adjoining buildings, and each case will have to be considered on its merits.

VENTILATION, WARMING, AND LIGHTING.

234. Ample window space (with a large proportion of the windows opening) is desirable for light and ventilation, and in no case should the total glass area of the windows be less than one-tenth of the floor area of the various rooms in which they occur. The fanlights for casement windows should be hinged at the bottom and fall inwards. Glazed cheeks or gussets should be provided to admit of continuous ventilation, and at the same time prevent down draught. All casement windows should be made to open for use in warm weather and to flush the rooms with air after the principal meal. Louver ventilators under the roof or in turrets provide ventilation for the main mess room. A simple cord attachment to wooden flaps should be provided to admit of these ventilators being closed during cold or windy weather. The kitchen should be provided with a continuous louver ventilator, as indicated on the drawings. It is desirable, where electric or other power is available, that an exhaust fan should be placed in the kitchen to extract the heat and steam from the kitchen and scullery and, incidentally, assist in the general ventilation of the dining rooms. Larders should face north and have nearly half the glass omitted in the window panes and perforated zinc panels substituted to provide suitable ventilated storage for perishable food.

235. Central heating by radiators or hot-water pipes would, no doubt, provide the most satisfactory means of heating the building. The cost, however, of such a heating installation adds so considerably to the initial cost of the whole scheme that it becomes extremely doubtful if the expenditure is warranted, especially in view of the fact that for four or five months of the year no artificial heating is required. Where central heating is not provided, use may be made of independent stoves, standing on the concrete floor, the stovepipe being carried up through the roof. Such stoves may be obtained from any iron founder or ironmonger at varying prices.

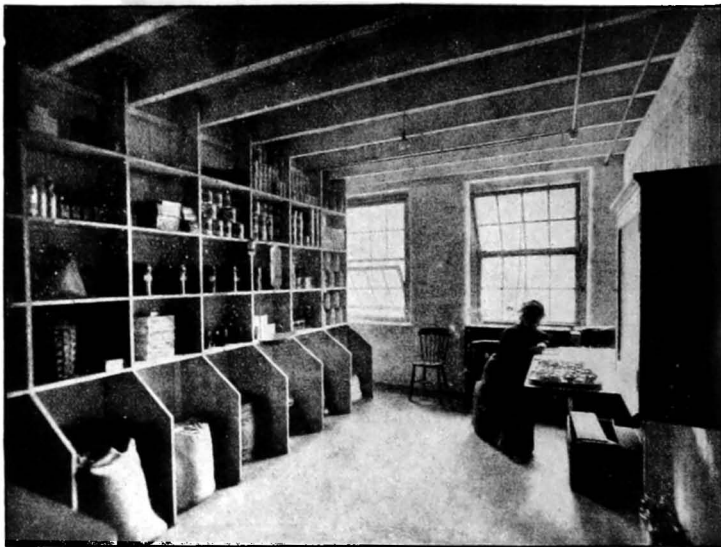
236. The steps to be taken for the prevention and extinction of fires should be fully considered. The method of carrying the stovepipe through the roof should be carefully planned, as, owing to the combustible nature of the timber in roofs, defective construction at this



CANTEEN DINING ROOM.



COUNTER SERVICE.



CANTEEN STOREROOM.



SURGERY.

(See page 144.)

point may prove a source of danger to the building from fire. The construction may simply consist of asbestos packing, a sheet-iron sleeve piece, with $1\frac{1}{2}$ -inch space between the sleeve piece and the stove-pipe, and hood to keep the rain out.

237. Where electricity is available it is, no doubt, the most satisfactory means of artificial illumination, otherwise gas should be used.

EXTERNAL AND INTERNAL MATERIALS.

238. For inexpensive permanent construction walls may be 9-inch brickwork rendered externally with Portland cement $\frac{3}{4}$ inch thick and finished with rough cast surface; with large span roofs, brick piers of greater thickness will be required under the roof principals. Roofs may be boarded and slated, and floors made of concrete with granolithic surface.

239. The selection of materials, owing to the high prices obtaining, presents some difficulty at the present time. Formerly one of the most favored external coverings for temporary buildings was galvanized corrugated sheet iron. The cost and supply of this material, however, is now prohibitive, and alternatives must be sought in felt and other forms of roofing. Felts are usually laid on the boarding with a lapped joint and patent cement supplied by the makers, the sheets being then secured with galvanized clout or large flat-headed nails. Only the stoutest material of the respective makers should be used to insure a water-tight roof. Light asbestos slates also provide a satisfactory, although somewhat heavier, roof covering. All roofing felts need careful laying, otherwise bulging occurs, which, in addition to being unsightly, is a frequent cause of a defective roof.

240. A large variety of materials have been available during the war for the external coverings of the walls, amongst which may be mentioned feather-edged weather boarding (treated with creosote), ungalvanized painted sheet iron, plaster finished in cement, secured to the wood framing by expanded metal, asbestos slates, or other materials. Internally, plaster and cement on expanded metal, asbestos sheets (the joint covered by a small fillet), match boarding, or various other materials have been used above the dado. The dado should, however, be somewhat stronger; three-fourths-inch match boarding is suitable. Thin sheet iron (painted) has also been used, or linoleum on flat-jointed boarding provides a suitable dado and is easily cleaned. The interior of the building should present a clean and cheerful appearance, and distempers of a fairly light tint are preferable. Straw color, primrose, duck's-egg green, or French gray are suggested as suitable. An alternative color scheme would be a dark-green dado about 5 feet high with 2-inch black line, and the

remainder of the walls, including the roof, finished white, the roof principals being stained a dark brown.

COOKING APPARATUS AND KITCHEN EQUIPMENT.

241. The cooking arrangements in an industrial canteen naturally form an important part in the equipment of the building. There are various means of cooking food, but for canteen purposes attention may be confined to:

- (a) Gas.
- (b) Coal.
- (c) Steam.
- (d) Electricity.

242. Gas, by reason of its cleanliness, efficiency, and the saving in labor which results from its use, is probably the best cooking factor in small and medium sized canteens. In large canteens, while the roasting is done by gas, it is economical to use steam for boiling, steaming, and for warming the hot closets. The use of steam is especially economical if it can be drawn from the factory boilers, but in the larger canteens it is worth while to install an independent boiler to supply the steam for cooking purposes if it can not be supplied otherwise. Coal is used where gas is unobtainable or expensive. It is most efficient as a means of cooking, but is less cleanly than gas and is objectionable in summer on account of the heat developed by large coal ranges. Electricity is the newest means of cooking; not only, however, is the original installation costly but, unless the supply of current is exceptionally cheap, the running cost is high.

243. The relative position of cooking apparatus naturally varies with the type of apparatus used, but, generally speaking, it has been found better to have the stoves and roasters in the center of the kitchen, with the steamers or boilers behind and the carving table and hot closets adjacent to the serving counter. The serving of tea, etc., should be kept quite separate from the general service table.

244. It is most essential that there should always be a plentiful supply of hot water through the sink taps for washing-up purposes. There are several alternative methods of producing this, among which are the following:

- (1) Circulator boiler connect to a storage system.
- (2) Large hot-water geyser.
- (3) Separate boiler over each sink.

245. The maintenance of cleanliness is one of the most important points in the whole scheme of a canteen, and it is one that the workers are quick to appreciate. In the mess room all floors, tables, seats, and windows should be thoroughly cleansed every day, and in the kitchen all cooking apparatus should be well scoured and kept scrupulously clean. The table equipment should always be well

washed and polished. The immediate surroundings of the canteen should be kept free from accumulated rubbish and refuse, as by this means trouble from flies is greatly reduced.¹

MANAGEMENT.

246. In the early part of the war excellent and devoted work was accomplished by some 8 or 10 public-spirited voluntary societies, including the Y. M. C. A., Lady Lawrence's Mmunition Makers' Canteen Committee, the Salvation Army, the Church Army, the Women's Legion, etc., in regard to canteen management. On the whole, however, the committee are satisfied that the industrial canteen should be undertaken by the proprietors of the factory (whether public or private) and should be regarded as an integral and permanent part of the factory organization, controlled like any other branch of the works under a duly appointed and competent manager or manageress. The proprietor should scrutinize the accounts of the trading, or arrange for their proper audit. He should watch the working and satisfy himself that full value is being obtained in the shape of increased nutrition, efficiency and contentment of the worker, and that current charges are reasonable. The selection of the canteen manager demands no less care than the selection of a head of any department of the business. The qualifications principally required are organizing ability, powers of discipline, a thorough knowledge of buying foodstuffs and a fair working knowledge of the economical preparation and cooking of food. Sympathy, tact and an understanding of the purpose of the canteen are also necessary.

FOOD AND DIETARIES.

247. The food supplied should be varied, fresh and good; suitable in quality and sufficient in quantity; well cooked, appetizing, and obtainable at low cost. It is obvious that the tariff must differ in accordance with food prices, and administrative charges and incidental expenditure. It will often be found expedient to allow the workmen's committee of management to examine the trading accounts periodically. The following figures show approximately the nature of a canteen tariff during the earlier war period:

Dinner; meat or fish, two vegetables.....	4d. to 8d. [8.1 to 16.2 cents.]
Hot-pot, cottage pie, meat puddings.....	3d. to 6d. [6.1 to 12.2 cents.]
Meat pies and other prepared meat dishes.....	3d. to 6d. [6.1 to 12.2 cents.]
Soup, bovril, oxa, etc. (with bread).....	2d. to 3d. [4.1 to 6.1 cents.]

¹ Cost.—About 6d. [12.2 cents] per foot cube, exclusive of central heating and lighting, is now (1918) the standard cost for building the fabric. Equipment varies from 30s. to 50s. [\$7.30 to \$12.17] per person seated. Total cost for building and equipment of canteen for 500 persons will work out from £7 to £9 [\$34.07 to \$43.80] per place.

Puddings and stewed fruits.....	2d. to 3d. [4.1 to 6.1 cents.]
Suet, bread, currant, jam, or fruit puddings.....	2d. to 3d. [4.1 to 6.1 cents.]
Bread and cheese.....	1d. to 2d. [2 to 4.1 cents.]
Vegetarian and cheese dishes.....	2d. to 4d. [4.1 to 8.1 cents.]
Cakes, buns, tarts, bread and butter, sandwiches....	1d. to 3d. [2 to 6.1 cents.]
Tea, coffee, cocoa, milk, lemon, barley, aerated and mineral waters, etc., per cup or glass.....	1d. to 2d. [2 to 4.1 cents.]
(Good quality important.)	
Fresh fruit in season, as practicable.	

248. In certain districts and in special circumstances, there may be a case for the establishment of a "wet" canteen, where alcoholic beverages may be obtained. Special supervision and restrictions are necessary in such cases.

PROMPT SERVICE.

249. The quick service of meals is essential. Three methods are practicable. (Method (1) is probably best, as a rule, for large numbers):

(1) Long serving counters (with short barriers as at railway booking offices) from which workers fetch their food. A number of portions should be prepared beforehand and stored in hot closets under the counter. Portions should be standardized.

(2) Food placed ready on the table before workers admitted. This may be convenient for breakfasts or teas, or where the food provided is cold and the same for all, but it is not always practicable for hot dinners.

(3) Waiters or waitresses, organized in shifts.

CONVENIENT HOURS.

250. The canteen should be open at any hours which meet local needs and circumstances. Midday is clearly the principal occasion of its utility. But in many works it should also be open in the early morning hour for breakfast, and at supper time. Where there are night shifts meals and refreshments should be available as by day. Provision should also be made for the supply of water, milk, tea, or coffee at specified times.

PAYMENT.

251. Different methods of payment are in vogue, but if payment at the time by bill or check is found, which is usually the case, to be impracticable, the most appropriate method is for workers to buy books or series of tickets or checks previously to the meal or at the door.

ACCOUNTS.

252. The factory account should bear the capital charges and certain current expenses, leaving to the canteen account the cost of food, wages, and general administrative charges.

ORGANIZATION.

253. The committee have been impressed with the importance of proper economical and effective organization of industrial canteens. Their purpose, it must be clearly recognized, is to provide sufficient and suitable food and not to yield a revenue. The revenue of a canteen is improved health, contentment, and physical efficiency of the workers, and not a cash balance.

254. Speaking generally, three methods of organization are available and are not mutually exclusive. First, the employer may manage directly; secondly, he may hand over the management to a properly constituted committee of the workers or of the workers and the staff conjointly; or thirdly, the entire direction may be contracted out to a professional or voluntary caterer. In not a few of the most successful canteens joint control is exercised by employer and men (e. g., an elected shop committee with a chairman representing the management) who may or may not contract out the catering. The method of control is materially affected by the proprietorship. In all cases it should be disinterested and solely for the benefit of the workers. Exploitation in any form should be avoided and efficiency, economy, and smooth working kept steadily in view.¹ It must be borne in mind that money can not be deducted from wages by the employer for food or drink without a contract under the truck act.²

255. It is not possible for the committee to lay down hard and fast rules or methods for the successful organization of canteens. In one district or set of circumstances, one condition or factor, and in another district another condition is predominate. But whatever be the local circumstances to secure an effective industrial canteen it is necessary (*a*) that it should be accessible and attractive; (*b*) that it should be suitably constructed and equipped; (*c*) that the diet offered should be fresh, varied, good, and in accordance with popular taste; (*d*) that the service should be prompt; (*e*) that the canteen should be

¹ The tariff can be kept low only by careful management. The food materials can usually be made to pay, but the incidental expenditure is relatively heavy. Workers are not accustomed to paying for food in canteens, and will not always purchase the most nutritious food. Tact, discretion, and an appropriate menu of popular dishes are necessary. Constant supervision and the careful adaptation of means to ends are needed to prevent loss if good food is to be sold quickly, at the low price the worker can afford to pay.

² The Truck Act, 1831, Sec. 23, provides that "no deduction shall be made from the wages of a workman in respect of victuals dressed and prepared under the roof of the employer unless an agreement or contract for such stoppage or deduction shall be made in writing and signed by the artificer." Such an agreement can be readily made and may prove to save time and prevent waste.

open at convenient hours of the day or night; and (f) that the arrangements for payment should be simple and convenient.

256. The committee recognize that since the issue of their first memorandum on the subject (Cd. 8133) in November, 1915, substantial progress has been made, due in no small degree to the activity of the canteen committee of the Central Control Board. The industrial canteen is rapidly becoming a social agency. The committee welcome the Police, Factories (Miscellaneous Provisions) Act of 1916, section 7 (see Appendix H,) as a statutory enactment likely to make universal and permanent the advantages of this agency.

RESULTS.

257. The committee have been impressed with the consensus of opinion which they have received from all parts of the country as to the substantial advantages both to employers and workers following the establishment of an effective and well-managed canteen. These benefits have been direct and indirect. Among the former has been a marked improvement in the health, nutrition, and physical condition of the workers, a reduction in fatigue and sickness, less absence and broken time, less tendency to alcoholism, and an increased efficiency and output; among the latter has been a saving of time of the workman, a salutary though brief change from the workshop, greater contentment, increased opportunity for recreation, and a better midday ventilation of the workshop. The committee are satisfied that the evidence of these results is substantial, indisputable, and widespread. In the isolated cases where the canteen has failed it has been evident that its failure has been due to exceptional circumstances, misuse by the workers, or mismanagement. In almost all large works the committee find that there is a body of men or women (averaging at least 25 per cent) who in the interest of physical health and vigor need canteen provision at the factory. They are convinced that this group of ill-fed workers accounts in a large degree for such inefficiency as exists and that its energy and output are reduced in the absence of suitable feeding arrangements. Whilst it is impossible to separate the benefit derived from canteens from other welfare agencies or to render statistical evidence as to the effect upon output, the committee have received a number of statements in favor of industrial canteens, from which they select the following:

(a) In answer to your inquiry as to the effect which our canteen arrangements have had upon the health and efficiency of our own workpeople, we were so fully alive to the importance of this as to erect a complete installation, separated from the factory proper, for the use of those who live too far away from the works to dine at home. From 1,500 to 2,000 workpeople make use of these rooms daily.

The building has a well-equipped kitchen, but the majority of those who dine at the works, although buying tea and light refreshments, bring their own dinner.

This habit obtains elsewhere. We make a point, however, of having, in addition to other things, one or two cheap and very nutritious dishes, e. g., a 1d. [2-cent] basin of soup or stew, of which some hundreds are sold daily. In planning the dining block we felt it was not merely a question of supplying food, but of doing so under restful and comfortable conditions in rooms well lighted and ventilated and properly warmed. A great deal more was done than was required for bare efficiency, and it is not necessary to build on so costly a scale. We have never had a moment's doubt as to the importance of a comfortable dinner hour for our people from the point of view of their efficiency in the afternoon.

The health of our workpeople has unquestionably improved in recent years, and we feel sure that the dining room has helped to bring about this result. At the same time, as there are many factors which have come into play, it is impossible to value with any approach to accuracy the part that each of these has played. The proper ventilation of the workrooms, medical and dental attendance freely given at the works, with facilities for those in poor health getting to a convalescent home, are among the many factors which have each exercised an influence.

(b) A large number of our men workers still prefer to bring their own food with them and to infuse their own tea in a building which we have supplied for the purpose.

About 80 per cent of our female workers earn a perfect timekeeping bonus each week, which means that they have not lost a minute, whereas the percentage of men who do so rarely exceeds 55 and is generally under that figure. I do not suggest that the whole of the credit for these differences is due to the fact that the women feed in the canteen and the men do not, but I have no hesitation in giving it as my opinion that this is one of the factors of the question.

Especially as this factory is placed 11 miles from Glasgow and miles removed from the nearest village, we simply could not do without a canteen, and I think you will agree that it is very satisfactory to know that although all our workers have to spend practically an-hour morning and evening in getting from their homes to the factory and vice versa, which has the effect of keeping many of them out of their homes for a round of the clock, we have an excellent bill of health and have so far been able to resist very satisfactorily even the special dangers to health which attend working with amatol, TNT, and cordite.

At the present moment in our whole staff of 10,000 workers we have not a single TNT sickness case.

I might add that our medical officer fully concurs in the opinion given as regards the value of a canteen from the health point of view.

At first we had some trouble in getting our girls to take a substantial meal in the middle of the day. The home conditions of many of them had evidently been such that they were accustomed to a diet consisting largely of tea, bread and butter, pastry, etc., and they preferred to continue to feed themselves in that way even when they did buy food in the canteen. There are clear evidences that their tastes in this respect are improving and they are appreciating a properly cooked meal. It has taken a good deal of effort on the part of the management to get as far in this matter as we have, but I feel certain that once they fully experience the advantages to their own health with better food the workers will not readily return to their old methods.

Whilst our experience in this respect is principally in regard to women workers, we are certainly of opinion that the benefit is a very considerable one, as not only have the canteens conduced to better timekeeping, but the direct effect of the substitution of well-cooked food for the cold (often tinned) or even reheated food brought by the workers and eaten under uncomfortable and often

insanitary conditions, has certainly had an excellent effect on the health and appearance of the women.

The provision of canteens where the workers can obtain well cooked and suitable food at a minimum cost is therefore advantageous—apart from whether there are other means for them to obtain their food in the neighborhood of the factory—whilst the provision of hot drinks and soups on cold nights tends considerably to improve production.

The institution of a canteen is also essential if a three-shift system (as in the case of our women workers) is to be adopted without an undue loss of time for meal hours.

(d) One solution of the problem, both from the point of view of the girl herself, who will get a good meal cheaply (owing to wholesale buying and more expert cooking) and from that of the factory, both as to health and output of energy, is undoubtedly the provision of meals by the canteen for all workers.

Practical proof of this is shown by this factory, where incidentally the provision of two square meals a day, with 1½ hours each to take them in and get out in the fresh air afterwards, has put a stop to the far too frequent fainting whilst at work, to much constipation and other disorders, due often to defective nutrition, and to much dissatisfaction among the workers themselves, really due to their feeling out of sorts from these causes.

Proper feeding and proper ventilation, with cleansing of the workers before food and after leaving work, and attention to the flushing of the internal drainage of the body, will produce the maximum of immunity to TNT poisoning or any other infection which may be prevalent, provided the worker starts healthy. Of this I am quite convinced. The medical department is occupied in sifting applicants for work in order to exclude obviously unsound persons and to put less unsound persons into working order—by regulating their bowels and cleansing their mouths from the far too frequent sepsis before allowing them to work in TNT. It is the privilege of the management to see that these reasonably sound workers get suitably fed and housed, that their work is suitably apportioned, and that they are trained up by competent persons to do this work with as little waste of energy as is compatible with the perfect performance of the particular duty on which they are engaged.

(e) The advantage of having freshly cooked meals, well served in the canteen, removed from the noise of machinery and the odor of the factory, has had a marked beneficial effect on the health and spirits of the workers. The meal hours in the canteen are now welcome breaks in the monotony of what was previously too often a 12-hour "shift." Since the introduction of canteens the employees have really worked in a "shift" which consists of three parts, with added initial energy for each part. The increased energy, good spirits, improved health, and "staying" power is appreciably noticeable to the most casual observer.

An experiment has been tried in this factory of having concerts in the canteen during the long meal hour. The conduct of the workers is the best index of their success. The employees have packed the canteen; the best of their talent has been freely given for the benefit of their workers; the audience has been ideal in discipline and appreciation of the efforts of the entertainers.

(f) A canteen properly managed and in which the management of the factory take as great an interest in regard to its efficiency as they would do in any department of their work presents an unlimited scope for all high-thinking employers for the betterment of their workers. The first advantage of this is that it will draw employees and employers together on domestic matters, as I consider that the management of the canteen should be under the factory control, and that all supervision should be undertaken by a committee of the em-

ployees with the manager or some high official as ex officio chairman. The various little questions that arise for discussion, though small in themselves, will be found to be of that nature which will inevitably result in the chairman having the opportunity of displaying a "human touch" which he may rarely have an opportunity of at present. I do not wish to be misunderstood by this, that the manager would be reduced to coddling or merely sentimental action; such would be strongly resented by the workers themselves; but the very fact that there would be the "chief" taking an interest in the questions of their daily livelihood will be, I venture to believe, a big advance in bringing the two together.

(g) Knowing your interest in the details of these matters, we would like to mention how useful has been the installing of a number of small tea depots, distributed throughout the shops, which are open for a quarter of an hour in the afternoons and again for a quarter of an hour during the night shift, for the sale of tea and cakes. This has been done that we might put an end to the promiscuous tea making that went on previously. The running of these tea depots has been only possible by the existence of the canteen, and from an administrative point of view we are indebted to the canteen management that it has been possible to adopt this system of tea depots.

258. Such declarations are, after all, substantial evidence, and they confirm the conviction of the committee as to the benefit arising as a result of a good industrial canteen. The committee have been impressed not only with the improved nutrition manifested by the users of the canteen, but by a lessened tendency to excessive consumption of alcohol, by the prevalence of the spirit of harmony and contentment engendered, and by a declared increase in efficiency and output.

CONCLUSIONS.

259. From what has been said in the present section it will be understood that the committee were convinced at a very early stage of their inquiries of the value and, indeed, necessity of establishing industrial canteens in order to provide for the proper nourishment of munition workers. As however, the Central Control Board (liquor traffic), of which Lord D'Abernon was chairman, had in June, 1915, appointed (under the statutory powers conferred on them by Defense of the Realm Regulation No. 5 of 1915) a canteen committee (the chairman of which was Sir George Newman), the health of munition workers committee deemed it inexpedient to intervene in the work which that canteen committee had already commenced. Accordingly the burden of work in connection with the establishment of industrial canteens has fallen upon the canteen committee of the liquor-control board, assisted by His Majesty's Office of Works, who have thus facilitated the supply of proper and sufficient nourishment for the munition worker not only in the interests of sobriety, but also in the interests of industrial efficiency.¹ In the first enthusiasm of this great movement

¹ See first [Cd. 8117], second [Cd. 8243], third [Cd. 8558], and fourth [Cd. 9055] reports of the Central Control Board (liquor traffic) appointed under the Defense of the Realm Consolidation Act, 1914, and Defense of the Realm (Amendment) (No. 3) Act, 1915.

a number of voluntary assistants and voluntary workers undertook the responsible duties in connection with the establishment and maintenance of canteens. Eventually, however, it became necessary owing to the magnitude of the undertaking that the State should shoulder increased responsibilities in the matter. The Munitions of War Act, 1915, provided that "controlled" employers, in which category were included practically all manufacturers of munitions, in the wide meaning that modern warfare imparted to the term, were to receive only their standard prewar profits plus one-fifth, the remainder being paid to the exchequer. It seemed hardly reasonable to expect them to sacrifice profits so rigidly limited in order to provide canteens for their workers, and it could fairly be argued that, as the advantages of the increased output anticipated from the establishment of industrial canteens would accrue to the State, the State should find the money. On the initiative of the liquor-control board it was therefore decided that "controlled" employers should be allowed to charge to revenue the expenditure which they might incur with the approval of the board on the establishment of canteens at their works; in other words, that the cost of the establishment of canteens should be borne from funds which would otherwise accrue to the exchequer. At the same time the minister gave instructions for the provision, where necessary, at all Government munition establishments (royal arsenals, national factories, etc.) of adequate canteen accommodation at the expense of the State, and intrusted the board with the general responsibility for the organization of the canteen at these establishments.

260. The liquor-control board have thus been the responsible authority for the organization of industrial canteens in munition works throughout the country. They established the necessary departmental and expert staff for the effective performance of this duty, and in its execution have through their representatives visited all the larger and many of the smaller munition works, and have urged the provision of canteens wherever a real and undoubted need was found to exist, whether that need arose on grounds of liquor control or of nutrition of the munition worker. The board have made it their study to do all that was possible to assist employers in the design, equipment, and management of canteens. The services of their expert staff have been placed freely at the disposal of employers, and they have published a handy compendium of information on these subjects in the form of a pamphlet entitled "Feeding the munition worker," to the usefulness of which they have received numerous testimonies.

261. The policy of the liquor-control board, with which the committee have fully concurred, has been first to encourage the employer or owner to make suitable provision for canteen accommodation

where necessary; secondly, to facilitate such provision by voluntary or other agencies; or, thirdly, to establish a canteen themselves, either managing directly or handing over the management to a properly constituted committee of employers and workmen. At the end of 1917 some 840 industrial canteens had been established in national and controlled munition factories and at docks concerned in transport in connection with the war (at an approximate cost of upward of one and one-quarter millions). The canteens established under the auspices of the liquor-control board have been, with few exceptions, known as "temperance" or "dry" canteens—that is to say, no intoxicants have been supplied. In a few exceptional cases the liquor board have made special orders providing for the "on" sale and consumption of beer limited in specific gravity and in quantity purchasable. Exceptional conditions in various areas, owing to concentration of munition workers, congestion of population, the building of large factories in isolated places, the employment of women and night employment, have necessitated exceptional arrangements.

Speaking generally, the committee are glad to recognize that the liquor-control board have initiated, guided, or assisted a social and industrial reform which force of circumstances has rendered imperative in the present emergency, and which has, the committee are satisfied, contributed substantially to the successful output of munitions. The industrial canteen has, in fact, proved itself one of the most effective instruments in securing and maintaining a high standard of industrial work. It has contributed to increased sobriety; it has reduced "industrial drinking"; it has served as a counterattraction to the public-house; it has supplied improved nutrition to the worker, which has led to a reduction in sickness and to increased energy, better timekeeping, and improved output. The committee earnestly trust that these substantial gains may be maintained in the future and that the industrial canteen will become a permanent and essential factor of the modern factory.

SECTION X.—SICKNESS AND ILL HEALTH.

262. The effect of industrial occupation upon the health of the worker has been a subject of medical investigation since the seventeenth century. Early in the nineteenth century similar inquiries were instituted in England, and in 1831 Thackrah showed that the environment and conditions of factory life, or the mental and physical strain entailed, were associated with exceptional disablement, disease, or mortality among the persons employed. Numerous commissions have been appointed by the Government to ascertain more precisely the exact causes of such effects, and these have considered successively the general circumstances of the worker, the injurious influences of the factory system, the special conditions of certain occupations, the risks incurred in the use of machinery, and the results arising among those employed in dangerous trades. Thus has been accumulated a body of medical experience, growing with the growth of industry and with the increase of our knowledge of the causes of disease. Concurrently with the appearance of evidence of a medical and social character further light has been thrown upon the subject by actuaries, insurance agents, and statisticians. As long ago as 1853 Finlaison, the actuary of the national debt, said that "the real practical difference in the distribution of sickness seems to turn upon the amount of expenditure of physical force," and 50 years later, in 1903, Watson, who had studied the subject from an actuarial point of view, wrote that "the proportion of members sick during any year varies with occupation." Again, the experience of insurance authorities confirms the same view. The report on national health insurance for 1913-14 states that "in many cases the rate of sickness is affected by occupations or by the conditions incidental to particular occupations." Lastly, there is the incontrovertible evidence furnished by the bills of mortality steadily accumulating in proof as the years pass. The decennial reports of the registrar general demonstrate that certain occupations have a high comparative mortality, that this mortality is due to well-defined and preventible diseases, that the occupation may exert a greater influence on mortality than the aggregation of population and its associated conditions, and that occupational mortality is affected by the age incidence of the worker.

CAUSES OF SICKNESS.

263. Sickness due, directly or indirectly, to the industrial occupation takes various forms and degrees, from the passing headache to

serious organic disease of fatal issue. The lungs, the heart, the digestive organs, the nervous system, the muscular system—each or all may be affected with results harmful both to industrial efficiency and output, and also to personal health and expectation of life. Moreover it must be remembered that an undue proportion of sickness in any group of workers usually represents among those not actually sick lessened vigor and activity which can not fail to reduce output. Disabling conditions or influences which injure some have a tendency to mark all. Employers and their workpeople should therefore have a general appreciation of these injurious conditions if they are to be on the outlook to guard against or mitigate their evil effect. Speaking generally, attention should be given to the following points:

(a) Excessively long hours of work, particularly by night, if continued, produce fatigue, irritation, and sickness. "You will find," writes Sir James Paget, "that fatigue has a larger share in the promotion or transmission of disease than any other single causal condition you can name."

(b) Cramped and constrained attitudes or postures during work which prevent the healthy action of the lungs and heart.

(c) Prolonged and excessive muscular strain, e. g., the lifting of heavy weights or prolonged standing, may produce rupture or varicose veins.

(d) Machinery accidents.

(e) Working in unventilated or insufficiently ventilated shops predisposes to disease and interferes with individual energy and physical capacity. The effect of continuously working in a stagnant or polluted atmosphere is not trifling or insignificant.

(f) The air, even if fresh, may be too hot or too cold, too humid or too dry; either extreme should be avoided if reasonable bodily comfort and the most efficient work are to be insured.

(g) Imperfect lighting, whether by day or night, conduces to eye-strain and headache.

(h) Working with, or in the presence of gases, vapors, poisons, or other irritating substances may lead to direct poisoning.

(i) Dust produced in certain industries, unless effectually safeguarded, may produce lung disease.

(j) The manufacture and use of high explosives involves risks to the workers.

264. In considering the physical capacity of a woman for withstanding the fatigue consequent upon prolonged industrial employment, it has to be remembered that her body is physiologically different from and less strongly built from that of a man. Her muscular system is less developed. Account must also be taken of the fact that

at the present time many workers have until recently lived a sedentary or domestic life and have not been in the habit of taking active and regular exercise. Certain ailments and forms of physical disability to which women are liable are readily caused or at least accentuated by inattention to these considerations; among such conditions are—

- (i) Disturbances of digestion due to unsuitable food, irregular and hurried meals, or to fatigue;
- (ii) Anemia, with possibly associated disease of the heart and circulatory system;
- (iii) Headache;
- (iv) Nervous exhaustion;
- (v) Muscular pain and weakness, flat foot, etc.;
- (vi) Derangement of special physiological functions.

265. Though these conditions may not in all cases be immediately incapacitating, they frequently tend to become chronic in nature and far reaching in effect, and they lead directly to malnutrition and to reduction of bodily energy. If allowed to persist they invariably lay the foundations of ill health and disease in later years.

266. Special problems also arise in the prevention of sickness amongst boys and girls. Both physically and mentally they are less capable than adults of prolonged effort or sustained attention to work. They need vital energy not only for the maintenance of health but for growth; even though there are no signs of immediate ill health their future growth and development may become stunted.

267. Though these are a sufficiently formidable list of disabling conditions, or conditions which without proper care and precaution may readily cause disablement, they do not complete the inventory. At least as important as any of these occupational influences, but inseparable from them, is the predisposition to disease arising from the absence of personal hygiene. The necessities of individual health are few and simple, but they are essential. Suitable and sufficient food, fresh air, warmth, moderation, cleanliness in ways and habits of life, the proper interrelation of work, repose, and recreation of mind and body are laws of hygiene, the elements of vital importance for which facilities must be provided if the maximum industrial output of the individual is to be secured and maintained. These matters need consideration by the management just as much as the healthy supervision of the external circumstances of the factory and its technical processes.

INDICATIONS OF SICKNESS.

268. In addition to the clinical signs and symptoms of ill health and disease, there are three general indications of sickness in a factory which can be gauged by the management:

(a) Absence, broken time, irregular timekeeping, or diminished output of the individual worker.

(b) Sickness register.

(c) Death certificates. These, though few in number, form important indications of the health of the workers as a whole.

269. Every case of lost time or absence calls for inquiry. It should be properly recorded. The study of such records is certain to disclose the existence of adverse influences or circumstances previously unsuspected which may denote the beginning of sickness. Unfortunately the number of instances where reliable records are kept is comparatively few. Even when their importance is recognized difficulties have arisen owing to pressure on the time of the staff or owing to the unsatisfactory character of many of the medical certificates supplied by workers. These certificates frequently give no information as to the cause of illness or as to its probable duration. They seldom state whether immediate absence from work is essential or whether it can be postponed for a brief period until a particular job has been completed. Apart from these, certificates are sometimes given on odd slips of paper or do not show the address of the medical practitioner. In their Memorandum No. 16¹ the committee have suggested the need for a form of medical certificate which, if adopted, should do much to obviate these difficulties. A model form is given in Appendix G.

270. Prof. Loveday, in his memorandum on The Causes and Conditions of Lost Time, which is included in the committee's interim report on Industrial Efficiency and Fatigue, sets out the results of a series of investigations which he made on behalf of the committee into the lost time. He concludes that nearly all records understate, and most records understate greatly, the proportion of lost time due to sickness and other unavoidable causes. This is partly due to the difficulty in regard to medical certificates, already referred to, and partly to the fact that many absences for which no medical certificates are or can be forthcoming are attributable to fatigue, colds, or other minor ailments. While such absences may in a sense have been avoidable, they frequently serve to prevent future breakdown. He gives reasons in support of the view that, except where there is an undue degree of slackness, more than half of the time lost is lost through unavoidable causes. Various methods are suggested for testing the accuracy of sickness records:

(a) If the returns of bad time keeping and sickness coincide in direction.

(b) If the number of whole weeks lost through sickness is abnormally high when compared with the shorter periods similarly lost.

¹ Cd. 8522.

(c) If the number of days lost through sickness is abnormally high when compared with the number of "quarters" similarly lost.

271. An affirmative answer to any of these questions, unless explicable otherwise, gives good reason for supposing the rate of sickness to be understated. While no doubt in some places and in some trades timekeeping has really been slack, there seems little doubt that the underestimate of sickness and unavoidable absence generally has led to many misinformed and unjust statements about the lethargy and irregularity of the whole body of workers in controlled factories.

272. In scrutinizing sickness returns and in studying their rise and fall account must be taken of various causes of fluctuation:

(a) *Climatic conditions.*—It may be assumed that the rate of sickness will be above the average in January, February, March, April, and occasionally in November. In the remaining months it will ordinarily be below the normal. If the sickness rate does not respond to considerable changes in weather, or fluctuates independently of them, other causes of fluctuation must be operative and should be determined.

(b) *The approach of a holiday.*—A worker, though feeling unwell, may hold on if a holiday is approaching, and a reduction in the sickness rate may accordingly result.

(c) *A holiday just past.*—If the sickness curve fails to respond to a holiday, and especially to a break of several days, or if its steadiness or rise can not be attributed to worsened climatic conditions, epidemics, or the like, there is reason for receiving statements as to sickness with caution and sometimes with suspicion.

(d) *Patriotic enthusiasm.*—Many workers will keep at work when they are convinced of its urgency and national importance even though they may be unwell and need rest. Consequently when a period of relaxation occurs the rate of lost time and also of sickness may rise substantially.

(e) *Long hours, much overtime, and especially Sunday labor,* undoubtedly exercise a most deteriorating effect. Prof. Loveday quotes the case of a factory where there was much Sunday labor during the spring and where no fewer than 22 per cent of the men were at one time sick. During the following August, when Sunday labor had been much reduced (but overtime on week days remained heavy), the sickness rate was little over 4 per cent. This reduction was partly attributable to the change of season, but the figures of a neighboring factory showed that in that district the weather during the spring, though inclement, was not abnormally unhealthful, and Prof. Loveday sees no reason to doubt the manager's view that the weather was less accountable for the improvement than the restriction of Sunday work.

273. As regards the signs of ill health most commonly met with amongst munition workers, a large body of information has been rendered available as the result of the medical examinations of male and female workers which were conducted on behalf of the committee. Full particulars of the ailments and defects found by Dr. Agnew as the result of examining over 3,000 men and boys are given in a table set out on pages 98 and 99 of the committee's interim report on Industrial Efficiency and Fatigue. Dr. Agnew reports:

There is no one defect that points conclusively to overwork or strain, but many of the symptoms taken collectively indicate severe strain, and I would suggest that sleepiness on the night shift, headache, foot ache, and muscular pains are probably the most common signs of overwork. The nervous symptoms added to these go far to complete the picture. The effect of noise upon the individual and its contribution to feelings of overtiredness and exhaustion must be considerable. In many of the factories, though the work was not heavy, the noise was such that the result of lengthened periods in these factories was almost as severe as exposure to high temperature coupled with hard work.

274. On pages 120 and 121 of the same report similar particulars are given of the defects found as the result of examining over 1,300 women and girls; the results of these examinations were thus summarized:

The ailments most frequently observed included indigestion, constipation, headache, anemia, and muscular pains. These are all frequently met with among women workers and can not be attributed especially to munition work. The great difficulty in estimating their precise importance is the lack of any control investigation or data. In some cases the ailment had undoubtedly been caused or accentuated by conditions of factory work. In other cases it has existed before beginning munition work. In others, again, the workers expressed themselves as in better health than formerly.

METHODS OF REMEDY AND TREATMENT.

275. At the foundation of any sound system of dealing with industrial diseases lie two elementary principles: First, that prevention is better than cure; and, secondly, that for treatment to be imposed effectively it must deal with the beginnings of disease. Bearing these in mind, the preliminary safeguard should be to provide for the medical examination of all workers in order to secure as far as may be their physical fitness for employment. In some munition works, and especially in those where dangerous substances are manipulated, a preliminary medical examination of all workers is usual. Dental treatment is also sometimes provided. Such examinations are specially important at the present time owing to the strain involved by the conditions of employment and owing to the large number of persons who are taking up industrial employment for the first time; but such examinations are always likely to be desirable where the work involves any special strain, and particu-

larly so in the case of women. Apart from their value in detecting early signs of ailment or defect, medical examinations are valuable as affording convenient opportunity for the inculcation of sound doctrines as to personal hygiene, cleanliness, and healthy habits. Periodic reexamination is practically confined to certain dangerous trades and processes, the workers in which have to be periodically examined under the regulations of the Home Office or the Ministry of Munitions. Where they can be arranged for, such examinations might usefully be extended to workers engaged in other processes involving special strain or risk.

276. It is true that under section 63 of the factory and workshop act it is necessary for every boy and girl under 16 to be certified by the factory certifying surgeon¹ as physically fit for employment in the factory. Unfortunately, this certificate is not always adequate for its purpose. The decision of the surgeon has normally to be based simply on one brief examination. More often than not he has no previous knowledge of the boy or girl, and generally the records of the school medical service are not available. After a young person has once been admitted to a factory no further medical examination is required except in the rare instances where the factory inspector may specially require it. In view of the strain which industrial employment may often impose on growing boys or girls, it would undoubtedly be an advantage if arrangements could be made for their periodic reexamination. It may be pointed out that the departmental committee on the night employment of male young persons emphasized the need for such periodical examinations once at least in every six months, and recommended that records of the results should be kept.

277. The second step is to reduce to a minimum any unfavorable conditions obtaining in the factory by providing proper sanitary conditions and accommodation, safeguarding machinery, controlling hours of labor, furnishing canteen facilities, and securing sufficiently warmed, lighted, and ventilated workrooms.

278. Thirdly, arrangements should be made for adequate medical and nursing schemes. Medical attendance is obtainable under the national insurance system, or may be made available by the special provision of a medical and hospital service for the factory. Nursing can only be obtained by the employment of one or more trained nurses to undertake duties in the factory by night as well as by day. Such arrangements have been instituted in many munition factories, especially where women are employed, and have proved of great value to employers and workers alike. The duties of the factory nurse may include—

¹ See memorandum on Certificates of Fitness, issued by the Home Office in 1915, and obtainable on application to that office.

- (a) Supervision of the health of the workers.
- (b) Superintendence of the rest room for those who are temporarily indisposed.
- (c) Following up cases of sickness at home.
- (d) Taking charge of first-aid treatment of injuries.
- (e) In the absence of medical advice, observing and controlling in its initial stages any threatened outbreak of the influenza type of sickness, which, if it extends, may temporarily paralyze output.

279. The committee are glad to recognize the increasing frequency with which nurses are now being employed in factories to perform some or all of the duties mentioned above. The employment of doctors is, of course, less common. In factories engaged upon the manufacture or manipulation of poisonous substances and gases 51 medical officers are at present employed. Of these 14 are whole-time officers and 37 part time. Their duties include the preliminary medical examination of the workers, the supervision of their health whilst at work, a constant inspection of the working conditions of the factory, and the regulation of suspensions. In addition, they are constantly concerned with other matters more or less directly affecting the health of the workers. They report periodically to the ministry on medical problems arising in their work. At many of these factories dentists are employed by the management to treat new workers who require to have carious teeth removed before they can be safely employed. In other factories the employment of medical officers is still rare, though it is increasing, and development is likely to be encouraged through the need for securing the proper supervision and maintenance of the first-aid appliances, the provision of which is required by the recent Home Office order.¹ The need for training workers in the use of these appliances will also require to be provided for. The three cases quoted below indicate other directions in which development may be anticipated:

(a) At an engineering factory employing about 2,250 workers (mostly men) a whole-time medical officer has been appointed, who acts also as panel doctor for most of the employees. He makes a medical examination of all new employees. Absentees are followed up by him if they have not seen him before leaving work, and they again see him before resuming work. The number of patients seen varies from 60 to 75 a day, and the medical officer's work consists in the supervision of the dressing carried out by his male dresser, ordinary diagnosis, minor surgical treatments, and any attendance on the workers where necessary in their homes or at the neighboring cottage hospital.

(b) At an engineering factory, where about 2,500 men and women are employed, a medical officer attends at the surgery daily from noon till 1 p. m. He sees cases of injuries which have been held over for his inspection or which have come up to be redressed. He also examines all workers before engagement, when any physical defects, such as hernia, hydrocele, varicose veins, or heart trouble are entered in a book and the entry countersigned by

¹ See paragraph 289 and Appendix L.

the worker; in this way claims in respect of that particular defect at some later date are avoided. The medical officer also treats at his own house cases sent to him by the nurses on duty.

Employees have to report every accident, no matter how slight, to the foreman, who passes the case on to the ambulance room. The workers are in no case allowed to treat any wound themselves. All wounds are dressed by nurses under the supervision of the medical officer. Patients are not sent to their own doctor, for the latter have not time for, and can not be expected to, treat daily a large number of minor and apparently trifling injuries. Under the system adopted every wound, however slight, is dressed within a few minutes of its occurrence, and is properly cared for until it is healed. As a result, the proportion of workers who lost time on account of accidents was markedly lowered, and there was an increase in the proportion of cases that lost no time at all. This scheme is also of interest because the firm on starting it decided to carry their own insurance for all claims less than £100 (\$486.65), and they found after due allowance was made for the doctor's salary and the expenses associated with the nurses, that they had at the end of 18 months a credit balance of nearly £500 (\$2,433.25). To this balance must be added the indirect though considerable value of working hours and weeks saved.

(c) A group of factories are employing one medical man, paid on a capitation basis, to make not less than four health inspections annually. His inspection includes the organization of first-aid treatment; records of the health and progress of each worker; the condition of the sanitary conveniences; the cleanliness of the windows; the ventilation, temperature, and cleanliness of each workplace; the facilities for obtaining food and drinking water; and the cloakroom and washing accommodation. He also advises on any medical subject connected with the work of the factory and as to the health of any worker specially referred to him. Any necessary observations or suggestions are entered in writing for the information of the management and for reference on subsequent visits.

SECTION XI.—INJURIES AND ACCIDENTS.

280. The provisions of the Factory and Workshop Act in regard to accidents fall into two main categories—the prevention of accidents, and the notification and investigation of certain kinds of accidents. The provisions for the prevention of accidents include the proper fencing of machinery (sec. 10), safety valves for boilers (sec. 11), the position and operation of self-acting machines (sec. 12), the cleaning of machinery by women and young persons (sec. 13), means of escape in case of fire (sec. 14), and the making of doors to open outward (sec. 16). The occupier of the factory is required to notify to the factory inspector all fatal accidents and all accidents sufficiently serious to necessitate absence from work for a period of one day in some cases and of seven days in others. Notification is also required of dangerous occurrences, such as fires, or certain types of explosions or accidents to machinery or plant. Under the Police, Factories, etc. (Miscellaneous Provisions), Act, 1916, section 8, it is the duty of the factory certifying surgeon to investigate and report upon certain kinds of injury caused by exposure to gas, fumes, or other noxious substances, and also upon any other cases which may be specially referred to him.

281. How grave is the amount of disablement caused by injuries and accidents is shown by the fact that though only accidents of a certain degree of severity are notifiable, the number notified annually amounts to over 150,000. To these must be added a vast number of minor injuries and accidents which in the aggregate cause perhaps an even larger amount of interruption to work. A somewhat formidable return of accidents is therefore to be anticipated in munition factories, which include not only metal and engineering work, but certain dangerous trades and the manufacture of explosives. Moreover, the introduction of new labor, and of employees unaccustomed to the processes concerned, particularly in conjunction with the need for speed and pressure, overtime, and night work, with the consequent fatigue, must inevitably lead to greater risk of accident. The injuries in a typical munition works are not only open wounds, contusions and abrasions, injuries to the eye, sprains, simple and compound fractures, and injured limbs, but also scratches, cuts, burns, and other minor injuries which may readily lead to more serious conditions by neglect. The slightest wound may become infected with germs, and a greater or less degree of sepsis or blood poison-

ing supervene, with the resultant serious loss of time and efficiency, and possibly even risk of life and limb.

An insurance company reports that out of 27,500 accident claims in 1917, 2,700 were septic claims, over 2,000 of these being septic conditions caused through wounds on the hand.

282. Much valuable and suggestive information on the relation of the incidence of accidents to output and to fatigue is contained in Dr. Vernon's memorandum on An Investigation of the Factors Concerned in the Causation of Industrial Accidents.¹ The inquiry is of the greater importance in that so far as the committee are aware no inquiry of a similar nature had previously been conducted, at any rate in this country. As he points out previous inquiries on the subject have suffered from certain defects. In the first place the accident data are in no case correlated with the output data. Secondly, no allowance has been made for the considerable period of time often lost at the beginning and end of a spell. And thirdly, no allowance has been made for the time which has elapsed between the occurrence of the accident and the time when the worker applies for treatment. This period is always appreciable, and in the case of some types of accident (e. g., sprains) may be considerable.

283. As to what are the principal causes of accidents Dr. Vernon states:

Speed of production is the essential factor in accident causation which can never be neglected. Its action depends especially on the degree of nervous and muscular coordination possessed by the worker, and on psychical conditions such as his alertness and attention.

The various factors concerned in accident production may be classified under two main headings, according as they depend on the worker himself, i. e., are of personal origin, or depend on external conditions not directly under his control.

Factors of personal origin:

- I. Nervous and muscular coordination in relation to speed of production.
- II. Fatigue.
- III. Psychological influences.
- IV. Nutrition and alcohol consumption.

Factors of external origin:

- V. Lighting.
- VI. Temperature, humidity, and ventilation.
- VII. Defects of machinery and absence of guards.

284. For an adequate appreciation of the character and scope of Dr. Vernon's inquiry, reference should be made to the report itself.² Here it must suffice to give a brief summary:

Accident data were collected at four factories, for periods of 9 to 25½ months. The accidents (over 50,000 in number) were classified separately under the headings of cuts, foreign bodies in the eye, burrs, sprains and injuries incurred

¹ Cd. 9046.

² See Committee's Memorandum No. 21. (Cd. 9046.)

one or more days before they were first treated. Eye accidents afford the most reliable index of accident incidence, as they are almost invariably treated within a few minutes of their occurrence. Cuts are fairly reliable, but sprains are quite unreliable, as the workers generally do not come for treatment till some time after they are incurred. Hence their incidence resembles that of "previous injuries," or depends on the inclination of the worker to attend the dressing station. This inclination varies greatly at different times. For instance, day-shift women attended three times more frequently toward the end of the morning spell than at the beginning, but night-shift women attended most frequently at the beginning of the shift, and only a fifth as frequently towards the end of it.

Speed of production.—Output determinations at a fuse factory were made by measuring the excess electric power supplied to the various sections of the works, and verifying the results by direct enumerations of the articles produced. The output rose steadily during the morning spell and was 11 per cent greater in the fourth hour of full work than in the first hour. It remained high during the first hour of the afternoon spell, but fell off during the rest of the afternoon. The incidence of accidents showed a qualitative resemblance to these output variations but not a quantitative one, for accidents increased 10 to 30 times more rapidly than output during the morning spell. Nevertheless it was concluded that varying speed of production is the factor largely responsible for the day-shift variations of accidents in men, and not fatigue. Though the night-shift output followed a similar course to the day-shift output, the accident incidence, except that of eye accidents, was entirely different. It was at a maximum at the beginning of the shift, and fell gradually the whole night through to about half its initial value. This was due to the fact that the night-shift workers started work in a careless and excited state, and calmed down gradually during the night. At the other factories, where 6, 9.2 and 15-inch shells were manufactured, there was very little hourly variation in the speed with which the operations on these shells were performed, and in correspondence therewith the hourly incidence of accidents incurred by the day shift was fairly steady. The night-shift accidents dwindled rapidly the whole night through, because of the psychical factor.

The diurnal variations of accidents at the fuse factory generally corresponded with the output variations, as both rose to a maximum in the middle of the week and declined at the end of it. This correspondence held for night shift as well as day shift, and the diurnal variation of eye accidents was especially marked. In the shell factories the night-shift accidents rose rapidly in the course of the week, and in women were 47 per cent more numerous on the last day than on the first day. This was a fatigue effect. The monthly variations of accidents at the fuse factory corresponded with output variations, for the accidents gradually increased about 40 per cent, whilst the hourly output at the same time increased 30 per cent.

Fatigue.—The influence of fatigue on accidents to women was strikingly shown at the fuse factory when the operatives were working a 12-hour day, or 75 hours a week. The women's accidents were two and a half times more numerous than in the subsequent 10-hour day period, but the men's accidents were not affected. The women's accidents showed a five-fold increase during the course of the morning spell, as compared with a three-fold increase during the subsequent 10-hour day period, but the men's accidents did not change as between these two periods. The women's accidents were 45 per cent times more frequent in the afternoon spell than in the morning spell, whilst the men's accidents were only 7 per cent times more numerous. Also the women were treated for faintness nine times more frequently than the men, and were given

sal-volatile 23 times more frequently, whereas in the subsequent 10-hour day period they were treated for faintness and given sal-volatile only three times more frequently. When the hours of work at one of the shell factories were equalized for the men and the women, whereby the women were made to work 9½ hours more than they had done previously, and the men 9½ hours less, the ratio of women's accidents to men's accidents (corrected for the alteration of hours) increased 19 per cent for the day shift and 61 per cent for the night shift.

Psychical influences.—At all the factories the night-shift workers suffered fewer accidents than the day-shift workers, the average defect being 16 per cent. This was not due to the output being smaller, as at the fuse factory it was distinctly bigger by night than by day. It was psychical in origin, and due to the night-shift workers settling down to a calmer mental state than the day-shift workers, and so becoming less careless and inattentive. The psychical factor is one of the most important in accident causation.

Alcohol consumption.—Indirect evidence as to the effects of alcohol consumption was obtained by assuming (a) that the increasing restrictions on the alcohol consumption of the Nation in general during the war applied also to the munition workers; (b) that such of the night-shift workers as took alcohol did so shortly before coming on to work. It was found that the accidents treated during the three spells of the night shift at the fuse factory fell off much more rapidly in men than in women—as one would expect them to do if the excess of accidents in the first spell were due partly to alcohol consumption—and that between February, 1916, and December, 1917, the fall steadily became less. Again, in the 12-hour day period (November, 1915, to January, 1916) the accidents were at a maximum on Monday and fell gradually to a minimum on Friday, which was 30 per cent less than the Monday value. Then they shot up again nearly to the maximum on Saturday. This suggests weekend drinking, as no such variations were observed during the subsequent 10-hour day period.

Lighting.—Accidents due to foreign bodies in the eye were 7 to 27 per cent more numerous in the night shift than in the day shift, though all the other accidents were considerably less numerous. This was due to the artificial lighting, as the excess of eye accidents was most marked in the worst lit factory. During day shift the eye accidents to men were most frequent in the winter months and most infrequent in the summer months, but this relationship was not observed in the women. Other accidents were not affected, for during day shift they were not more numerous in the hours of artificial lighting than in those of natural lighting.

Temperature.—The temperature at the fuse factory was recorded continuously for six months by means of a thermograph. Accidents were at a minimum at 65° to 69° F. and increased rapidly at higher temperatures (e. g., by 30 per cent at temperatures above 75°) and slowly at lower temperatures. Continuous records were obtained of the external temperature of the town in which the shell factories were situated, and it was found that in all of them the accidents increased considerably as the weather grew colder and diminished as it grew warmer. In one factory the women's accidents were nearly two and a half times more numerous when the temperature was at or below freezing point than when it was above 47°, whilst the men's accidents were twice as numerous.

Prevention of accidents.—Various directions in which accidents could be diminished were suggested by comparing the accident frequency of men and women at the different factories. The women suffered twice as frequently as

the men from sprains and were especially liable to wrist sprains at the fuse factory, as they had not sufficient strength to push home the clamping lever of the lathes. Both men and women suffered many more sprains at the 6-inch shell factory than at the other shell factories, as they often moved the 90-pound shells by hand, instead of with the tackle provided. The women at the shell factories suffered three times more burns than the men, chiefly from the hot metal turnings. Accidents arising from carelessness and inattention can be diminished by preventing the workers from talking to one another in the shops.

MEANS OF PREVENTION.

285. It has been estimated that from 25 to 40 per cent of all industrial accidents are preventable if all practicable means are taken. In America it has been estimated that roughly 30 per cent of accidents are due to illness or to imperfections in machines or in guarding dangerous parts; that 60 per cent are due to apathy and lack of appreciation of danger on the part of operatives and only 10 per cent to wholly unpreventable causes. Whatever the proportions may be, there is no doubt that a large number of accidents are preventable, and the State which desires the maximum output of munitions, the employer who pays compensation, the unions who subsidize absentees, and the operative who undergoes suffering and pain, and perhaps, permanent disablement, are alike concerned to secure a reduction in the number of accidents.

286. It is obvious that much can be done by adopting various methods of prevention, such as the proper and effective guarding of machinery, the provision of safety appliances, the proper regulation of dangerous processes, the adequate lighting of the factory, and the more careful cleaning of machinery. But however complete the provision made for securing the safety of the worker, its success must largely depend upon the intelligent cooperation of workers and foremen in the maintenance and use of the appliances provided and in the enforcement of precautionary regulations. As already suggested, many accidents occur through ignorance or apathy—"familiarity breeds contempt." One method of securing the necessary cooperation which might with advantage be more widely adopted is by the establishment of committees of workers. The duties of such committees are to study the causes of accidents, to suggest and advise suitable means for prevention, to keep careful records, to make frequent inspection of machinery and plant, and to note any defects or dangers. The interest of the workers may be further encouraged by giving prizes for suggestions or by awards to the committee of the department where the greatest reduction of accidents has been secured. In some instances monthly pamphlets or bulletins have been published dealing with the safety and hygiene,

with particulars of accidents, with notes as to their prevention and illustrations of safe and dangerous methods of working.

287. However perfect and complete may be the methods of prevention adopted, accidents will always occur, and provision must therefore be made for their suitable treatment, and particularly for the first-aid treatment of minor injuries. Wherever possible training in the essentials of first aid should be given to a sufficient number of workers to provide that in each shop there are at least one or two persons who know how to render first aid in case of injury, and much valuable work has been accomplished in spreading knowledge of first-aid practice by the St. John Ambulance Association and similar organizations, with a result that in many munition works there are employees who possess the requisite training. Unfortunately at the present time long hours of work and the difficulty of obtaining teachers makes training difficult to organize. Distribution may also usefully be made of leaflets or placards of instruction and advice. Any instruction or advice should be simple and precise and should emphasize the need for treatment in all cases as well as methods of treatment.¹

288. In the majority of factories some provision is made for the treatment of injuries, but inspection indicates that there is great and urgent need of improvement, especially for treating minor injuries. While one factory may possess a well-equipped surgery with a trained nurse in charge, at another provision for treatment may be wholly absent, or the surgical equipment may be represented by a soiled roll of some so-called "antiseptic" lint or gauze, an open packet of absorbent wool, a few bandages, some antiseptic lotion, or an unclean pair of scissors, all kept in a dusty drawer. It is obvious that provision of equipment for first aid is worse than useless unless it is properly kept and maintained.

289. What is required is an adequate though simple organization which provides—(a) a local dressing station or aid post in each workplace for minor injuries, and (b) a central dressing station or surgery for more serious cases or cases requiring continuous treatment. An order² recently made by the Home Office under the Police, Factories, etc. (Miscellaneous Provisions), Act, 1916, section 7,³ requires that in the case of blast furnaces, copper mills, iron mills, foundries, and metal works a first-aid box shall be provided in the proportion of at least one to every 150 persons, and an ambulance room wherever 500 or more persons are employed. Arrangements

¹ A leaflet (see note at end of section) has been issued by the Home Office and is obtainable on application.

² The terms of the order are given in Appendix I.

³ The terms of the section are given in Appendix H.

should also be made for the immediate conveyance to hospital of cases which can not be treated on the spot.

LOCAL DRESSING STATION OR AID POST.

290. In order to be effective under industrial conditions any form of treatment for minor injuries must be extremely simple, easily understood, and readily applicable. Elaborate provision for the treatment of minor injuries is the less necessary, because of its unsuitability under factory conditions and because in machine shops wounds are usually comparatively free from germs. Further, the treatment must be always and promptly available. The workman who sustains a slight injury while at work will often decline to surrender a quarter of an hour of time and earnings in going to and from a central surgery to have his wound dressed. Time is a consideration, and the exigencies of factory life do not allow of an elaborate procedure. The aid post may take the form of a cupboard or box containing first-aid materials, with brief, simple, and clear instructions as to their use. The box should contain packets of sterilized dressings, a supply of iodine solution (alcoholic solution containing 2 per cent iodine), a bottle of "eye drops," a pair of dressing scissors, some triangular bandages, safety pins, and a roll of plaster (1 inch wide). The sterilized dressings may suitably be of three sizes:¹

(a) Three dozen small size, for fingers, composed of a strip of gauze or lint 8 inches long and 1 inch wide, with narrow tape attached to one end. The tape should be rolled up inside the strip, which is then wrapped in a cover of ordinary nonabsorbent wool and the whole sterilized. In use the wool is first removed and the dressing unrolled round the injured finger, when the tape is disclosed ready for tying the dressing in position.

(b) One dozen medium size, for hands or feet, similar to the above, but 18 inches long and 1½ inches wide; and

(c) One dozen large size, for which the ordinary field dressing may be taken as a pattern.

The aid post should be under the care of an officer, preferably the foreman or forewoman, trained in first-aid work. This officer should keep a note of every case dressed, and should be responsible for seeing that the box is kept stocked and in proper order. Ordinarily one such aid post should be provided in each workplace, but in large engineering shops several may be required.

¹ Such dressings may be obtained, amongst others, from Messrs. Cuxson, Gerrard & Co., Oldbury, Birmingham, and Southall Bros. and Barclay, Birmingham. Dressings are also prepared by Messrs. Burroughs, Wellcome & Co., Reynolds & Bransom, 13, Briggate, Leeds; C. F. Thackray, Great George Street, Leeds; and the St. John Ambulance Association, St. John's Gate, Clerkenwell.

CENTRAL DRESSING STATION OR SURGERY.¹

291. The central dressing station² should be easily accessible and specially constructed or adapted for the purpose. The room or rooms should, in large factories, provide for a surgery, a rest room, and a storeroom and nurse's room. Where a surgery is used for workers of both sexes a second small room will be found advantageous. The walls should be covered with glazed tiles, enameled iron sheets, or washable paint. The floor should be of smooth, hard, durable, and impervious material; the natural and artificial lighting should be ample; hot and cold water should be laid on or be immediately available; the room should be warmed in winter. A glazed sink is needed, the waste pipe opening over the drain, and trapped outside the surgery. A foot bath, preferably fixed and provided with hot and cold water, is desirable. The furniture should consist of a table, a couch, chairs, and cupboards. The room should not contain a carpet, rugs, curtains, tablecloth, window blinds, or wall pictures. The keynote should be simplicity and cleanliness. The floor should be washed once a day with antiseptic fluid, and the walls at least once a week.

292. The object of the central dressing station being the treatment of more serious cases than can be dealt with at the aid post, and the redressing of cases of minor injury, it is desirable that it should be properly equipped. It may also be convenient to use it for the medical examination of applicants for work.

293. The station must be in charge of a competent person with knowledge of ambulance work. Wherever possible, a trained nurse should be on regular duty, ambulance assistants being selected from employees trained in first-aid work. Many large works now have a medical officer on the staff, who is responsible for the supervision of the surgery and available for serious cases before removal to hospital. The equipment of the surgery will largely depend upon the character of the accommodation provided and the experience of the person in charge, but the following will generally be required:

- (i) Stretchers, splints, and strong bandages for major accidents;
- (ii) Bandages and dressing for minor injuries (a stock should be kept to replenish the aid posts);
- (iii) A simple sterilizer and necessary surgical instruments such as scissors, forceps and tourniquet; and
- (iv) Simple lotions and drugs (with sufficient enameled basins).

Where a medical officer is employed at the factory he should be provided with accommodation adjoining the central dressing station. The accommodation should ordinarily include a consulting room

¹ For information as to the conditions under which capital expenditure on an ambulance room can be regarded as an expense for the purposes of the excess profits duty, see Appendix K.

² See illustration facing page 117.

(fitted with hot and cold water and a sterilizer), a clerk's office, and a waiting room. If arrangements are made for men and women to attend at different hours separate waiting rooms will not ordinarily be required.

294. The following statement is of interest, as showing the arrangements made at a large national filling factory for dealing with cases of sickness and injury:

Ambulance equipment.—At each of our two factories we have a roomy ambulance with accommodation for doctors' consultations, first-aid dressings, sickness cases. Each ambulance building has two separate casualty dressing rooms, one for men and one for women, a ward with eight beds where sickness and accident cases can be treated at ordinary times, and where in the event of an explosion the victims can be promptly attended, a small emergency operating room, with sterilizers for dressings and instruments and a roomy cupboard for surgical emergency appliances. At the other end of the ward there are two doctors' consulting rooms, patients' waiting room, storeroom, etc.

The staff of the ambulance consists of two doctors, one sister, and four nurses in the shell-filling factory (where we have 7,000 workers and a night shift as well as a day shift) and one sister with two nurses in the cartridge-filling factory (where we have about 3,000 workers and a day shift only).

In connection with our ambulance station, we have an ambulance wagon, which is at our disposal day or night for removing patients to their homes or to hospital.

Arrangements are also made with the local ambulance association for the expedition of ambulance wagons in the event of any serious explosion at the factory.

Two large local hospitals have arranged to receive our urgent cases when required in the event of explosion or otherwise. Liberal contributions are made by the factory workers to these institutions.

Any of our TNT cases who have been ill enough to require hospital treatment have been sent to the * * * Infirmary, where I am in touch with the superintendent and also with the house doctors and the pathologist, who inform me immediately of any matter of importance concerning a worker.

Convalescent home for workers.—The Y. W. C. A. very kindly opened a convalescent home about 6 miles from here in a bracing part of the country, and this has been kept almost entirely at our disposal and has been of inestimable value to us. The expenses of this establishment are defrayed partly by the Y. W. C. A. and partly by donations from our workers' hospital fund.

Home visitation of workers who are sick.—Chiefly in order to obviate the risk of girls suffering from TNT poisoning lying ill at home, undiagnosed, and possibly untreated, we adopted from the beginning a system of home visitation. A postcard is sent to all workers in TNT parts of the factory who are reported absent for two days or more. As soon as the postcard is returned asking for a visit our health visitor calls at the house and immediately reports to me. As a result of this visit, it seems necessary that the doctor should call, that is done later. Girls who are in financial difficulties are assisted and infectious cases may be reported. Workers requiring subscribers' lines for admission to hospital or to convalescent homes are notified, and so on. In connection with this home-visiting department we have a welfare secretary and health visitor. The welfare secretary deals with all returned postcards. She arranges the work of the health visitor and makes reports to the doctor, keeps card index of those visited, deals with the subscribers' lines for convalescent

homes, infirmaries, etc., keeps the "comforts fund" money and the accounts connected therewith, and so on. The health visitor is not a trained nurse, but is sympathetic, tactful, and conscientious, and is liked by the girls, who give her their confidence.

Financial aid to sick workers.—A fund has been in our hands for about a year and a half. The money is spontaneously voted by the workers' committee at their monthly meetings, and it is entirely subscribed by the workers themselves. Help is given from this fund to any worker who seems to be in financial distress, especially through illness or accident, and who is unable to provide herself with the necessary food and comfort. It is also given at times to provide holidays for necessitous cases. The money is chiefly distributed through the health visitor on the recommendation of the doctor. This system has the advantage over other systems of financial aid that it is given for necessity observed by the doctors, nurses, or health visitors, and does not conduce to begging.

295. The following is an account of the arrangements which have been made at a munition works in the Midlands:

I commenced work here in 1914; for about two years I did the welfare work and nursing, but by that time the number of employees had increased so much that I had to give up the welfare work and specialize on the work I was engaged for (nursing). We have two ambulance rooms in different parts of the works, but new and larger ambulance rooms with rest rooms attached are under consideration.

We are starting classes in connection with St. John Ambulance and hope to have four St. John Ambulance people—two men and two girls—in each department, in charge of an ambulance cupboard. At present all accidents are attended to by myself in the daytime and a night nurse at night. Serious cases only are sent to hospital and minor cases attended to here. Repeated dressings are done each day at the works; this is more satisfactory, as it keeps us in touch with the people and we know when to expect them back at work. We also give electrical massage to those patients recommended by the doctor. Besides this I am qualified to treat simple medical cases, and we find this prevents a great loss of time by the employees. We keep a report of all accidents.

All children under 16 are examined by a doctor when engaged; if they have bad teeth a note is given them and they are sent to the dental hospital for treatment; if anything is wrong with their eyes, to the eye hospital; if anything is wrong with their throat, to the ear and throat hospital, and so on.

The employees pay 1d [2 cents] per week and from this fund so subscribed they receive hospital notes and obtain free treatment at the hospitals. The major portion of this fund goes to the local hospital Saturday fund, and our employees can, when recommended by their doctor for a change of air, get a fortnight's free treatment at a convalescent home; there are two at Llandudno, one at Malvern and one at Droitwich (for rheumatic subjects). Through the hospital Saturday fund our people can be supplied with artificial appliances, such as glasses and elastic stockings. The children of our work-people obtain the same benefits, the convalescent home for children being the Red House, Great Barr, near Birmingham. The distribution and the clerical work in connection with these notes is done entirely by the nursing department. The welfare superintendent looks the cases up and refers them all to me.

SYSTEMATIC RECORDS.

296. As already suggested, it is important that a full and accurate register should be kept of all cases of sickness and accident, with particulars of dressings, redressings, and treatment.

297. A case book should be drawn up somewhat as follows:

Identification number.	Date.	Name of injured person.	Nature of injury or illness.	How caused.	Progress of case with dates of subsequent dressings, and the occurrence of any sepsis.	Date of final dressing.
1.....	1915 Nov. 25	Mary Smith.	Crushed thumb	Fall of shell.	1915 Nov. 25, Nov. 26, Nov. 30...	1915 Dec. 3

Each case when first treated may appropriately receive a card, numbered to correspond with the entry in the case book, to be brought on the occasion of subsequent dressings.

This card must be brought to the surgery each time the patient comes for treatment.

Identification number.	Name.	Nature of injury or illness.	Date.	Instructions.
1.....	Mary Smith.....	Crushed thumb...	Nov. 25, 1915 Nov. 26, 1915 Nov. 30, 1915	To come tomorrow. To come on 30th. To come on Dec. 3.

NOTE.—Extract from first-aid leaflet issued by the Home Office.

TREATMENT OF MINOR INJURIES.

The following suggestions have the approval of H. M. medical inspectors of factories in rendering first aid in factories and workshops so as to prevent subsequent septic infection or blood poisoning:

A scratch or slight wound.

- Do not touch it.
- Do not bandage or wipe it with a handkerchief or rag of any kind.
- Do not wash it.
- Allow the blood to dry and so close the wound naturally; then apply a sterilized dressing and bandage.¹
- If bleeding does not stop, apply a sterilized dressing and sterilized wool; then bandage firmly.
- If the wound is soiled with road dirt or other foul matter, swab freely with wool soaked in the iodine solution,² and allow the wound to dry before applying a sterilized dressing.

A burn or scald.

- Do not touch it.
- Do not wash it.
- Do not apply oil or grease of any kind.
- Wrap up the injured part in a large dressing of sterilized wool.³

¹ Minute wounds can be efficiently closed by applying collodion.

² An alcoholic solution containing 2 per cent of iodine.

³ This would not exclude treatment by prepared paraffin or picric acid.

An acid burn.

Do not touch it, or apply oil or grease of any kind.

Flood the burn with cold water.

Sprinkle it (after flooding) with powdered bicarbonate of soda.

Apply a sterilized burn dressing of suitable size.¹

However slight the burn, if the area affected is extensive a doctor must be consulted.

Do not remove any dressing, but, if the injured part becomes painful and begins to throb, go to a doctor at once.

Destroy all dressings which have been opened but not used; they soon become infected with microbes and then are not safe to use.

Note.—Danger from minor injuries arises from blood poisoning which is caused when microbes infect a wound. The majority of wounds are at first "clean;" that is, they are not infected with microbes; such infection usually occurs later and comes from handkerchiefs or other materials applied to stop bleeding or to wipe away blood, and, in the case of eye injuries, from efforts to remove fixed particles with unclean instruments. It is better to leave a wound alone than to introduce microbes by improper treatment. The congealing of blood is Nature's way of closing wounds against infection and should not be interfered with.

Burns and scalds when the skin is not broken will heal if left alone; all that is necessary is rest and a protective covering. When blisters form they must not be pricked, except under medical advice.

Rest is an important aid to healing. A short rest at first allows healing to commence and often saves a long rest later. An injured hand or finger can be rested in a sling, and an injured eye by a bandage, but an injured foot or toe can only be rested in bed.

RESULTS.

298. The committee are satisfied of the urgent necessity and value of some such organization as that suggested above. They have been much impressed in visiting munition works with the useful part performed by competent nurses and the large number of cases of injury and sickness which receive treatment. Thus in one munition works employing rather over 4,000 workers the ambulance department during December, 1917, dealt with 1,260 accidents (including 635 cuts, 291 bruises, and 150 eye cases), 1,703 redressings, and 1,428 medical cases (including 415 indigestion, etc., 486 headaches, and 351 colds), a total of 4,391. For January, 1918, the figures were 1,186 accidents (including 670 cuts, 218 bruises, and 202 eye cases), 1,956 redressings, and 296 medical cases (including 118 indigestion, etc., 71 headaches, and 70 colds), a total of 3,438.

¹ This would not exclude treatment by prepared paraffin or picric acid.

SECTION XII.—EYE INJURIES.

THE EFFECT OF INDUSTRIAL CONDITIONS UPON EYESIGHT.

299. The rapid extension of munition work has brought in its train a great increase in the number of accidents and injuries to eyes. The result has been not only personal suffering and inconvenience but also serious loss of time and a reduction of output. The eyes are among the hardest worked of all the organs of the body, and they are extremely sensitive to external conditions. It is therefore not surprising that a number of special eye diseases and injuries from accidents to the eyes have come to be associated with particular processes in certain industries. Diseased conditions of the eye and defective eyesight are very common and are a serious and widespread cause of inefficiency. Every effort, therefore, should be made to prevent them. The following statement emphasizes the point:

The treatment of superficial injuries of the eyes is a subject which has during the past year acquired increased importance on account of the large number of superficial injuries occurring daily to the eyes of workers in munition factories. The out-patient book kept at the ophthalmic department of the Glasgow Royal Infirmary shows that the number of those suffering from "fires" and other trivial eye injuries who applied for relief during August, 1916, was more than double the number of those who had come suffering from similar injuries during the corresponding month in previous years. The figures in 1914 and 1915 are practically identical, and a scrutiny of patients during 1916 shows that the great increase has been brought about almost entirely by the attendance of men and women engaged in the manufacture of munitions. In such cases it is a matter of national importance that patients should receive skillful medical help as soon as possible after the occurrence of the accident, in order that there may be no unnecessary delay in their return to work.

300. The following statements are also of interest:

I think that it is somewhat of an exaggeration to say that each of these cases loses three days' work. If we take an average I should put it as more than half a day and less than a whole day. I think that I can safely say that these small accidents cause the loss of about 2,000 days' work in the town of Coventry alone. The more serious ones are responsible for the loss of weeks for each man, and I have in the past year had to remove about a dozen eyes after industrial accidents. Practically all of them could be avoided by the use of goggles. Most of the trivial accidents would be prevented if the men would wear goggles at the emery wheel and for grinding.

At the Northumberland, Durham and Newcastle Eye Infirmary there has been an increase in the number of patients in 1914 and 1915, and this is largely due to the number of people engaged on munition work. For example, in 1914, 2,491 eye cases were referred for treatment from the Elswick Works; in 1915

there were 4,973 similar cases; and in 1917, 4,567 in spite of the present attention at the spot by ambulance workers.

301. Industrial work may cause impairment of eyesight in three principal ways—

(a) Injuries due to exposure to intense heat or industrial poisons.

(b) Accidents due to flying particles, etc.

(c) Eyestrain due to uncorrected errors of refraction or other causes.

302. Apart from the immediately irritative effect associated with such work as acetylene welding, the influence of prolonged exposure to intense heat and light may take so long a period to manifest itself that the damage which may result is not likely to appear during the war. The effect also upon eyesight of certain industrial poisons, such as lead, is in the bulk small, and no special action in regard to the matter is called for.

303. *Accidents.*—It has been estimated that normally in any general group of industrial accidents over 5 per cent must be ascribed to eye injuries. There is reason for belief that eye injuries in munition works are relatively more frequent than in normal times, and that for engineering factories these cases probably represent about 7 per cent of all accidents, a total which may, however, be greatly exceeded. The accidents are mainly due to particles of metal which enter the eye; the majority are slight in character and should give rise to no permanent damage. To the damage which results from injuries sufficiently serious to come under observation must be added the graver conditions arising from infection following upon "fires" or other trivial eye injuries. Account must also be taken of the time lost and temporary inconvenience suffered from a much larger number of slight causes which may only incapacitate the sufferer for short periods, perhaps half a day. In so far as immediate reduction of output is concerned, these slight cases have probably a greater effect than the more serious injuries. Speaking of these cases, an ophthalmic surgeon in Glasgow writes:¹

In most instances the actual physical damage is slight, and the worker will be able to resume his duties in a few hours, or utmost in one or two days, if only the injury to the eye be promptly and skillfully treated. If, on the other hand, the injury be neglected, or if it be treated by anyone who is unskillful or careless sepsis will almost certainly occur; and all experience teaches that infection of the wound is a far greater danger than the actual physical damage to the ocular structures. The occurrence of sepsis at once transforms a very trivial injury to the cornea into a suppurative keratitis, which may run a prolonged course, lead to more or less impairment of sight, and in serious cases even destroy the eye.

304. *Eyestrain.*—Broadly speaking, eyestrain may be due to de-

¹ The Treatment of Superficial Injuries of the Eyes, paper by A. Maitland Ramsay, M. D., lecturer on the eye, University of Glasgow.

fects of vision or to the nature and conditions of work. It may be accentuated by age, fatigue, or unsatisfactory health of the worker, by near-distance work, insufficient or excessive illumination, abnormal position, or long hours. For munition work the eyesight of the worker should never fall much below that of normally useful vision. For fine work the eyesight should be approximately normal. Notwithstanding the important bearing of good eyesight upon output, the question has not hitherto received adequate attention. Evidence has been forthcoming of eyestrain and headaches resulting from (a) inadequate light, both artificial and natural; (b) artificial lights, adequate in amount, but so placed as to throw a glare upon the eyes of the workers; (c) employment of workers (whose eyesight should be aided by suitable glasses) to carry out fine work without first testing their eyesight. Eyestrain, including headache, may be one manifestation of general fatigue. It is thus likely to become more marked when long hours are worked, when night shifts are necessary, or when workers are undernourished, anemic, or of poor general physique.

305. Several of these points are exemplified by the report on a medical investigation in regard to the health of woman workers, in the course of which an inquiry was made into the eyesight of 156 workers engaged in different departments of a factory. Most of the eye defects were found in the fuse department, where fine processes were in operation involving close attention and considerable likelihood of eyestrain. In the work of machining shells only about 19 per cent of eye defects were noted, but in the fuse department the proportion reached 64 per cent. The results of the inquiry were thus summarized:

It will be noted that in the fuse department 8 per cent of the workers were obliged to obtain glasses since starting factory work, 19 per cent complained of eyestrain, of whom 12 per cent found sight difficult on the night shift, and 2 per cent found the eyestrain increasing in severity. Besides these, 10 per cent appeared to have latent eyestrain, as shown by severe headache, blepharitis, etc., and probably required to have their eyes tested. Conjunctivitis was present in 11 per cent. Many workers complained of the artificial light falling directly on their eyes, and others said that the reflection of the brass work of the fuses was dazzling. The artificial lighting in the factory was by electric lights placed over the benches. Owing to difficulty in train service it was not possible to visit the factory during the night shift in order to watch the effect on the girls, or to observe if shade could be adjusted without undue interference with the work, but this point appeared to need consideration.

On the other hand, it must be remembered that cases of eyestrain or frequent headaches may not be due entirely to factory conditions. Several girls had been warned at school by the school medical officer that their sight was defective and had neglected to obtain glasses. Five workers had obtained glasses but did not wear them; in one instance the previous occupation of dressmaking was probably responsible for the initial eyestrain, and in another case a girl who had previously been a domestic servant now visited the cinema three times a week, although suffering from marked eyestrain. It is also probable that

some of the employees were still feeling the effects of overtime and seven days' weekly work, which had recently been discontinued, and some visual improvement might be expected on subsequent examinations.

PREVENTION AND TREATMENT.

306. Many conditions likely to cause temporary or permanent damage to the eyesight of munition workers are admittedly preventable, while prompt and effective treatment of the injury when it has occurred will reduce suffering, hasten recovery, and lessen the chance of permanent injury.

307. *Methods of prevention* consist first of general measures designed to improve the physical health of the workers, and so to enable them to resist the effects of fatigue, and, secondly, of special measures designed to avoid undue strain on the eyesight or to reduce the liability to accident to a minimum. The general measures include the provision of suitable lighting, the establishment of canteens, the allowance of adequate time for sleep and rest, and have already been dealt with elsewhere. The special measures naturally vary according to circumstances. The following suggestions may, however, be made:

308. *Examination of eyesight.*—When operatives are being engaged for fine work their eyesight should be tested by a medical officer, or, if he is not available, a nurse or welfare supervisor should apply simple eye tests¹ to discover whether the vision is normal. Any worker who fails to reach the standard adopted should be referred to an ophthalmic surgeon or eye hospital for regular examination and, if necessary, be supplied with glasses. When workers are examined for glasses the nature of the work to be performed should be specified whenever possible. For many people, and particularly those past middle life, the glasses which give the best acuteness of distant vision would not enable the owner also to do fine work at close range, and vice versa. Workers who complain of frequent headache, pain in the eyes, or show signs of conjunctivitis should also be tested.

309. *Eye guards and goggles.*—Under certain conditions the eyes should always be guarded from flying particles of metal. On this point the observations of an official American publication² may be quoted:

The one feature of safety in nearly all of these occupations is the use of suitable goggles in those occupations known to cause injuries to the eyes. No other protection can take the place of this one. It is one of the most difficult measures in accident prevention to carry out. Workmen object to the use of these protectors, and even when provided they are not worn. The fault for this lies

¹ Each eye should be tested separately, and the following standard is suggested as a minimum: 6/9 in both eyes (Smellen's types), though 6/12 in one of the eyes may be sufficient in some cases, and the ability to read standard type 0.45 at 1 foot distance. The necessary standard types can be procured from any optician.

² The Commonwealth of Massachusetts, State Board of Labor and Industries, Industrial Bulletin No. 5, Boston, 1916.

often in the type or kind of goggles that have been provided. Many of these not only decrease the efficiency of the worker who wears them but they cause injury to the eyes of the wearer. Many conscientious workers refuse to wear goggles that are provided for the common use of all workers in the establishment. In this they are justified, as many infections of the eye are capable of transmission by means of eye protectors. The remedy is a better mutual under-

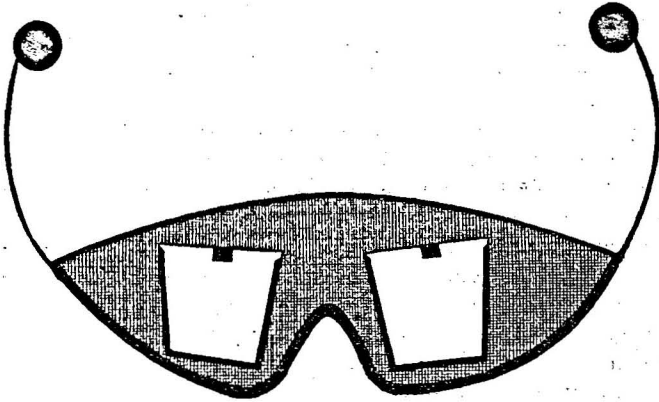


FIGURE 1.

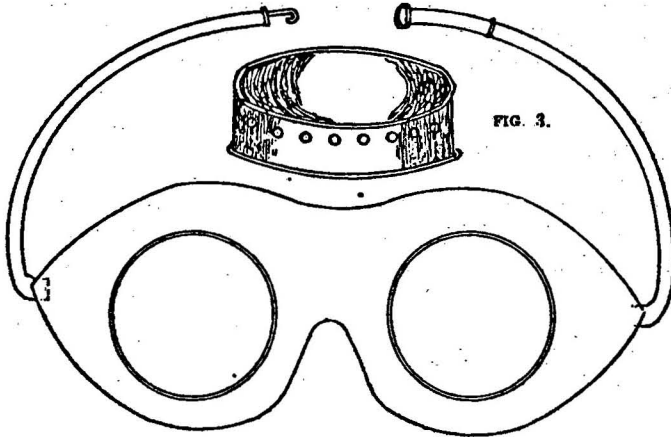


FIGURE 2.

standing between employer and employee and an insistent educational campaign on the value of this protection. Frequently the nature of the work is such that the lenses become clouded with steam or perspiration. Antisweat pencils should be provided to prevent this. The goggles worn should be of such a thickness of glass that they will withstand a hard blow, and of such a quality and so securely fitted into the frame that if broken the glass will not fly into small pieces but will remain in the frame. Goggles should be fitted to the wearer.

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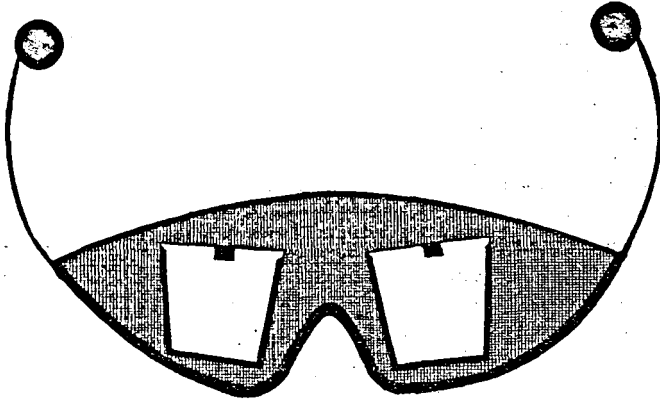


FIGURE 1.

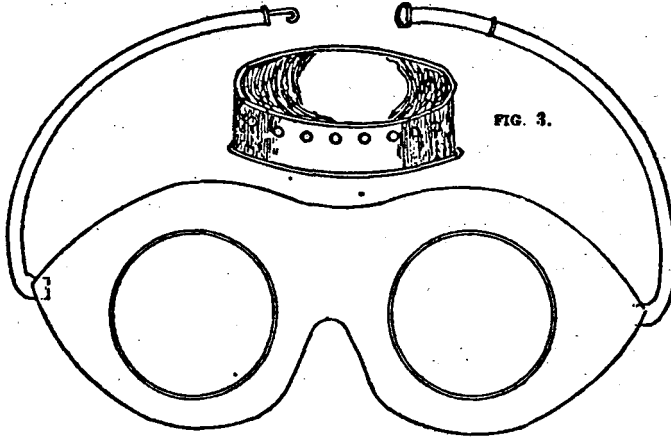


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To be effective an eye guard should—

(a) Prevent particles reaching the eye from in front, from either side, or from below. Practically nothing enters from above;

(b) Be light and comfortable, allowing free play of air;

(c) Not impede vision or become obscured by the impact of particles;

(d) Be strong and cheap.

310. Two forms of eye guard are here illustrated which have been designed to meet the requirements stated above.¹ That shown in figure 1² has the advantage that spectacles required to correct any error of refraction can be worn behind it. The eye guard shown in figure 2³ is composed of a strip of leather with detachable eyepieces (see fig. 3) pierced with holes for ventilation.

311. The fact that no particles are likely to enter from above is important, because the upper part of the goggle can be left open to allow of ventilation. A closed screen is not only hot and uncomfortable, but the transparent medium, usually glass, may become obscured by condensation of moisture. Where fine work has to be executed there must be clear vision and for this there is no better medium than glass. The objection has been raised that glass broken by a flying particle may be driven into the eye and cause a worse injury than if it were not present. Such accidents appear, however, to be very exceptional and a foreign body of considerable size would be required to inflict it. Glass, such as is used for shooting goggles, of sufficient strength to stand the impact of pellets of shot should be employed. The main objection to glass, or indeed to any other transparent medium, is that after a time it becomes pitted and obscured. Eye guards should therefore be so made that the glass can be easily removed and cleaned or replaced. Where there is exposure to bright light, as in the process of acetylene welding, the glass should be tinted or specially prepared to obscure the chemically active rays at or beyond the violet end of the spectrum. Dark-blue glass is usually employed for the purpose, though as the following statement suggests, it is not that best suited for the purpose.

My own experience has been that workmen at acetylene welding have generally been provided with very dark neutral smoked protection glasses, and not with dark-blue glasses. These would certainly be better than dark-blue glasses, and of all the tints which could be employed probably a very deep rose tint would be the best that could be selected—dark blue would, in my opinion, certainly be unsatisfactory. As regards the use of Crooks' glass in protection goggles, this glass is very expensive, and is certainly unnecessary for ordinary mechanical protection purposes. The virtue of it is the same as that of rose-tinted glass, for it has the power of excluding the actinic rays. I should

¹ Some oculists recommended Crook's glass No. 1 or No. 2, with fine gauze side pieces.

² From a design prepared by the Mentor Safety Appliance Co.

³ From a design prepared by Messrs. Wallach Bros.

think it could hardly be necessary to employ this glass, of which I believe only a limited quantity is available, for workers' goggles.

312. While goggles must be regarded as the principal and most effective protection against eye accidents, it is possible in some grinding and chipping processes to fix a wire or glass screen to the machine in such a manner as to protect the workers' eyes. Such an arrangement may, for example, be useful in emery-wheel grinding where the machine is used by many different workers irregularly through the day.

313. *Treatment of accidents.*—First-aid treatment is all that can be rendered effectively in the factory. Every precaution should be taken to avoid increasing the injury by well meant but misdirected efforts to give relief. Where a surgery exists all eye injuries should be sent direct to it, no treatment being attempted in the workshop. If a doctor is available the case should be referred to him at once. If the injury is not serious and he is not available the nurse in charge of the surgery should render first aid, the patient being then sent to a doctor or hospital, even though the injury is apparently slight. At any factory where such injuries are common the nurse should have had some ophthalmic training. The following statement emphasizes the importance of suitable provision for first aid:

In every factory where such accidents are of frequent occurrence there ought to be a rule that injuries should be reported at once, and provision should be made whereby "first aid" may be given with the least possible delay. Such an arrangement would not be difficult to carry out, and timely first aid would effect a cure in the mildest cases and prevent, as far as possible, extension or increase in severity of the injury in those that were more serious.

314. If there is no ambulance provision or a nurse, first aid can only be given by a fellow workman who should be instructed as to the routine treatment which may suitably be applied. He should be forbidden to exceed his instructions, otherwise, though he may be successful in removing the offending particle, infected ulcers may follow the operation, or he may even perforate the cornea. First aid is mainly needed to relieve pain and should usually be limited either to the use of eyedrops, which may be applied from a suitable bottle, or to a pad and bandage.¹ A camel's-hair brush kept in the

¹ Eye Injuries (Home Office first-aid leaflet):

Apply the eyedrops (see note) to the affected eyeball by means of the camel's-hair brush in the bottle.

Do not try to remove any particle which can not be brushed away.

Tie up with a clean handkerchief or bandage.

Go to a doctor at once.

Prevention is better than cure; therefore if your work entails danger to the eyes, wear goggles.

Goggles have saved hundreds of eyes; thousands have been lost for want of them.

Note.—Instructions to chemist for making eyedrops:

Cocaine..... 0.5 per cent

Hyd. perchlor..... 1 in 3,000

In castor oil.

Weigh 95 grams of castor oil into a flask capable of holding twice the quantity. Add 0.5 gram of powdered cocaine. Warm in a water bath till dissolved. While the solution

appropriate solution may be provided for the removal of visible particles which are not impacted or embedded, but its use should not be encouraged. After relief from pain the patient should be sent at once to a doctor or hospital.

is still warm (but not hot) add 1 cubic centimeter of a solution containing 3.3 grams of mercuric chloride in 100 cubic centimeters of absolute alcohol. Mix the solutions by rotating the flask.

About half an ounce, or 15 cubic centimeters, of this solution should be supplied in a bottle from the cork of which a camel's-hair brush is pendent in the fluid.

SECTION XIII.—SPECIAL INDUSTRIAL DISEASES.

315. The manufacture and manipulation of toxic chemical substances upon the immense scale required in warfare have brought many special dangers to the health and lives of munition workers. To some of these the committee made reference in their memorandum No. 8 (Special industrial diseases), issued in April, 1916, in which they gave a brief account of the information which was then available and likely to be useful.

LEGISLATIVE PROVISIONS.

316. The Factory and Workshop Act, 1901, contains numerous provisions for safeguarding the health of workers employed in certain "dangerous and unhealthful industries." Section 73 requires the notification to the chief inspector of factories of cases of poisoning from lead, phosphorus, arsenic, mercury, and anthrax by the medical practitioner attending the case. By an order of January, 1916, toxic jaundice was added, that is to say, jaundice due to tetrachlorethane, TNT, or other nitro or amido derivatives of benzene, or other poisonous substance. The employer must also notify these cases to the inspector of factories. Section 79 gives the secretary of state power to certify that a process is dangerous, and to make such regulations as appear to him reasonably practicable and to prescribe the conditions under which employment in the process shall be carried on. These regulations impose duties on both the employer and the worker. Such regulations have been made for various lead processes, and also in connection with the manufacture of TNT. Section 82 requires that the regulations shall be posted up in conspicuous places where they may be conveniently read by the persons employed.

Acting under powers conferred by regulation 35 AA. of the defense of the realm regulations, the Ministry of Munitions, with the concurrence of the secretary of state, has made regulations dealing with the use and manipulation of TNT.

Under section 8 of the Workmen's Compensation Act, 1906, the secretary of state has power to make orders extending the provision of the act to diseases contracted in the course of employment. Several orders¹ have been made extending the provision of the act, under cer-

¹ Statutory rules and orders, 1913, No. 814; 1914, No. 1007; 1915, No. 600; 1916, No. 28G.

tain conditions, e. g., to toxic jaundice, dermatitis, and other diseases arising from the manipulation of TNT and other industrial poisons.

TRINITROTOLUENE (TNT).

317. At the very beginning of their work the committee had their attention called to cases of sickness apparently due to the explosive trinitrotoluene (TNT), of which the manufacture and use was then rapidly increasing. This substance had hardly been regarded as toxic before the war; no ill effects had been traced to the small quantities previously used, and it was generally believed to be much less toxic than dinitrobenzene, which had been manufactured and used in this country for many years. A fatal case of toxic jaundice, however, definitely ascribed to TNT poisoning, was reported to the Home Office in February, 1915, and this appears to have been the first recorded fatality from this cause. At the time of the appointment of the committee in September, 1915, the first fatality from toxic jaundice due to the manipulation of TNT had just occurred at a filling factory, and during the succeeding winter months sickness due to TNT poisoning became generally recognized as a growing menace plainly concomitant with the introduction of new labor in rapidly expanding processes of manufacture and manipulation which had necessarily been hastily organized.

318. The urgent calls for an increase both in the volume and rate at which TNT could be supplied made the position one of grave anxiety, and had it not been for the preventive measures, based on previous knowledge and experience of the nearest analogies, which were then promptly advocated by the Home Office, the mortality from this poisoning, which advanced during 1915-16 until the autumn of 1916, when it reached its greatest height, must have been far higher. In July, 1915, the Home Office had warned the factories then concerned that TNT might be absorbed through the skin, or by the inhalation of dust and fumes, and had recommended accordingly that suitable precautions should be taken against both avenues of entry.

319. During these months the committee gave their cordial cooperation toward bringing to bear upon the problems confronting the ministry the advice which the skill and experience of the factory department of the Home Office could suggest, as well as the knowledge gained by scientific investigations organized for this purpose. From the autumn of 1915 the resources of the applied-physiology department of the medical-research committee, under the direction, for this purpose, of Dr. Benjamin Moore, F. R. S., had been applied to the determination of the mode, or modes, of entry of the poison to the body with a view to its effective prevention; and other collateral inquiries were set on foot. The symptoms of TNT poisoning already reported seemed closely similar, in respect at least of the fatal cases

in which jaundice was characteristic, to those which had occurred earlier in 1915 as due to exposure to the fumes of tetrachlorethane, used as a constituent of varnish applied to aeroplanes—a cause of industrial poisoning to which further reference will be made below. This coincidence in time of the two forms of poisoning made it natural to look then upon the inhalation of the fumes or the dust of TNT as probably the chief cause of this new and unexpected danger at the filling factories, in spite of the fact that the path of entry to the body in the most familiar examples of poisoning from the industrial use of nitrocompounds was well known to be by way of the skin. Administrative measures at the factories were chiefly addressed during the spring and early summer of 1916, as new factories sprang into existence, to the perfection of ventilation and the removal of dust and fumes from the air. Although it was well known that dinitrobenzene and other nitrocompounds could rapidly enter the body through the skin, the apparent immunity with which the great majority of persons could freely handle TNT without signs of poisoning had done much to divert general attention from the explicit warning given by the Home Office in 1915 that absorption of TNT by the skin was to be guarded against.

320. With the advent of warm weather in the summer of 1916, coincident with the preparations for the Somme offensive, a large increase in the amount of TNT sickness occurred; and a conference upon this was held on August 25, 1916, at the ministry, when representatives of the health of munition workers' committee met those of the factory department of the Home Office and of the factory managements. The experience of one very large factory in which up to that time no death had occurred was brought forward to show that if proper ventilation was secured the risk of poisoning was small in spite of an almost universal distribution of TNT powder over the factory floors and furniture, as well as upon the skin and clothes of the workers. In the following month, however, several cases of fatal toxic jaundice were notified from this factory, while at the same time experiments conducted by Dr. Moore and his colleagues, both in the laboratory and in factories, showed conclusively not only that the poison could enter the system freely by way of the skin but that poison, having so entered, could be held within or under the skin itself and so remain for continued absorption even after, and sometimes for many days after, the worker had been altogether removed from the neighborhood of TNT. The experimental evidence gave no ground for attributing any important share in the poisoning to the inhalation of dust or fumes; the value of ventilation from this point of view appeared to consist in aiding the maintenance of the chemical balance of the blood and in removing dust which might otherwise

settle upon the skin or food, or enter the noses and mouths, of workers, and for these purposes ventilation was nugatory in the face of manual processes involving the scattering of TNT dust upon every exposed surface of the workshop and of the workers. It became apparent that a campaign had to be fought in detail for the reduction of danger by the trial and adoption of every expedient for minimizing physical contact between the workers and the manipulated TNT. For the introduction of the necessary measures when devised, and, further, for their general enforcement, new legal powers were required.

321. With a view to an immediate concentration of effort upon these problems, Mr. Montagu, in October, 1916, appointed a committee to consider and advise him as to (1) the prevention of poisoning in filling factories, and (2) the treatment of cases of such poisoning, and to make such inquiries and experiments as they might deem desirable for these purposes. This TNT advisory committee contained representatives of the factory department of the Home Office, members of the health of munition workers' committee, the medical officer for the filling department, together with engineering and administrative representatives of the various departments concerned within the ministry. This committee, sitting daily at first, worked actively toward the framing of defensive regulations against TNT poisoning. They made recommendations upon the organization and functions of the medical officers of the filling factories, upon the probable scope of the legal powers likely to be required by the executive, and they considered and advised upon the best modes of translating into practical preventive methods the knowledge then being gained of the possible modes of TNT poisoning and of their pathological results. In December, 1916, Dr. Addison, having succeeded Mr. Montagu as minister, reappointed the advisory committee, who submitted to him, in January, 1917, a detailed code of regulations governing the use of trinitrotoluene in all factories and workshops in which it, or any mixture containing it, is used or manipulated. The necessary powers having been obtained, these rules were formally given legal effect in February, 1917, though during several preceding months they had been widely introduced into practice, owing to the dissemination of knowledge of the dangers of TNT by the ministry's medical officers and the scientific workers engaged, and no less to the good will of the factory managements. These regulations, still in force, are given below in summary form.

322. Before outlining the pathology of TNT poisoning as such, reference may be made to the remarkable practical results which have coincided with the progressive application of the findings of scientific investigation to practical measures for the preservation of the TNT workers. The returns of the Home Office of cases of

toxic jaundice from TNT for the quarter October-December, 1916, show 86 cases, including 23 deaths, as compared with 29 cases (4 fatal) in the corresponding quarter of 1917, though the number of the workers exposed in the latter year to risk was far greater than in 1916. Accompanying the cases of jaundice there has also been an unmeasurable volume of minor illness, which has shown a parallel reduction in all factories; in one of the largest factories, for instance, in which the sickness returns have been generally the highest, sickness attributed to TNT has declined from being 11 per cent of the operatives in August, 1916, to 1 per cent in January, 1918. The latest returns show that TNT sickness has been almost abolished, while no fatal case has been reported since February, 1918, and there is now good ground for believing that when all factories have reached the standards attained by the best of them from this point of view, and now within the reach of all, TNT poisoning may become so rare as to be almost unknown. The results so obtained must be regarded as a striking testimony to the value of close cooperation between research work on the one hand, carried out not only in the laboratory but also in the field of its practical application, and administrative action on the other. They show further the benefits of a cooperation between factory doctor and factory manager established now to a degree almost unknown before.

323. While the experimental analysis of the paths by which TNT may enter the body, the new tests which have been devised for tracing its elimination in changed form, and other gains in knowledge have gone to secure the present successful measures of prevention, much still remains to be discovered with regard to the detailed nature of the complex toxic effects of TNT or of its derivatives, when it has once gained access to the system. When Mr. Winston Churchill succeeded Dr. Addison as Minister of Munitions in the summer of 1917, the practical problems of TNT poisoning had been so far solved, and the maintenance of the preventive measures so organized in the health and welfare section of the ministry that he found it unnecessary to reappoint the former large TNT advisory committee, whose work had been in the main completed, and instead he formed a small committee of medical experts for the purpose of maintaining and co-ordinating further inquiries into this subject and of advising him with a view to administrative action that might seem desirable in the light of fresh knowledge. Further researches are being actively prosecuted into the toxicology of TNT, and in this direction a definite advance in the curative treatment is still to be hoped for. But while these studies have great theoretic interest and are likely to have importance in the study of toxic jaundice, known to be produced in special conditions or in persons specially susceptible, by

other poisons and certain drugs, the present success of preventive measures against TNT poisoning allows the hope that these investigations may have only an academic interest for the Ministry of Munitions as such.

324. *The pathology of TNT poisoning.*—It would be out of place here to give detailed descriptions of the pathological results that may be produced by the absorption of TNT. For these, reference may be made conveniently to the following:

Trinitrotoluene Poisoning (an account communicated on behalf of the TNT advisory committee; references to earlier work may be found here). *British Medical Journal*, December 16, 1916. Report of Discussion at the Royal Society of Medicine. *Proceedings Royal Soc. Med.*, January, 1917.

The Causation and Prevention of Trinitrotoluene (TNT) Poisoning, by Dr. Benjamin Moore, F. R. S., medical research committee, Special Report Series No. 11, 1917.

The Effect of Trinitrotoluene upon the Blood, by Dr. P. N. Panton. *The Lancet*, July 21, 1917.

Preventive Measures against TNT Poisoning, by Dr. W. D. O'Donovan. *Proceedings Roy. Soc. Med.*, April, 1918.

325. TNT when manufactured and used in a pure condition or compounded with ammonium nitrate (amatol or ammonal) is by far the most important of the dangerous substances used in the production of high explosives. Danger arises not only from its explosive power but from its liability to affect the health of the workers exposed to it. Operatives engaged in its manufacture, packing, or loading may become affected. Apart from this, unless the incidence of poisoning is rigidly controlled, other workers may become disorganized through fear of contact, and fresh labor may become difficult to obtain.

326. TNT may be absorbed through the skin or through the digestive tracts, or by inhalation of fumes or dust. Poisoning may take one or more of the following forms:

(a) TNT stains the skin yellow. Skin disease (Dermatitis) is due to a direct irritant action. Some workers are more susceptible than others. The effects, like those of other irritants, are increased by flushing, perspiration, and mechanical friction. Localized rashes, especially where there is pressure or friction, as from bands or ill-fitting clothes, are common. The parts most frequently affected are the hands, wrists, face, neck, and feet. There is ground for the view that dermatitis is distinct in its incidence from other forms of its poisoning.

(b) *Digestive troubles.*—Gastritis, shown by pain in the stomach, vomiting, and constipation, is the most common of the ill effects of poisoning.

(c) *Blood changes.*—Blueness of the lips and, rarely, breathlessness on slight exertion are evident signs of absorption of TNT.

These signs are an indication for cessation from TNT work, during which they will generally disappear rapidly. They must be taken as a warning that the absorption of TNT is going on, and if this can not be explained by faulty factory conditions or by careless and unnecessary handling, when proper precautions ought to prevent recurrence, they point to a special susceptibility, and the worker should be transferred to other employment. Pallor does not necessarily signify anemia, which is uncommon among TNT workers. A rare and fatal form of anemia (aplastic anemia) has occurred in a very few instances and is characterized by a slowly, increasing debility or by sudden unexplainable subcutaneous or uterine hemorrhages.

(d) *Liver degeneration, "toxic jaundice."*—Jaundice is here a sign of gravely serious illness, and will be shown by a yellow tinge first of the whites of the eyes and later by yellowness of the skin. (This must not be confused with the yellow staining which TNT itself may cause in the skin by direct contact.) Jaundice may appear without obvious warning, though rarely before the fourth week of employment, and it is possible that in half the cases it arises after a preliminary warning, which has been given by the blood changes just mentioned but which may have been overlooked. Every effort should be made to recognize the first beginnings of this illness, and to take them as an indication for immediate cessation from all TNT work and for proper medical treatment. Many cases are now known of apparently complete recovery after serious illness of this kind.

327. To detect a case of TNT poisoning care must be taken to avoid confusion with digestive disturbances due to other causes. Accounts given by patients may be unintentionally misleading. The yellow staining which usually occurs with TNT can not be taken as in itself a sign of poisoning. The following points are the more important indications of TNT poisoning:

(a) Pallor of the face and an ashen-gray color of the lips, tending to disappear if the worker becomes excited, as by medical examination. Sometimes the lips and tongue are purple in color; the tongue is generally free from fur.

(b) The character and situation of the stomach pains.

(c) The presence of constipation and stomach distention.

Treatment when jaundice is absent should be simple and successful. It should include (1) the immediate removal from contact, and all the fresh air possible, (2) rest in bed for a day or two, (3) a diet consisting of milk, milk puddings, fruit, and green vegetables, with drinks such as barley water, tea, and coffee. If jaundice is present, hospital in-patient treatment is necessary. Milk should be given in small quantities to begin with, the amount being slowly increased to 2 pints a day.

The occurrence of TNT poisoning depends sometimes upon personal idiosyncrasy. Women do not appear to be more readily affected than men. Boys and girls may be more susceptible than adults, and, in consequence, their employment has been forbidden under the age of 16, and is only allowed under the age of 18 with the special consent of the ministry. Serious poisoning seldom occurs within the first four weeks of employment. While the great majority of workers are insusceptible and remain so, a small minority are susceptible and liable to succumb between the fifth and fifteenth week of exposure. The few affected are not always those who owing to ill health or malnutrition might be expected to be especially liable. Industrial conditions, though important, have perhaps less influence than personal idiosyncrasy.

328. It is essential that strict measures be taken for prevention. The precautions prescribed by the regulations of the ministry for the use and manipulation of TNT are as follows:

(a) Exposure to dust and fumes should be reduced to a minimum by cleanly methods of work and by ventilation and cleaning of work places.

(b) No person may be employed for more than a fortnight without an equal period of work at a process not involving contact with TNT, unless such employment has been specially approved by the medical officer of the factory.

(c) It is of the utmost importance that all workers should obtain ample and suitable food. Every person employed should be supplied gratis daily with half a pint of milk or some equally nutritious substitute.

(d) Special working costumes should be provided for all persons employed. These should be cleansed or renewed at least once a week.

(e) Cloakrooms should be available where clothing put off during the working hours should be placed.

(f) Washing facilities are essential, with a suitable supply of soap, nailbrushes, and towels.

(g) A constant medical supervision should be exercised, not only by formal medical examination but also by scrutiny of the workers while at work. The medical officer should have power of immediate suspension where necessary. Careful health records should be kept.

(h) A special official should be appointed to secure the carrying out of the prescribed regulations. A woman welfare supervisor is also essential wherever women are employed.

329. Similar preventive measures are required by the Home Office and the ministry for the manufacture of TNT.

The following statement describes the medical arrangements made in a large national filling factory:

In the early days we were confronted by the specter of TNT poisoning in a wide variety of processes—shell filling with amatol and TNT blocks, liquid filling, "hot-mixed" filling press houses, incorporating houses, trotyl bag filling, etc.—and no one could tell us how it might be exorcised.

Cleanliness.—Our first preventive measure was cleanliness. The method was to watch the shops from day to day, instruct workers and overseers in the meaning of "physiological cleanliness," and devise means of preventing TNT from entering the bodies of the workers by any of the possible channels of absorption. After some initial difficulty with the management (who were naturally chary of moisture) we were allowed to introduce our system of damp dusting of benches and damp mopping of floors. A slightly moistened cloth was used for dusting the table, and the girls were instructed that the powder on tables and floors must be "kept damp and kept down," in order to prevent it getting into the air, and being thus swallowed and inhaled. The method of dusting was to "coax" the powder off the table with the slightly moistened cloth, instead of flicking it about and contaminating the atmosphere. The floors were swept with damp sawdust.

This method was easily adopted in the trotyl bag-filling shops, and was most successful. In other parts of the factory, such as the melts, press houses, rectifying rooms, etc., it was a much more difficult matter to obtain perfect physiological cleanliness, and it was only after many months of hard, uphill work that any approach to this was reached.

Every foreman, forewoman, and worker had to be convinced of the necessity of this cleanliness, and we had a long educative campaign. Then we had to introduce a new TNT cleansing department, with reliable overlookers, whose duty it was to keep all TNT shops free from powder. The staff of this cleansing department has been large and the expense to the factory has been considerable, but the results have afforded ample repayment.

Lectures to overlookers.—A necessary part of the doctor's duty in a TNT factory is the education of overlookers, foremen, etc., in the rationale of the prophylactic measures to be employed. In this factory it has been our practice, as each new group of overlookers was engaged, to devote one lecture of the course of preliminary instruction to the question of TNT poisoning and its prophylaxis. The overlookers are thus from the outset cooperators with the doctor in all efforts to prevent TNT sickness.

Mouth wash and gargle.—As an additional precaution each worker is made to wash out her mouth and throat at lunch hour, and after each shift with a fluid provided (popularly called "the gargle"). Special "gargling lavatories," with numerous basins, are built for this purpose in connection with each TNT shop. These basins are also supplied with hot and cold water and the workers are encouraged to wash their hands thoroughly with hot water and soap before proceeding to the shifting house. (N. B.—Cold water has no advantages and many disadvantages.)

Ventilation and other such obvious health measures are also kept under medical supervision.

Questions of suitable clothing, boots, gloves, etc., are discussed jointly between the doctor and the lady superintendent.

Questions of food and canteen arrangements are discussed with the lady superintendent and the canteen superintendent.

The doctor advises regarding suitable menus, adequate food substitutes, etc. On the advice of the doctor a free breakfast consisting of porridge and milk, sausage or egg, bread and butter and tea, is given to all workers while employed on TNT. This takes the place of the milk originally recommended by the health of munitions workers' committee.

In our early days it was difficult to persuade the women workers to eat substantial meals, and the doctor was asked to publish a leaflet making an appeal for more adequate feeding on the grounds of health and patriotism. "Post hoc" (but due also to many other causes) we now find that the great majority of our workers take a substantial midday dinner in the canteens.

Choosing of suitable workers for TNT processes.—No worker is engaged for any occupation involving exposure to TNT without being passed by the doctor as suitable.

During the first few months we engaged girls at the rate of 500 to 600 per week. As, according to present knowledge, the chief dangers of TNT are to the liver and the bone marrow, the attention of the doctor is directed chiefly to the detection of anemia and "billousness" or any liver trouble. No girl with any trace of cyanosis of lips or yellowness of sclerotics is admitted as, although possibly healthy, such a girl would lead to difficulty for the doctor at her weekly medical inspection. The result of this preliminary medical examination is that the TNT workers in the factory conform to a certain standard which, although arbitrary, is of great assistance to the doctor in her subsequent work of inspection and diagnosis.

Inquiry into epidemics, etc.—The doctor takes measures against the spread of infectious diseases, and sees to the occasional examination of water supply, milk supply, etc. A thresh disinfectant for the sterilization of clothing is installed in the factory.

LEAD.

330. *Disease and its causes.*—Operatives come in contact with lead and its compounds in a variety of processes in munition factories, e. g., in smelting lead and spelter; in making sheet lead and bullets; in file cutting; in hardening and tempering metals; in common tinning; in soldering and plumbing; in the manufacture of accumulators and of india rubber; and in the use of lead paints and red lead. Under industrial conditions lead gains access to the body principally by the inhalation of lead fumes or dust. Lead tends to accumulate in the body, and careful investigations have established that a daily dose of as little as 2 milligrams must be regarded as capable, when inhaled as fume or dust, of setting up chronic poisoning. Lead may also enter the system through the digestive tract, by eating with unclean hands, or by putting pipes or other articles into the mouth while the hands are soiled with lead. Lead is a cumulative poison, that is to say, even small doses absorbed day after day tend to collect in the system and finally cause illness. The existence of a blue line at the gums is an indication of lead absorption, and headache, colic, constipation, and marked paleness are early manifestations of poisoning.

331. *Prevention.*—The prevention of inhalation of dust or fumes is the principle underlying the regulations made by the Secretary of State for the chief industries concerned with the manipulation of lead and its compounds. Inhalation of lead in the form of fumes or dust can only be avoided with certainty by preventing the production of dust (e. g., by keeping all lead material damp), and by

insuring the lead fumes do not escape into any place in which work is carried on. The nature of certain processes, however, may render the production of dust inevitable or the escape of fumes possible. Under such conditions localized exhaust ventilation should be applied as closely as is practicable to the point of origin, so as to withdraw the dust or fumes from the atmosphere of the work place. Respirators may be required in a few exceptional cases, but, as a protection against dust, only a few of the many forms of respirators obtainable are effective, and no one of them is comfortable to wear; while as a protection against fumes no respirator exists which an operative can be asked to wear for prolonged periods.

332. To prevent lead entering the system through the digestive tract the following special steps should be taken:

(a) Smoking should be prohibited in all places where lead is manipulated.

(b) No person should be allowed to take a meal or to remain during the time allowed for meals in any room where lead is used.

(c) Special mess rooms or canteens should be provided where workers can take their meals. Good food is of special importance in helping a worker to resist poisoning. In particular, workers should not commence work without having taken food. Evidence shows that hungry and ill-fed workers succumb more readily than others, and excellent results have been obtained from supplying workers with at least half a pint of milk or cocoa before starting work in the morning.

(d) Overalls should be provided and cloakrooms established, separate provision being made for the keeping of outdoor clothes and overalls respectively; they should never be allowed to come in contact with one another.

(e) Special washing facilities should be provided, and should be sufficient to enable the workers not only to wash their hands but also their faces, necks, and arms. Such facilities will only be effective if a sufficient supply of hot and cold water, clean towels, soap, and nail-brushes is always available. In some processes the employment of women, boys, and girls is forbidden.

Where their employment is allowed, boys and girls should be closely watched, because they are not so likely to observe the necessary precautions as grown-up people. Women should be especially careful, as the injurious effect of lead in them seriously interferes with the health of their children. Only healthy and temperate persons should be employed.

333. The manifestations of poisoning can be detected by a medical man, and their presence indicates that the worker should be transferred to other work. The Home Office regulations require employers to have persons engaged in various lead industries examined peri-

odically by a surgeon who is intrusted with powers of suspension from work. This medical supervision has been found of much value, and has been widely adopted even in industries not governed by regulations. It may be usefully extended to all factories where the use of lead oxides or other of its many compounds may have been introduced into the manufacture of munitions. In the handling of metallic lead, e. g., bullets, the risk of poisoning is very slight, and medical supervision is less important.

AEROPLANE DOPE.

334. In the earliest stages of the war, certain dopes used for aeroplanes contained a poison—tetrachlorethane—which gave rise to cases of toxic jaundice amongst those engaged in its manufacture and manipulation. In addition, numerous cases of ill health occurred. The manufacture of these dopes ceased in September, 1916. The dopes now in use, though free from tetrachlorethane, are still not without harmful effects upon the health of the worker. Volatile constituents of the new dopes and varnishes, such as acetone substitutes, benzol, etc., though they have not been found so far to produce illness of the nature produced by tetrachlorethane, cause headache, dryness of the throat, coughs, nausea, sickness, and serious anemia.

335. Good ventilation of the dope room decreases the intensity of the symptoms. On the other hand, the effects are aggravated by the temperature of 65 to 70° F. which has to be maintained, and it is of great importance to procure a satisfactory solution of the problem of ventilating the dope rooms while maintaining the requisite temperature.

The localized exhaust of the dope fumes at the point of their origin is hardly practicable in the case of parts having the size of aeroplane wings. In some works, however, a partial solution on these lines is obtained by laying the wing to be doped in a large shallow tank connected to an exhaust fan, and as the doping proceeds, drawing a spring roller-blind arrangement in stages across the open top of the tank. Small components such as wheel covers can be doped under suitable hoods having a localized exhaust. The fuselage and cockpit can be doped separately in the doping room before the machine is erected, or the machine, when completed, can, if practicable, be run for doping into a cubicle provided with exhaust fans. If the size or weight of the machine make it impracticable to use a doping cubicle the dope can be applied to the fuselage when in the erecting shop, provided the shop is of large size and well ventilated by natural means, and provided the doping is done after the ordinary hours of employment.

The Home Office requirement with regard to the ventilation of dope rooms is that the air shall be changed thirty times per hour. This standard also applies to doping cubicles. In order to attain it, in conjunction with the maintenance of a temperature of 65° to 70° F.; economy demands that the height of the room should not be much more than sufficient to accommodate the largest size of wing

to be doped. The average height, the Home Office recommends, should not be greater than 15 to 20 feet or less than 10 feet.

Dope rooms and cubicles should preferably be ventilated by means of extraction or propeller fans of the open-blade type, having a free intake to the fan and a free discharge to the open air. Louvers, wind screens, or other obstructions should not be fitted on the discharge side, as these considerably reduce the output. As the fumes are heavier than air, the fans should be installed at, or arranged so as to draw from, a point near the floor level. If the air inlets into the dope room are properly proportioned—the total inlet area should not be less than three times the discharge area of the fans—no draft should be felt in the room, either with the doors closed or opened temporarily to allow passage of persons or materials. The air inlets should be provided at the side of the room opposite the fans and at about 10 feet above the floor level. They may be of the open hopper type, or be covered with cheesecloth, to serve as a dust filter and to diffuse the in-coming air currents. The provision of ample air inlets prevents the formation of pockets of dense fumes in the room by drafts of high velocity, and the impingement of such drafts on the doped surfaces, with the consequent formation of white patches on the fabric. It may be remarked that the Home Office authorities have always been strongly opposed to plenum ventilation in dope rooms.

The heating of the air may be effected by means of numerous steam or hot-water pipes and radiators placed close to the air-inlet openings, by hot-air plenum ducts, hot-air stoves, slow-combustion stoves, or hot chambers heated by steam pipes. It should always be remembered that the temperature and rate of change of air with a given plant are interconnected, and that if the air inlets are closed, the fans slowed down, or the outlets partially obstructed so as to attain the temperature required, the standard of ventilation is correspondingly reduced. It is not advisable greatly to exceed the specified number of changes of air per hour—30—as some have done to be on the safe side. If the changes are made 60 to 100 per hour, the maintenance of the required temperature in cold weather becomes impossible. In lofty shops, if difficulty is experienced with regard to the temperature, the height of the room should be reduced by matchboarding or other nonconducting material, and the walls of temporary buildings should be lined with wood.

Doping should be commenced at the end of the wing nearest the exhaust fan. The workers, when not applying the dope, should stand as near the fresh-air inlets as possible. Work should not be commenced on an empty stomach. The workers must not be allowed to take a meal in the dope room. If no provision is made for removing the wings to a separate drying room as soon as the dope is tacky, the wings should be placed to dry in a position between the workers and the fans, but not so as to obstruct the fans.

336. With a view to reducing ill health amongst the workers so far as possible, the following preventive measures are also desirable:

- (a) Periodic medical examination of all workers should be provided for.
- (b) Periods of exposure should be reduced to a minimum and not prolonged by overtime.
- (c) Operatives should not be allowed to remain in the work place during meal hours.
- (d) Adequate facilities should be provided for obtaining sufficient and nourishing food.

- (e) Overalls should be provided.
- (f) Adequate washing accommodation should be provided.

POISONOUS GASES.

337. The chief dangers arising from the manufacture and manipulation of poisonous gases are—

- (a) Poisoning by the lethal and lachrymatory gases;
- (b) Irritation of the skin, eyes, and other exposed parts of the body, caused by the handling of raw materials or finished products;
- (c) Mechanical accidents; these, however slight in the first instance, may become serious unless they receive prompt medical attention on account of the poisonous character of the bodies handled or manufactured.

338. Apart from mechanical safeguards against accidents, the principal measures necessary for prevention and treatment are—

- (a) The appointment of a medical officer for each factory;
- (b) The medical examination of all workers before engagement, and at frequent intervals during employment;
- (c) Suitably equipped ambulance stations in charge of a trained nurse and under the constant supervision of the medical officer;
- (d) Hospital accommodation for special cases;
- (e) Suitable protective clothing (including overalls, helmets, respirators, gloves, goggles, and clogs); all such clothing must be worn only during the period of actual working. Overalls should be washed weekly.
- (f) Suitable cloakrooms;
- (g) Washing facilities sufficient to enable workers to wash thoroughly at the end of each period of work;
- (h) No food may be taken into a work place;
- (i) Adequate facilities for obtaining food.

339. Notification is required of all cases of gasing, eczematous affection of the skin, inflammation of the eyes, poisoning, and mechanical accidents.

FULMINATE OF MERCURY.

340. *Disease and its causes.*—In the manufacture and use of fulminate of mercury there is a liability of mercurial poisoning and eczema. Owing, however, to the small amounts manipulated, the symptoms of mercurialism are seldom marked, but a blue line may be seen on the gums, appetite may be impaired, headache may be present, and there may be nervousness and depression. The last symptom is important not merely as a sign of illness but as an indication that the operative should be removed from dangerous work which calls for a steady hand and a clear head. Eczema of the hand, forearm, and face occur and may cause serious disability.

A medical examination of 60 women workers employed on manipulating substances containing mercury fulminate showed that only 5 had remained in good health throughout their work at the factory. The most common symptoms were rash on face or hands (41.6 per cent) often associated with severe internal pains, sickness, and diarrhea (30 per cent). The eyes are often affected, either with conjunctivitis (35 per cent) or inflamed lids (20 per cent). Soreness of mouth and gums occurred in 21.6 per cent, though salivation was infrequent (7 per cent), and a blue hue on gums was only noticed in two instances. Workers complained of the difficulty caused by soreness of the mouth, as this affected their appetite and was most painful if artificial dentures were worn. Disorders of menstruation occurred in 20 per cent of those examined, and depression was marked in 25 per cent. Sleeplessness was generally due to the irritation produced by the rash, probably increased by the fact that at least 25 per cent of the women admitted that they slept in some clothes worn during the day. It was ascertained that 41.6 per cent wore neither veil nor respirator, although in about 30 per cent the onset of symptoms was associated with sneezing or signs of "cold" due to the inhalation of the mercurial powder.

The greatest susceptibility was shown in the case of a woman in whom mere contact with a mercury worker wearing a dirty overall was sufficient to produce a rash. Rashes were more severe in those women who did not wear veils or respirators. It was noted that one worker who remained immune for two months habitually used a veil, respirator, and goggles, though it can not be said that these afford complete protection.

341. *Prevention.*—The principal preventive measures to be adopted should include—

- (a) The provision of overalls and of adequate cloakroom and washing accommodation;
- (b) Adequate facilities for obtaining food. No worker should be allowed to commence work without food;
- (c) Careful selection of workers;
- (d) Where exposure is marked, periodical medical examination;
- (e) Transference to other work of those specially affected.

TETRYL (TETRANITROMETHYLANILIN).

342. *Disease and its causes.*—Manipulation of this explosive produces a light dust, which may cause troublesome eczema. Individuals vary in their susceptibility; some appear to be almost immune, while others can hardly enter a room where tetryl is handled without suffering severely. Observation suggests that this may depend on the varying natural dryness or moistness of the skin of different persons. The parts most frequently affected are the conjunctivæ, the openings of the nostrils, and the chin. The hands and arms are less often affected, and in this the eczema caused by tetryl differs from that due to trinitrotoluene, which usually affects the forearms and hands. Operatives manipulating tetryl may also suffer from headache, drowsiness, and lack of appetite in varying degrees of intensity.

343. *Prevention.*—The principal measures to be taken consist in—

(a) Avoiding the escape of dust by carrying out manipulations in glass cupboards with armholes for introduction of the hands;

(b) Providing light gauze veils to protect the faces of the workers;

(c) Supplying, if veils are not worn, some simple powder (such as a mixture of one part of zinc oxide to two parts of starch) for applying to the face before beginning work;

(d) Providing adequate washing accommodation and encouraging the use after washing of an application for the skin;¹

(e) Excluding workers who show special susceptibility or idiosyncrasy.

344. Apart from its tendency to cause eczema, tetryl stains the skin and hair; in order to prevent this, overalls and gloves should be worn, and, where women are employed, suitable head coverings should be used.

PICRIC ACID.

345. Picric acid (melinite or lyddite) is known chemically as trinitrophenol, and is made by the nitrating action of mixed acids upon carbolic acid. The manufacture, though simple, exposes those engaged in it to risk of the inhalation of nitrous fumes. Workers engaged in the use of picric acid, however, are usually regarded as being employed in a nonpoisonous occupation. Those handling it usually become dusted over with a fine yellow powder which stains the hair and exposed skin surfaces of the body a bright canary yellow color. Occasionally an irritating dermatitis of a simple type is found on the hands and forearms; and those who are commencing work for the first time in picric acid may have an initial gastritis, which passes off in two or three days. Systematic poisoning, however, is practically unknown among picric workers, and much confusion has arisen between the negative effects of picric acid and the ill effects of TNT, since both stain the skin a yellowish color and workers are apt to call all shell-filling work TNT.

346. Except in relation to nitrous fumes, which are dealt with below, no special precautions are called for.

NITROUS FUMES.

347. The present demand for explosives, nearly all of which are products of nitration, has introduced increased risk of exposure to nitrous fumes, not only in nitrating processes, but also in the manufacture of nitric acid to be used in these processes. The factory department of the Home Office have issued the following memorandum:

¹ An application found of value to prevent eczema is a mixture of two parts of castor oil to one part of lanoline; this mixture, which should be rubbed into the skin after washing on leaving work, should be placed in the lavatories for general use.

In the manufacture of nitric acid, and in its use for various purposes, particularly in the manufacture of explosives, danger exists of accidental escape of nitrous fumes into the work places. The full effect of inhaling these fumes is not felt immediately, and unless workers are warned of the danger they may continue at work and unwittingly inhale a fatal dose.

In such a case the affected person develops an irritating cough, which becomes steadily worse, until, three or four hours after exposure, he becomes seriously ill, suffering from marked dyspnoea and collapse; sometimes these symptoms have come on after leaving work on the way home. The secretion of mucus now becomes profuse, and vomiting, which helps to clear the air passages, may occur. The congestion of the bronchioles and alveoli progresses, and, if the case survives for 48 hours definite pneumonic consolidation may develop. More frequently a fatal issue results in about 30 hours, the patient remaining conscious until near the end.

Every case exhibiting the initial symptoms does not progress to a fatal termination, and recovery has occurred even after marked collapse and dyspnoea.

Prevention.—Notices warning those employed of the danger of remaining in an atmosphere containing nitrous fumes should be posted in every place where there is any possibility of these fumes escaping.

Emergency helmets¹ of a pattern which can be easily and quickly put on and provided with a fresh air supply from without should be kept in accessible places near at hand, and the efficiency of such helmets should be tested at least once a month.

Respirators such as are efficient to intercept dust are useless against gases and must not be used.

Treatment.—The following routine may usefully be pursued pending the arrival of a medical man:

Make the patient lie down.

Keep him warm.

See that he has plenty of fresh air.

If he is blue in the face:

(i) Administer oxygen; and

(ii) If he has not been sick, give a drink of 1 ounce of salt in 10 ounces of lukewarm water, and repeat the dose until he is sick;

(iii) Meanwhile, send for a doctor.

Persons even apparently slightly affected must not be allowed to walk home until permitted to do so by the doctor.

DERMATITIS.

348. *Disease and its causes.*—The occurrence of serious dermatitis, or eczema, caused by exposure to trinitrotoluene and to tetryl has already been referred to, and similar trouble may result from exposure to fulminate of mercury. Apart, however, from these special substances, eczema is liable to occur among munition workers employed in engineering works who come in contact with certain fluids used to lubricate and to cool metals. Two forms of inflammation of the skin, which, however, may coexist, result, (i) yellow pustules and boils, and (ii) more general inflammation which in marked cases de-

¹ Such helmets can be procured from Messrs. Siebe, Gorman & Co. (Ltd.), 187, Westminster Bridge Road, London, S. E.

velops into typical weeping eczema. Probably the occurrence of pustules and boils is due to sebaceous glands and hair follicles becoming blocked and infected with oily grime rubbed in by soiled overalls. The more general inflammatory conditions appear to be caused by the direct action of the fluids used, accentuated by the abrasive effect of fine particles of metal produced during machining processes.

349. *Prevention.*—Clean overalls and the provision and use of suitable washing accommodation with hot water laid on have proved to be the best means of prevention.

350. The first-aid leaflet issued by the factory department of the Home Office contains the following advice in regard to eczema from lubricating oil:

Dermatitis and eczema from oils and fluids used to lubricate and cool metals can best be prevented by cleanliness of (1) the overalls, and (2) the skin. All overalls should be washed weekly, and the hands and forearms daily in warm water before leaving the factory. Lanoline and castor oil ointment (equal parts) applied to the skin after washing is a help. When dermatitis and eczema occur washing should be stopped and a doctor seen at once.

351. Experience has shown that if lubricating and cooling fluids are filtered free from metal particles, and if they contain a small amount of some antiseptic, say carbolic acid up to 1 per cent, or other coal-tar antiseptic, cases of eczema do not occur. Antiseptic lubricants and cooling fluids are rapidly coming into general use in engineering shops, and cases of eczema are less prevalent than formerly.

SECTION XIV.—CLEANLINESS, VENTILATION, HEATING, AND LIGHTING.

FACTORY ENVIRONMENT.

352. The Factory and Workshop Act, 1901, section 1 (i) provides as follows:

The following provisions shall apply to every factory as defined by this act, except a domestic factory:

(a) It must be kept in a cleanly state.

(b) It must be kept free from any effluvia arising from any drain, water-closet, privy, urinal, or other nuisance.

(c) It must not be so overcrowded while work is carried on therein as to be dangerous or injurious to the health of the persons employed therein.

(d) It must be ventilated in such a manner as to render harmless, so far as is practicable, all the gases, vapors, dust, or other impurities generated in the course of the manufacturing process or handicraft carried on therein that may be injurious to health.

353. In subsequent sections these various requirements are elaborated. It will be convenient to deal with them separately.

CLEANLINESS OF FACTORY.

354. As has already been pointed out, the first provision of the factory act is that the workshop must be kept in "a cleanly state." Section 1 (3) deals with lime washing.

355. A high standard of cleanliness not only is essential for health but also has an important bearing on the self-respect of the workers. The difficulties in maintaining such a standard are frequently substantial, and constant attention is necessary. In the majority of munition works the conditions are not unsatisfactory in this respect, but in some works, and especially in the older and more crowded ones, the conditions leave much more to be desired. If dust is allowed freely to accumulate, its inevitable circulation in the air represents a material danger to health even where it is not derived from poisonous substances.

356. *Flooring.*—(Sec. 8 (1).) If the floor is to be kept clean it should be hard, smooth, durable, and impervious. While flooring of concrete or similar material may be best for the parts of a shop where the machinery is placed and for passage ways, it is not the material most suitable for workers to stand on. It is a matter of common knowledge that some softer material such as wood is much less fatiguing to stand on for any continuous period. It is also warmer for the feet—a matter of no small importance in cold

weather. Where the processes render a wet floor unavoidable it is extremely desirable, however effective the drainage may be, to provide low wooden platforms upon which the worker can stand.

GENERAL VENTILATION AND HEATING.

357. The provisions of the factory act in regard to these two matters are as follows:

Sec. 7 (1). In every room in any factory or workshop sufficient means of ventilation shall be provided and sufficient ventilation shall be maintained.

Sec. 6 (1). In every factory and workshop adequate measures must be taken for securing and maintaining a reasonable temperature in each room in which any person is employed, but the measure so taken must not interfere with the purity of the air of any room in which any person is employed.

358. In their report dated 1902 the departmental committee on the ventilation of factories and workshops recommended that—

such a standard of ventilation should be prescribed for all classes of factories and workshops not otherwise specially dealt with, that the proportion of carbonic acid in the air at about the breathing level and away from the immediate influence of any special source of contamination, such as a person or light, shall not (except on very foggy days, when no tests should be made, on account of the vitiated state of the outside air) rise during daylight, or after dark when only electric light is used, beyond 12 volumes of carbonic acid per 10,000 of air, and that when gas or oil is used for lighting the proportion shall not exceed 20 volumes after dark or before the first hour after daylight.

359. The standard thus recommended has generally been adopted by the Home Office in determining whether the ventilation of a factory is sufficient within the meaning of the act.

360. The factory and workshop act is concerned only with the minimum necessary in ordinary times, but present conditions and circumstances render it necessary to consider the problem of ventilation from a somewhat different standpoint. At present the importance of proper and effective methods of ventilation are intensified by the increase in the number of workers (many of whom are new to industrial conditions), by the long hours of work, and by the continuous occupation of the shops by day and by night. Frequently there is no interval in which natural ventilation can restore a vitiated atmosphere, and each shift succeeds to the conditions of ventilation left by its predecessor.

The objects of ventilation are to provide—

- (a) Air which is pure and clean for the workers to breathe;
- (b) An atmosphere which is stimulating and refreshing.

361. Air which is entirely pure from the chemical point of view may afford an atmosphere of a most depressing character, which is highly detrimental to physical efficiency. It is not enough to aim only at clean air, as has been often the custom in the past, or only

at a stimulating atmosphere. Both objects must be constantly borne in mind.

362. *Clean air.*—The impurities which are liable to be added to the air inside the workshop are—

(a) Carbonic acid given off in the breath of human beings, and by fires, gaslights, or any other form of open combustion. Carbonic acid in the percentage found in rooms and factories is harmless, but it affords a useful indication of the efficiency of ventilation. If it is efficient, the percentage of carbonic acid will not measurably exceed that in the atmosphere. This is the ideal to be aimed at, rather than the practice hitherto followed of keeping the acid below 12 parts per 10,000 of air in daytime and below 20 at night.

(b) Various ill-defined volatile substances arising from human beings, from the skin and the alimentary canal, especially when personal cleanliness is defective. These substances are probably harmless in themselves, but they excite a feeling of discomfort or even of disgust.

(c) Bacteria arising from human beings form a more definite and more directly harmful sort of impurity. Colds, sore throat, influenza and the like are largely spread from an infected individual to his neighbors by organisms which are carried in the air. Though these diseases may be regarded as trivial in character, there can be no doubt as to the amount of industrial inefficiency which they cause. Of diseases more serious as regards life as well as health, tuberculosis of the lungs is undoubtedly found disseminated in a like manner.

(d) Industrial processes may give rise to varied impurities such as dust and fumes. Some are simply unpleasant, others are directly harmful. Fuller reference to these has been made in Section XIII.

363. It is obvious that the kind of impurity present in any particular workshop will vary widely with the prevalent conditions. Given normal conditions, impurities can be removed by an effective system of general ventilation.

364. *Stimulating atmosphere.*¹—At first sight a workshop may

¹ Whether a workshop has an atmosphere which is satisfactory in this sense may generally be judged by the sensations, especially on first entering from the outside air. More accurate information may be obtained by the study of the particular way in which a "stuffy" atmosphere may be made "fresh." The ordinary thermometer measures the temperature of the air; the wet-bulb thermometer determines the humidity and gives an important measure of the facility with which the body can be cooled by sweating. These instruments, however, give only very imperfect data as to the cooling and skin-stimulating properties of any atmosphere, and it is necessary to have in addition some measure of the rate at which a warm body will lose heat.

In the observations made for the committee by Dr. Leonard Hill, the rate of cooling has been investigated by means of the Kata thermometer (purchasable from J. Hicks, 8, Hatton Garden, E. C.). A large bulbed spirit thermometer (of standard size) is used; this is heated in hot water, and the rate of cooling measured by taking the time which the meniscus takes to drop from 100° F. to 95° F. while the instrument is suspended in the atmosphere. This gives the dry reading, and shows the rate of cooling due to radiation and convection. To take the wet reading the bulb of the Kata thermometer is cov-

have so large a cubic capacity in relation to the number of work-people and the kind of process in operation that it does not require any definite ventilation. This is wholly false. In large shops there is a mass of stagnant atmosphere which is obviously depressing and relaxing, and fails entirely to provide the stimulating effect of cool air in gentle motion which is provocative of the best physical and mental exertion. This exhilarating influence of atmosphere depends essentially upon the cooling of the skin by moving air, and is closely connected with questions of temperature and heat. Cool air is more stimulating than warm, and more conducive to physical effort. Damp warm air is more relaxing than dry air at the same temperature. These considerations are fully borne out by direct experimentation in the laboratory, and the desired atmosphere is characterized by being—

- (a) Cool rather than hot;
- (b) Dry rather than damp;
- (c) Diverse in its temperature in different parts and at different times rather than uniform and monotonous;
- (d) Moving rather than still.

365. The explanation of the familiar conditions of such an atmosphere appears to lie in the cooling and varying stimulation of the skin of the exposed parts of the body. The concentration of a current of air on too small a part of the body only causes what is commonly known as a draught. It is a common experience that a slightly open window causes a draught, whereas a widely open window does not.

ered with a damp muslin glove and the operation repeated, giving the rate of cooling when evaporation is added to radiation and convection. The rate of cooling at body temperature is recorded by means of a factor (determined for each Kata thermometer) in mille calories per square centimeter per second. The number of seconds occupied in the fall from 100° to 95° is divided into the factor.

In addition to the readings of the Kata thermometer, those of the wet and dry bulb thermometer were taken. The records show how with the same wet and dry bulb readings, the rate of cooling may be strikingly different. The Kata thermometer, like the human body, notes the rate of change, while the thermometer notes a given state or the result of change. Thus the Kata thermometer takes count of the movement of the air and indicates conditions of comfort.

The following examples are given in illustration of the results obtained. The first set of readings are for a bright, pleasant day in May, and the other four are for typical shops as a contrast of types of "bad" and "good" shops. A comparison of the first, second, and third sets of readings shows that with the same temperature widely different rates of cooling may exist.

Rate of cooling at body temperature in mille calories per square centimeter per second.

	Wet bulb.	Dry bulb.	Radiation, convection, evaporation.	Radiation, convection.	Evaporation.
(1) Bright, pleasant day in May, out of doors.....	66	68	27.2	7.5	19.7
(2) Brass foundry (good).....	60	72	24	7.3	16.7
(3) Machine shop (bad).....	61	72	15	4.6	10.4
(4) Cartridge annealing and cleaning (bad).....	64.5	69.5	17.5	2.0	14.5
(5) Cartridge annealing and cleaning (good).....	54.5	60.0	24.0	0.0	15.0

WAYS AND MEANS.

366. The ventilation and heating of every workshop provides a separate problem. There is no uniform or stereotyped method which will give satisfactory results everywhere. The means to be adopted must be subject to local considerations in each case, and the general lines alone can be indicated here:

(a) Cubic capacity is the first essential. Though the minimum of 250 cubic feet per worker (400 during any period of overtime) prescribed by section 3 (1) of the factory act is seldom infringed, the provision of adequate ventilation may be rendered difficult owing to the close proximity of the workers to one another. They should at least be so arranged that they do not cough or sneeze in each other's faces.

(b) Definite openings communicating with the outside air should be provided in every workshop, preferably opposite each other. The average machine shop and all similar one-story shops should be provided with louvers along the length of the roof ridges, or, better, with narrow openings where the roof meets the wall. Such louvers should be permanently open, and would generally insure that the atmosphere will at least not be grossly bad.

(c) Such fixed openings do not, however, allow of the flexibility required to meet varying internal and external conditions, and should be supplemented by the use of doors and windows (which will open) and fans. Fans are specially valuable to meet emergencies and abnormal conditions and provide for the thorough cleaning of the air during mealtimes.

(d) Local sources of impurity and heat production should be dealt with by the provision of hoods, exhausts, etc. (See, also, pars. 372-379.) Smoke and fumes from neighboring chimneys may also require attention.

367. As a result of a detailed inquiry into the conditions of ventilation at an important factory, a member of the committee reports:

The skylight method of ventilation is a bad one; unfortunately it pertains throughout the factory, both in old and new shops. The opening of a skylight leads to a local draft, and this usually entails its closure. The skylights, too, take time and trouble to open and shut, and rain comes in when they are open and may rust metal work upon which it falls. For these reasons the opening of the skylights is generally neglected, except at the intervals when a special set of men carry out the duty. Moreover, skylights opened here and there do not ventilate the shop in all its parts. The warm, smelly air rises up against the roof and does not escape in parts where no skylights are open. A very great improvement would be made in all these shops if louvers were introduced, running continuously along the whole length of each serration of the roof. These louvers would allow a ceaseless, draftless, and equal ventilation of every part of the shops. It is regrettable that the new shops should not have been designed with such louvers, for the efficiency of their action is demonstrated in many factories.

The smell of oil and soapsuds can be lessened by strict attention to cleanliness. Similarly, the cleaning of machines and floors is the first thing to pay attention to in regard to the smell of the machine shops. In the stress of present conditions and lack of labor cleaning is sure to suffer. Continuous roof louvers would insure ceaseless change of air and a cooler temperature, and these together would insure much fresher atmosphere. The monotonous smell and lack of freshness of the air nervously disturbs the more sensitive men who are working long hours and at a high pitch, men some of whom have been used to an open-air life and who, acquainted with the popular but erroneous doctrine of ventilation, concern themselves over chemical poisons in the air, the presence of which they believe to be indicated by the close smell.

In the days of hot summer weather there is no means provided of cooling the workers beyond the stirring of the air produced by the shafting and belts. In some of the shops the committee saw in action impulsion fans, each placed high up on the wall of the factory with a sheet of canvas placed below it and stretching out into the shop so as to act as a baffle. These fans sent a grateful current of moving air through the shop in hot weather. Such an installation repays itself by the increased efficiency of the workers.

368. It is unnecessary to emphasize the close connection which exists between ventilation and temperature. For a shop to be too hot is disadvantageous from every point of view, but the stimulation of too cold air may be more than counterbalanced by the physical depression which results, and in cold weather efficiency may deteriorate because the worker becomes uncomfortably chilled.

In his memorandum on *The Causation of Industrial Accidents*, Dr. Vernon states that—

At each of the three shell factories B, C, and D the women's accidents greatly increased during cold weather. The men's accidents increased, though to a less extent, at two of the three factories, and but for exceptional conditions would have increased at the third factory likewise. At factory A there was no detectable seasonal change in the number of accidents, and so there can be very little doubt that if the shell factories had been more adequately heated the whole of the seasonal increment of accidents might have been avoided. The data collected at factory A show that in order to reduce accidents to a minimum the temperature should be kept at 65 to 69°, but probably not much harm would be done so long as it was not allowed to fall below about 55°. As the temperature falls below 50°, however, there can be little doubt that accidents increase very rapidly. An external temperature at freezing point probably meant an internal temperature of about 45° at factory C, and a temperature of 40° or less at certain parts of factory B, and we saw that under such conditions the women's accidents were, respectively, 48 per cent and 143 per cent greater than when the external temperature was above 47°.

369. Dr. Vernon adds the opinion that "the optimum temperature for accident limitation is higher than the optimum for output." What is the best temperature depends on the character of the work and the habit of the worker. Sedentary workers require a warmer atmosphere than those engaged in more violent labor. It may, however, be suggested that when the air is stagnant the temperature should not exceed about 60° F., though it may be somewhat higher when the air is in motion.

370. Means of heating are usually restricted by practical considerations to some system of steam heating or hot-water pipes; the ideal form is, no doubt, by radiant heat, as may be seen from the excellent and invigorating conditions which prevail in many smithies and forges. Gas-heated radiators in which the burnt gas escapes into the shop are not permissible. A plan by which warmed air is pumped into the shop (commonly known as the "plenum system") tends to create an atmosphere of a highly relaxing and depressing character. The means of ventilation should be kept separate from that of heating, and the "plenum system" should only be used to pump in cool air in summer.

371. *Maintenance.*—The most complete installation for ventilation and heating may be rendered ineffective by injudicious management or failure in proper or continuous maintenance. Rapid changes of climate at different times of the day, varying circumstances of use and occupation, all require appropriate treatment. Mismanagement is frequently due to the fact that it is the prescribed duty of no one in particular to observe the prevailing conditions and to put in operation the appropriate appliances for the supply of air and heat, and the committee are of opinion that some responsible person should be specially detailed for the purpose. While it is for the management to provide the means, it is for the workers to aid in their use and application. The effective maintenance of ventilation is the more important owing to the large number of women now employed in munition works, since women are especially susceptible to the effects of defective ventilation.

LOCAL AND EXHAUST VENTILATION.

372. In addition to the general provisions in regard to ventilation, the Factory and Workshop Act contains various special provisions in regard to the provision of local or exhaust ventilation in the case of dangerous or unhealthy industries.

Section 74 provides—

If in a factory or workshop where grinding, glazing, or polishing on a wheel, or any process is carried on by which dust or any gas, vapor, or other impurity is generated and inhaled by the workers to an injurious extent, it appears to an inspector that such inhalation could be to a great extent prevented by the use of a fan or other mechanical means, the inspector may direct that a fan or other mechanical means of a proper construction for preventing such inhalation be provided within a reasonable time; and if the same is not provided, maintained, and used, the factory or workshop shall be deemed not to be kept in conformity with this act.

Section 79 provides that—

Where the secretary of state is satisfied that any manufacture, machinery, plant, process, or description of manual labor used in factories or workshops

is dangerous or injurious to health or dangerous to life or limb, either generally or in the case of women, children, or any other class of persons, he may certify that manufacture, machinery, plant, process, or description of manual labor to be dangerous, and thereupon the secretary of state may, subject to the provisions of this act, make such regulations as appear to him to be reasonably practicable and to meet the necessity of the case.

373. Local or exhaust ventilation is normally required to remove from the atmosphere dust, heated fumes, or volatile vapors. The essentials to such ventilation are—

(a) A duct along which a flow of air is maintained in a definite direction.

(b) Suitable opening or openings in the duct, through which the dangerous substances are withdrawn.

(c) Suitable openings for the admission of air into the workroom.

374. Nearly every work place has special problems in the solving of which expert advice may be necessary. There are, however, certain principles that are generally applicable to all such instances. The duct along which a flow of air is maintained should be of sufficient length and size. It must not contain bends so sharp as to impede the flow of air. The opening or openings through which the air enters the duct must not be too small or they may become choked with dust. The openings should have hoods so arranged as to surround so far as possible the seat of origin of the substance to be removed. In the case of dust from a revolving wheel, the hood and duct should be placed so as to intercept the dust which is thrown tangentially from the wheel and to catch dust which would otherwise fall to the ground; the dust then comes under the influence of the air current in the hood and is drawn into the duct, while the air current itself is assisted by the air thrown off by the wheel. Where dust is created by manual labor the operative should stand or sit facing the opening of the hood so that the current of air draws the dust away from him.

375. For heated fumes the hood should be bell-mouthed, and its lower end should envelop and extend below the place from which the fumes originate. The opening of the hood should be at such an angle as to prevent accumulation of dust, or, in the case of heated fumes, to prevent the expanding gases from rebounding and escaping like smoke from the badly constructed chimney. Volatile substances are difficult to localize. If, as is usually the case when noxious vapors have to be dealt with, the vapor is heavier than air, the openings to the dust must be at the ground level and as near as practicable to the place where the vapor is given off.

376. The removal of dust or volatile substances is generally best effected by a current of air produced by mechanical means. Generally speaking, where a keen draught, as for the removal of dust, is

required, pressure fans should be employed, since these fans, though requiring more power to drive them, can work against considerable pressure and smaller ducts may be used. Where, on the other hand, large volumes of air are to be removed, volume fans can be more economically employed, but with such fans attention to the sectional area of the ducts is of great importance. The ducts must never be constricted at any point; the total area of the opening must be greater than that of the fan, and all sharp bends in the duct must be avoided. Further, the delivery side of the fan must not be impeded or so placed as to be exposed to the action of wind.

377. Heated fumes can usually be removed without using mechanical power, provided that the duct is vertical and of ample diameter and height. Down drafts should be guarded against by the provision of wind cowls or by other means.

378. The distribution and size of openings for the admission of air to the workroom is a matter of essential importance. To obtain an interchange of air and so secure general ventilation, these openings should be placed as far as possible from the exhaust openings, preferably on the opposite side of the workroom, and, to avoid drafts, such openings should comprise an area three times that of the exhaust openings. Where volatile vapors are being dealt with, it is specially important that the openings should be ample and should be arranged high up in the workroom. The supply of incoming air may in some cases be insured by the use of a pressure fan driving in air through well-distributed openings.

379. Experience shows that installations which are in themselves satisfactory frequently fail to effect their purpose through insufficient attention to their care and maintenance. Hoods become detached from ducts, holes are broken into the ducts, and ducts have been found blocked with every kind of débris. The whole installation may be impaired by a dust-collecting apparatus with exits of inadequate area.

LIGHTING.

380. The Factory and Workshop Act does not contain any provision in regard to the lighting of factories. The question has, however, been exhaustively dealt with in the report of the departmental committee on lighting in factories and workshops, published in 1915. The essentials of good lighting are summarized as—

- (a) Adequacy;
- (b) A reasonable degree of constancy and uniformity of illumination over the necessary area of work;
- (c) The placing or shading of lamps so that the light from them does not fall directly on the eyes of an operative when engaged on his work or when looking horizontally across the workroom;
- (d) The placing of lights so as to avoid the casting of extraneous shadows on the work.

381. An expert witness before the committee thus summarized the principal effects of good lighting:

(a) The quality of work and output both suffer if the illumination is inadequate, particularly in the case of delicate operations often called for in munition factories. Adequate illumination assisted the supervision of workers, with the result that carelessness and errors on the part of newly trained workers were more readily detected, and instances in which a worker required a rest were noticed more speedily.

(b) Inadequate illumination, by adding to the difficulties of skilled labor, increases the nervous strain on operators and reacts on their physical condition.

(c) The risk of accident is in many cases increased by inadequate lighting.

(d) In cases where machines do not receive sufficient attention the risk of breakdowns is increased.

(e) It is generally recognized that operators work more cheerfully in well-lighted rooms; bad lighting, on the other hand, has a depressing effect on the spirits, and thus affects the operator's capacity for work.

382. Natural lighting is to be preferred to artificial lighting on grounds of health as well as of economy. Where it can be provided, roof lighting is generally superior to lateral lighting, especially if it can be arranged that the light enters from the north. In a good system of roof lighting the illumination is very uniform. In modern factories where lateral lighting is employed a large part of the walls are devoted to windows, but it is evident that there is a limit to the width of the room beyond which the illumination falls below what is adequate. What this width is will depend partly upon the nature of the work to be done in the shop and partly on the extent to which light is impeded by outside obstacles such as neighboring buildings or inside obstacles such as machinery.

383. The effect of light-colored walls and white ceilings on the general brightness of the rooms and in forming an effective background to dark objects should not be overlooked. Sometimes the natural lighting may be improved by deflecting vertical light into the room by means of reflectors or prismatic glass or by whitening the surface of an external wall or building which obstructs the light. The position of permanent working points should be so adjusted in relation to the windows and to internal obstacles of whatever kind as to secure so far as practicable adequate light for each.

384. The necessity for regularly cleaning the windows on the inner and outer surfaces can not be too strongly insisted on. Not only do dirty windows seriously hinder daylight from entering the shop, but the daylight period of work is considerably shortened and needless expenditure on artificial lighting incurred in consequence. Air-raid regulations have tended to increase this loss of natural light. Dr. Agnew, in the course of his medical inquiries, inquired into this question. He reports—

The natural lighting in almost every case would be good if the windows were cleaned regularly, but owing to the anti-air-raid darkening regulations the

windows were not cleaned regularly, or if cleaned regularly the transmission of daylight is interfered with by blinds which have become dislodged or have got out of order and hang loosely about the windows. The advantage of white-washing the walls and keeping the ceilings clean was shown by contrast with some workshops where these processes are sadly neglected.

385. In the construction of shops care should be taken to render the outside of windows easily accessible for cleaning. In many existing shops access is so difficult as to make cleaning almost impossible.

386. Artificial lighting is of special importance at the present time when night work is done, and when women and boys are employed in large numbers. Bad lighting affects output unfavorably, not only by making good and rapid work more difficult but by causing headaches and other effects of eyestrain. The difficulties of supervision, which are always considerable, are further increased if the general lighting of the workshop is insufficient. Attention should be paid to the lighting of passages and the immediate surroundings of the factory as well as to that of the factory itself.

387. In the report of the departmental committee standards of lighting for factories are suggested, and though the figures given are the minima considered necessary, they may at any rate prove of assistance in considering the relative amount of light necessary in different parts of the factory. The unit of illumination is the "foot-candle;"¹ that is, the illumination produced by a light of one standard candle at a point of a surface 1 foot from the source and so placed that the light strikes the surface at right angles. Thus, 1 candle 1 foot from the surface is 1 foot-candle, 50 candles at a distance of 1 foot is 50 foot-candles, and 50 candles at 10 feet distance is 0.5 foot-candle.² Light should also be constant and uniform, without glare and without casting extraneous shadows on the point to be illuminated. Artificial lighting is usually obtained by use of coal gas, oils, or electric light. Cannel-coal gas is more illuminant than bituminous-coal gas. The chief results of the burning of coal gas are an increase in CO₂ and watery vapor, raising of temperature, with some production of sulphurous acid and other constituent bodies. Each cubic foot of gas pollutes the atmosphere to the same degree as one adult person. The best form of gas illumination is now commonly obtained by the use of an incandescent-mantle burner properly ventilated. Oil lamps give fair results, but raise the temperature and give off CO₂ and watery vapor. Electric light is the most hygienic form of illumination. No oxygen is used up, no CO₂ or moisture is produced.

¹ On the continent of Europe the meter-candle is the unit (= about $\frac{1}{16}$ of a foot-candle).

² Over the "working areas" of workrooms illumination at floor level should be not less than 0.25 foot-candle; in all open places, roadways, yards, or other approaches to work places, 0.05 (see report of departmental committee on lighting in factories and workshops, Cd. 8000, 1915).

**SECTION XV.—SANITARY ACCOMMODATION, WASHING FACILITIES,
AND CLOAKROOMS.**

SANITARY ACCOMMODATION.

388. Section 9 of the Factory and Workshop Act requires that—

(1) Every factory and workshop must be provided with sufficient and suitable accommodation in the way of sanitary conveniences, regard being had to the number of persons employed in or in attendance at the factory or workshop, and also where persons of both sexes are or are intended to be employed or in attendance, with proper separate accommodation for persons of each sex.

(2) The secretary of state shall, by special order, determine what is sufficient and suitable accommodation within the meaning of the section.

389. This section only applies to those parts of the country in which the analogous provisions of section 22 of the Public Health Acts Amendment Act, 1890, and of section 38 of the Public Health (London) Act, 1891, do not have effect. A special order was issued by the Home Office in February, 1903. While this order strictly only applies to those districts in which the provisions of the Factory Act have effect, it may be regarded as prescribing the minimum conditions which are generally considered as sufficient and suitable. The order includes the following provisions:

(a) Not less than one sanitary convenience shall be provided for every 25 females.

(b) Not less than one sanitary convenience shall be provided for every 25 men; provided that—

(i) Where the number of males exceeds 100 and sufficient urinal accommodation is also provided, it shall be sufficient if there is one sanitary convenience for every 25 males up to the first 100 and one for every 40 after;

(ii) Where the number of males exceeds 500, and proper supervision and control is exercised by a special officer, one convenience for every 60 men need only be provided in addition to sufficient urinal accommodation.

(c) The accommodation must be so arranged and maintained as to be conveniently accessible at all times to all persons employed.

(d) Every sanitary convenience must be kept in a cleanly state, sufficiently ventilated and lighted, and must not communicate with any workroom except through the open air or through an intervening ventilated space.

(e) Every sanitary convenience must be under cover and so partitioned off as to secure privacy, and if for the use of females must have proper doors and fastenings.

(f) Where persons of both sexes are employed, the accommodation for each sex shall be so placed that the interior shall not be visible, even when the door of a convenience is open, from any place, where persons of the other sex have to work or pass; if the conveniences for one sex adjoin those for the other, the approaches must be separate.

390. In some new factories or in isolated situations the most approved system of drainage and construction can not be carried out, and recourse must be had to pail closets; in such cases the accommodation should be at a higher rate in relation to the number of workers employed than the rate set out above unless proper arrangements can be made for daily scavenging (out of working hours).

391. Whatever the arrangements made it is of the utmost importance that a high standard of cleanliness should be maintained; especially at the present time this must be regarded as one of the essentials for the maintenance of the health of women workers, many of whom are new to industrial conditions. It will generally be found desirable, if not essential, to appoint some one to be responsible for proper supervision and maintenance. At one time provision for women was often unsatisfactory, largely, no doubt, owing to the rapid increase in their numbers and to their employment in many factories for the first time. Now, however, conditions are better and the need for proper provision and maintenance is generally recognized. While there has probably been an improvement also in the provision for men, it is in some places still highly unsatisfactory. Thus Dr. Agnew reports of the factories in one district which he visited—

The appalling condition of the sanitary accommodation calls for immediate action. In some cases the provision is insufficient, and almost everywhere the condition of such conveniences as are provided is so revolting that it is impossible to describe. They are also commonly situated in almost inaccessible places, the approach to which is particularly dangerous at night.

Conditions such as these should obviously be reformed at the first opportunity.

WASHING FACILITIES AND BATHS.

392. Under the Factory Act and the regulations of the Home Office and Ministry of Munitions the provision of washing accommodation is only required where workers are engaged on processes in which poisonous materials such as lead or TNT are manipulated. Though provision is most needed where poisonous substances are used or where heat, dust, or dirt are present to an unusual degree, there is a general agreement that washing is beneficial to the health and efficiency of all workers and that facilities should be provided wherever possible. Account must also be taken of the effect upon the self-respect of the worker, who is able to leave his employment clean and tidy. There is the mutual discomfort of the association with his fellow travelers of a man who returns home straight from work from some dusty or dirty employment. Lastly, there is the relation of cleanliness to good health and personal efficiency, a relation which is sufficiently obvious to make emphasis unnecessary.

393. There is ample evidence of the desire of workers for a more extended provision. Thus a representative trades-unionist stated, in evidence before the committee, that—

Material improvements in the arrangements for washing are desirable. It would be a great help if a worker could have the opportunity for really washing up and putting himself in a condition to go out with his family without having to return home first. Anything in the nature of evening recreation is rendered almost impossible if a worker has to travel all the way home, perhaps right through the city, and get cleaned up before returning to the city with his family.

394. The reports upon the medical examination of individual workers contain frequent references to the desire for better facilities. Thus—

In the bullet department there are only nine basins with cold water and nail-brushes provided for 130 girls, 30 of whom handle lead. Soap can nominally be obtained from the forewoman, and towels, conspicuous by their absence, are supposed to be provided biweekly to each of two sets of basins. Complaints are made by foremen that towels, etc., are stolen, and the workers complain of lack of accommodation. Very little washing is done, I think, although the girls had their hands jet black. In another case washing facilities are quite inadequate, workers in some departments being unable to wash their hands at all before meals, though at most processes they become very dirty. Many state that they clean their hands with oil, though they are not supposed to use oil for this purpose; others wash their hands in the water running from their machines. Even those who handle lead do not always wash their hands before meals; these latter state that five minutes is allowed for washing, and that hot water is provided but no soap or towels.

395. Since this report was written there has been a marked advance in the washing facilities provided for women, but there is still room for improvement. Experience shows that when facilities for washing are provided and maintained in a decent state they are usually used; there may be a short period of inertia at first, but workers have not only no innate desire to be otherwise than clean, but soon bring influence to bear upon any of their fellows who do not avail themselves of the facilities offered.

396. While the general provision of baths can not be regarded as a practical proposal, there is no doubt that extended provision is highly desirable in the interest of health and efficiency. Provision is at present mainly limited to a few works covered by the Home Office regulations or where the processes involve strenuous work in a high temperature. When men are employed under condition of great heat, baths may prove an effective antidote to muscular rheumatism. It is unnecessary to emphasize the benefit and refreshment derived from a bath after work under strenuous conditions; where they are provided they are appreciated. Thus an employer has informed the committee that—

Spray baths are provided for the foundrymen, who number about 100. Tickets can be bought at the rate of 10 for 3d. [6.1 cents]; this charge includes the use of towel and soap. Seven minutes out of working hours are allowed each man in the foundry to wash thoroughly before stopping time. Though the foundrymen are not in any way specially selected they use the spray baths greatly, especially in summer.

397. The need for baths is undoubtedly accentuated by the limited facilities for washing generally available in the worker's home. A representative of the National Federation of Blast Furnacemen has informed the committee that not more than 5 per cent of the members of his union have a house with five or six rooms and a bath. "In Lancashire and South Yorkshire many are living in houses of three small rooms with no scullery. Considering the dirty state into which the men's bodies and clothing get when working, baths should be general." The need for baths is also much felt by women living in lodgings, many of whom have come from good homes. In some districts considerable use is made of public baths. Unfortunately there are frequently no public baths within easy access, or they are not open at hours when they can be used by munition workers. While the inadequacy of the housing accommodation available for his workers is not a matter for which the employer can ordinarily be held responsible, yet it is one which he can not altogether neglect in determining what is necessary to secure their health and efficiency.

WASHING FACILITIES.

398. *Lavatories.*—It is of the greatest importance that attention should be paid to details of construction. Frequently the details seem to have been left to a building contractor with no special knowledge of the hard usage to which fittings are subjected under the conditions of industrial life; as a result lavatories, though adequate when new, may quickly fall into disrepair. Separate basins, originally provided with plugs attached by chains, are found with the chains broken, the plugs lost, and the waste pipes stuffed up with rags. Walls against which basins are fixed, unless protected by an enameled surface, soon become splashed with soapsuds, and present an uninviting aspect which can not be easily or quickly improved. Waste pipes are often too narrow for convenient cleansing, or contain sharp bends and angles, and consequently become blocked or broken.

399. Sufficient provision must be made for draining the lavatory floor, which, if not properly constructed, becomes uneven and the site of pools of dirty water. The floors should be smooth, hard, impervious, and properly sloped and graded. Nailbrushes and soap, even though frequently renewed, disappear, and thus involve a constant source of annoyance and expense. These troubles may be

largely overcome by adhering to certain principles in construction. The installation should be—

- (a) As simple as possible in construction and arrangement;
- (b) Strong and durable, able to withstand considerable wear and tear;
- (c) Sufficient and suitable in accommodation so that a large number can wash together or in a short time;¹

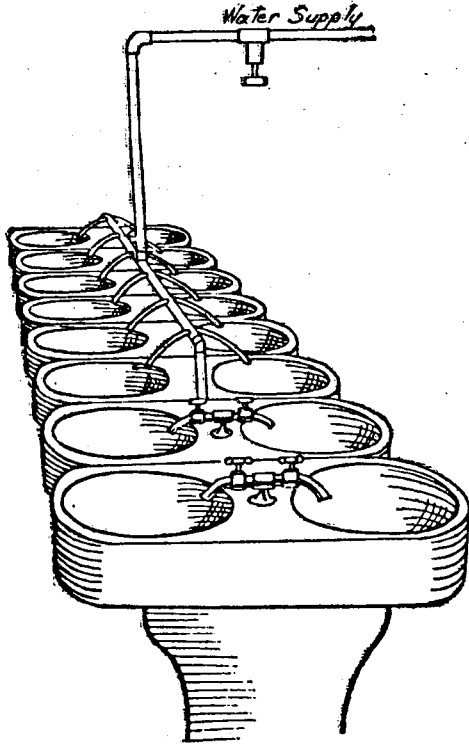


FIGURE 1.

Here the necessary plumbing is reduced to a minimum; there is no plug; washing is done under a spray of water; the waste pipe opens directly over the drain; and the drain itself is flush with the floor, which is sloped toward it. The trough stands in the center of the

- (d) Economical in space;
- (e) So constructed that it can be easily cleaned, and contain a minimum of removable or detachable articles;

(f) Basins, if provided, should not be too small and should not have grooved rims;

(g) Provided with an ample supply of water (hot and cold);

(h) So situated in the factory as to be readily accessible; and

(i) Well lighted, thoroughly ventilated, and kept at a reasonable temperature.

400. Where difficulties arise in regard to the use of ordinary lavatory basins, they may in certain cases be overcome by using such a washing trough as that illustrated in figure 2.

¹ The standard adopted under factory regulations is as follows: The washing conveniences should be under cover and maintained in a cleanly state and in good repair. There should be either (a) a trough with a smooth, impervious surface (fitted with a waste pipe without plug), and of such length as to allow at least 2 feet for every five persons, and having a constant supply of water from taps or jets above the trough at intervals of not more than 2 feet; or (b) at least one lavatory basin for every five persons, fitted with a waste pipe and plug, or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on, and a supply of hot water always at hand when required for use by persons employed.

room, free from the walls, and the wall space can be used for cloak-room accommodation, whether hooks or lockers. A useful modification of the water supply is to have only two spray taps for occasional use and a series of flush holes in both sides of the water pipe, the supply to which is controlled by a cock on the far side of the taps. This cock is turned on just before the operatives come to wash at the close of each spell of work. Arrangements can be made for controlling the temperature of the water. Where space is limited, say near the exit of a big engineering shop, a more compact installation may be used. This may take the form of a large circular basin with spray

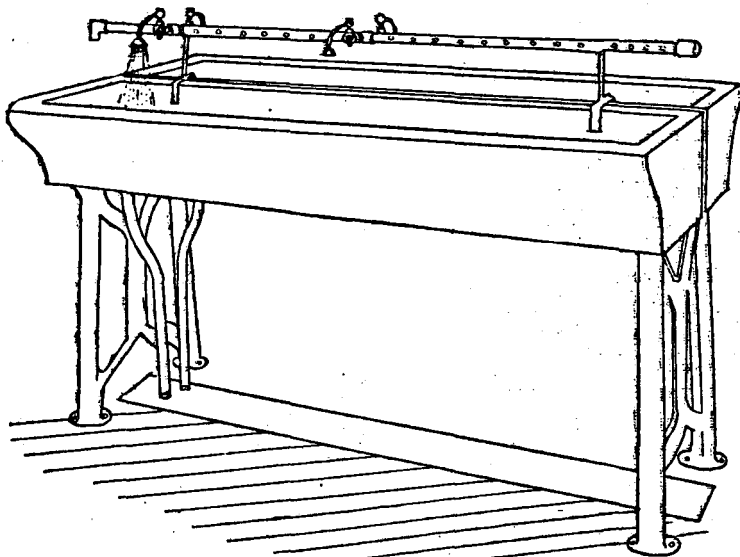


FIGURE 2.

taps radiating from a central supply pipe coming down from above and with an open pipe in the center for carrying off the waste water to a drain in the floor, as shown in figure 2. Wherever spray taps are used, advantage is gained by so arranging the height and position of the taps that a douche bath for the head, neck, and arms can be taken if desired.

401. *Nailbrushes*.—The difficulty occasioned by the disappearance of nailbrushes may be overcome by having large brushes made and fixed in position so that they can drain into the trough. In use the hand is rubbed against such brushes instead of the usual reverse process. In a number of factories stout nailbrushes are provided attached to the washing troughs by chains; and, on the whole, this plan appears to work satisfactorily.

402. *Soap*.—Soap may be supplied economically in small boxes, kept locked and fixed in convenient positions above the trough, say on or near the water pipe; the soap, of the consistency of butter or jelly, is obtained by inserting a finger into a round hole in the bottom of the box. Soap for use in this way can be obtained in powder form,¹ which sets to a jelly on the addition of water; by buying soap thus in powder form the cost of carriage is diminished. Alternatively the soap may be served out as powder placed in a flour dredger chained to the trough. If this latter plan is adopted care must be taken to prevent the holes getting clogged with wet powder. Another plan is to make the powder into blocks and then to cut it into small cubes just sufficient for one "wash." One point, however, should be borne in mind—the natural oil of the skin and hair may be removed by the use of strong alkaline soaps; if such soaps are used, as may be necessary to cleanse hands soiled with oil and grime in engineering works, then some ointment, glycerine, or lanoline should be employed after washing to restore the suppleness of the skin. Without this precaution the skin may become dry and cracked, and so be unable to resist bacterial infection, when dermatitis results.

403. *Towels*.—The supply of clean, dry towels should be adequate; for this purpose it is desirable that (a) a towel at least 5 square feet in area should be provided for each worker, and should be renewed or washed daily; or (b) one roller towel fastened in position, at least 15 square feet in area, should be provided for every three workers, and should be renewed or washed daily; or should be provided for every nine workers, and should be washed or renewed after every mealtime and at the close of the day's work.²

The provision of separate towels is preferable, and is made in national filling factories, partly because the danger of infection is minimized, and partly because each worker thus obtains a dry towel. They should be numbered or otherwise separately marked.

404. *Mirrors*.—A mirror is desirable, especially for women.

BATHING FACILITIES.³

405. *Baths*.—For men, the simplest and at the same time the cheapest and most efficacious installation is that of shower or douche baths. In comparison with other types, a shower bath economizes space, time, and water, and possesses the advantage that the stream of water is constantly clean. Moreover, the stimulating effect on the skin of the falling water is greater than is obtained by total immersion. Douche baths have been strongly recommended for use by coal miners,

¹ Such soap is prepared by Messrs. Lever Bros., Port Sunlight, Cheshire.

² These suggestions are identical with the requirements of the Home Office order for the manufacture and decoration of pottery.

³ Reference may usefully be made to the report of the departmental committee on washing and drying accommodation at mines. (Cd. 6724, 1913.)

and have been installed with success in many factories (see figs. 3 and 4). For women, ordinary shower baths are unpopular, because of the difficulty of keeping the hair dry or of drying it after bathing; a horizontal spray fixed at the level of the shoulders, or obtained from a movable nozzle or ring on a flexible tube, may meet this objection. Such an arrangement may also be found preferable for men.

406. *Cubicles*.—The cubicles in which the baths are placed should be arranged to secure privacy. In order to reduce the time which each worker spends in the cubicle it may be possible to arrange for the workers to dress and undress in a separate compartment, but at any rate in the case of women some provision for dressing, includ-

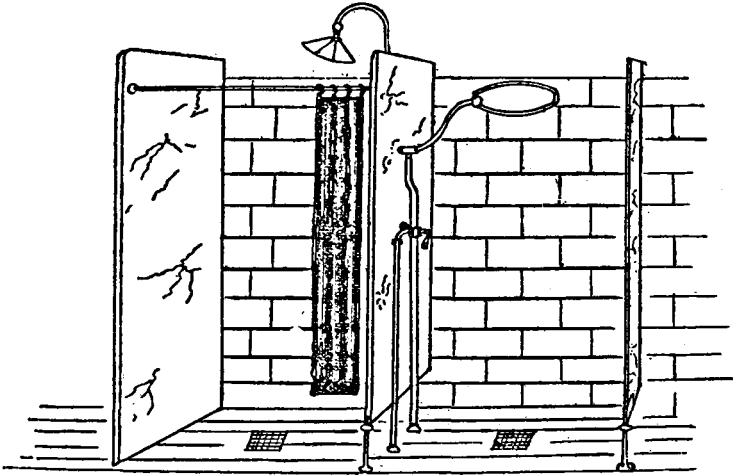


FIGURE 3.¹

ing a seat and pegs, must be provided inside the cubicle. Where this is done the size of the cubicle should not be less than 3 feet wide by 4 feet deep. The walls should ordinarily not be less than 6 feet high. A space should be left between the floor and the walls of the cubicles sufficient to permit of drainage and cleaning.

407. *Cleaning*.—The building and fittings should be so constructed as to facilitate the maintenance of absolute cleanliness. Square corners, ledges, or rough inner surfaces should be avoided. Wood should be used only for seats, and for this purpose hard wood should be employed with spaces between the wood for ventilation. The walls and partitions (and this applies also to lavatories and sanitary conveniences) should always have smooth and curved surfaces which

¹ From a design by Messrs. Doulton & Co.

can be readily washed down and which can not be used for writing on. Enamel tiles and bricks or enamel metal sheets may be used for this purpose; any initial cost thus incurred is soon recouped by saving in cleaning and lime-washing.

408. *Water.*—The water used should, of course, be clean and should not be liable to cause injury to the health of the workers or to yield effluvia. It will generally be found preferable for the temperature of the water to be regulated by an attendant rather than for the temperature of each bath to be regulated separately by the worker. A

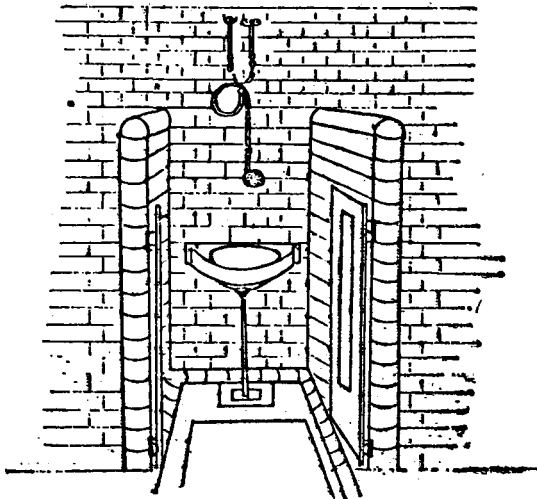


FIGURE 41

temperature of about 100° F. is usual. A thermometer should be placed in a convenient position for noting the temperature of the water.

409. *Soap and towels.*—A simple and economical method of supplying soap is to provide small tablets sufficient for one bath. A convenient size for towels is 25 by 60 inches. When the baths are used by a large number of workers it may be

found convenient and economical to provide a small laundry for washing the towels.

MAINTENANCE.

410. The maintenance of any installation provided is as important as its construction. This should be made the definite duty of an appointed officer, who should keep the lavatory clean, control the supply of nailbrushes and soap, and arrange that dry, clean towels are available. Such an officer may also usefully be employed in attending to the sanitary conveniences, and in supervising the cloak-room. While the ultimate responsibility for upkeep must rest with the employer, it may be found, at any rate in the case of baths, that the worker can, with advantage, be encouraged to participate in the management by a special committee or otherwise. Since periodic baths are of special benefit to health and efficiency, it is desirable to allow workers time for bathing within working hours.

¹ From a photograph taken in a munition factory.

CLOAKROOMS.

411. The committee are strongly of opinion that the provision of cloakrooms is a matter of great importance to the health and comfort of workers, and especially of women and girls. If, however, full advantage is to be taken of them it is essential that they should be well equipped and adequately maintained.

412. Cloakroom accommodation in order to be satisfactory should comply with the following conditions:

(a) It should be conveniently situated not only for the workshop, but should also be close to the canteens, lavatories, and sanitary accommodation.

(b) It should provide a separate peg or locker for each worker, which should bear the worker's name or work number.

Hanging pegs should be at least 18 inches apart, and 24 inches is desirable; and may be usefully separated by a small partition. If economy of space is of importance, two horizontal rows of pegs may be provided about a foot apart, the pegs in each row being at least 24 inches apart, and the pegs in the lower row being placed midway between those in the upper row.

Lockers may be made in metal openwork in preference to wood to allow free circulation of air.

Another alternative is to arrange for the suspension of the clothes from the roof of the building by rods which can be raised to the roof and fastened securely in position.

(c) There should be ample space for changing clothes and boots.

(d) Provision should be made for drying wet outdoor clothes in bad weather as well as the clothes worn for work at certain processes.

Steam pipes placed under the hanging pegs or lockers have proved useful for this purpose; care must, however, be taken, otherwise the damp clothes steam and become more objectionable than if spread out in the open air and allowed to dry. Ample space and ventilation are required between the pegs or in the lockers. Where pegs are used the clothing should not hang against a wall or wooden partition, but provision should be made for ventilation behind the clothing by covering the walls with laths or strong wire netting so that the clothes are kept at least an inch from the wall.

(e) A high standard of cleanliness should be maintained, and all practicable precautions should be taken against vermin.

(f) Cloakrooms should be thoroughly ventilated.

(g) Cloakrooms should be in charge of an attendant, and means taken to prevent petty pilfering and theft.

SECTION XVI.—SEATS, WEIGHTS, CLOTHING, DRINKING WATER.

413. The committee have not made any detailed laboratory study of methods for eliminating fatigue in regard to industrial machinery, lifting tackle, motion, etc., or of the application of American schemes of "scientific management" to factory conditions in this country. They have regarded such studies, important though they are, as lying outside their reference. There are, however, certain matters intimately affecting the health and efficiency of the worker to which some brief reference should be made.

SEATS.

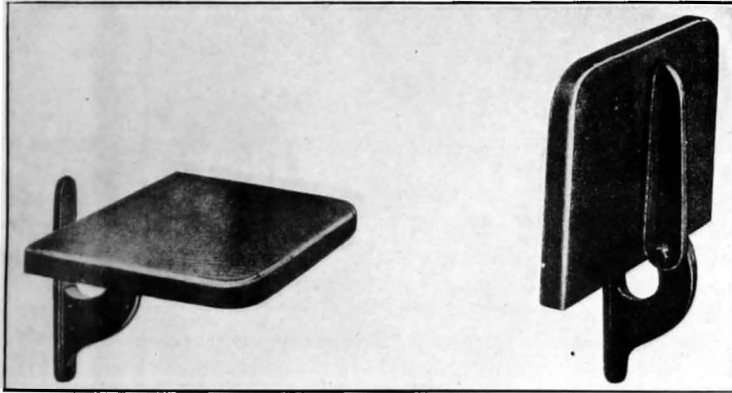
414. Fatigue and ill health and consequent loss of time and output are often due among women and girls to prolonged standing. The following extracts from recent reports emphasize the point:

Women here are employed on 30 different processes on lathes, milling and drilling machines, chiefly on shells weighing 130 pounds in the rough and 90 pounds when complete. Certain operations, e. g., nose blending, are difficult and arduous. * * * What renders the operations most trying is the lack of seating accommodation.

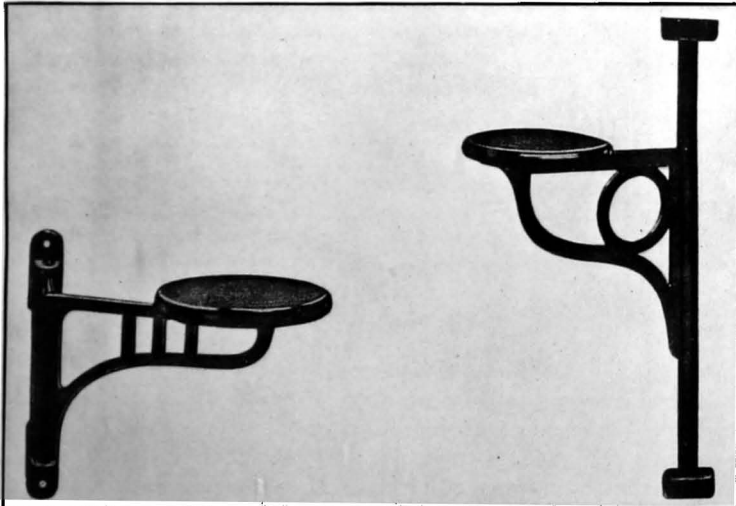
Many of the women and girls complained that they could not sit down even when waiting for work, as no seats were provided and they were not allowed to sit. One chair in the welfare supervisor's room is supposed to be for girls' use, but they have never used it. At night this room is locked up and a girl who is taken ill has to sit on a chair in the cloakroom until it is light enough to go home.

415. The Factory Act does not require seats to be provided for workers such as is the case for shop assistants under the Shops Act, 1912, but the secretary of state has now power under the Police, Factories, etc. (Miscellaneous Provisions), Act, 1916, section 7, to make an order requiring an employer to make reasonable provisions for "the supply and use of seats in workrooms." No order¹ has as yet been made under this section, but in a general order made in December, 1916, governing the employment of women at night on wool combing a condition was inserted that "the employer shall provide suitable

¹ On Apr. 23, 1918, the Home Office published a draft order requiring the provision of facilities for sitting for all female workers employed in any process in turning or machining shells or shell bodies.

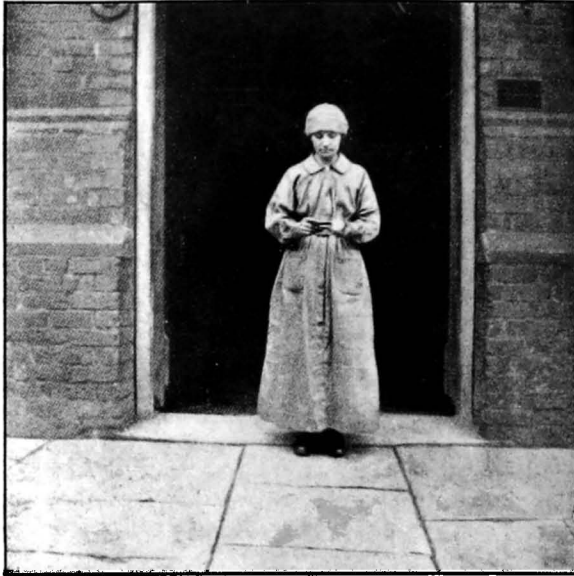


NO. 1.—FOLDING SEAT TO SCREW TO WALL OR PARTITION.

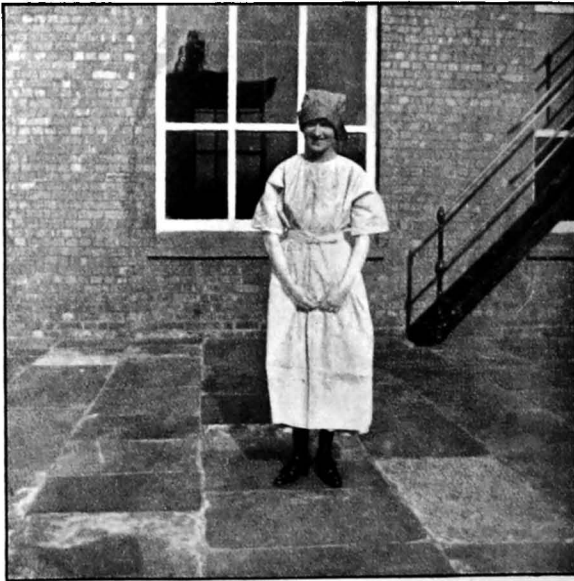


NO. 2.—SWING SEAT TO SCREW TO LEG OF TABLE, AND WHEN NOT IN USE TO SWING UNDER TABLE.

NO. 3.—SWING SEAT WITH IRON PILLAR SUPPORT TO SCREW UNDER TABLE IN ANY POSITION, AND WHEN NOT IN USE TO SWING UNDER TABLE.



1



2

TYPES OF PROTECTIVE CLOTHING.

seats for the use of women and girls at times when their work is not in need of attention."

416. Though opportunities for sitting are being provided to an increasing extent there are still a number of employers who hesitate to provide such facilities through fear that they will be abused. Experience, however, can not be regarded as justifying this fear. It should be explained that the object of the provision of seats is not to secure that all work should be done seated, since a sedentary life has its own disadvantages, but rather that means should be provided for varying the position wherever possible and for occasional use when the work necessitates a standing position. There are many types of munition work in which for a considerable proportion of her time the worker is simply standing by watching her machine, which she could do sitting equally well. In almost all the munition work which must be done standing pauses occur while the worker waits for the readjustment of the tool or some slight repair or is held up for material or for some other reason. During such pauses the workers should be allowed to sit. The need for such seats is often felt more at night than by day. Much ingenuity has been shown in providing seats which occupy little space. At the machine it is often practicable to fix a seat or bar at the side of the lathe; a flap seat attached to the wall or pillar; a leather strap may be hung between the machines or other fixtures; or a suitable form of high stool provided for use while at work with or without caster wheels.

417. The intervals between spells of work should be times of real rest and recuperation. This can not be obtained on the wooden forms without backs in canteens or mess rooms, which are too often the only seats provided. Forms with backs or chairs are generally much to be preferred. In addition comfortable chairs for women who may be overtired or faint should be provided, preferably in a rest room adjacent to the surgery. A brief rest under the supervision of the nurse frequently enables a woman or girl to return to work recuperated for the remainder of the spell.

WEIGHTS.

418. Admittedly women and young persons are physically weaker than men. Apart from this they are more liable to strain from the lifting of weights and other analogous operations which involve sudden muscular efforts. The matter is one of special importance at the present time owing to the large number of women now employed in munition works and the rapidly increasing extent to which they are being employed to replace men on "heavy" operations. The following tables are of interest as conveying some indications of the

amount of the weights handled in certain operations connected with the manufacture of 18-pounder and 4.5-inch and 6-inch shells:

Operation.	Output of shells per lathe per hour.	Approximate weight handled by operator per hour.	Operation.	Output of shells per lathe per hour.	Approximate weight handled by operator per hour.
18-pounder high explosive shell, Mark III:		<i>Pounds.</i>	4.5-inch high explosive shell, Mark VII—Contd.		<i>Pounds.</i>
Finish recess.....	60	1,807	Face base.....	48	2,592
Turn band.....	48	1,466	Turn band.....	30	1,650
Face base to weight.....	40	1,197	Thread mill.....	30	1,650
Thread mill.....	30	889	3.6-inch high explosive shell, Mark XII:		
4.5-inch high explosive shell, Mark VII:			Cut-off.....	10	3,000
Center.....	60	2,840	Center.....	20	6,000
Base to length.....	24	1,686	Rough face base.....	15	3,195
Face to weight and rough recess base.....	18.4	1,012	Recenter.....	30	6,120
			Turn band.....	24	4,044
			Thread mill.....	30	5,040

419. The framers of the tables give the following explanation in regard to them:

The weights on which the entries in column 3 are based were obtained by actually weighing each shell before and after each operation in a typical factory. The entries given were obtained by adding the weights of the shell before and after each operation and multiplying by the number of shells turned out per hour.

The actual amount of work done in handling these weights depends upon the methods employed. These methods vary in different factories with the operation and the type of shell. In some cases the heavier shell are only handled by men, laborers lifting the shell in and out of the lathe for the girls; or lifting tackle of one type or another may be provided. Sometimes also there are tables along which the shell may be rolled so as to obviate the necessity for lifting the shell from the floor to the lathe at each operation. A detailed inquiry into the methods prevailing at individual factories would be necessary in order to calculate the actual work done in each case. As an illustration: The work done per hour in lifting the shell bodies from the floor to the lathe (assuming no lifting tackle to be provided and the height of the lathe from the floor to be 3.5 feet) for the operations of centering and boring is given below.

[Foot-pounds per hour.]

Shell.	Boring.	Centering.
18-pounder.....	350	8,866
4.5-inch.....	367	4,970
6-inch.....	902	10,500

420. As the result of his inquiries into the causation of industrial accidents Dr. Vernon writes as follows in regard to the incidence of accidents due to strain:

At factory A the cuts, burns, and eye accidents were only a fourth to two-thirds as numerous in women as in men. This depended on the less risky

character of their work. The sprains, on the other hand, were 47 to 83 per cent more numerous in the women than in the men, or taking the other accidents as a standard, one may say that sprains were relatively three times more numerous in the women than in the men. The majority of these sprains were wrist sprains incurred in pushing home the lever which clamped the fuse part in the lathe. Evidently this clamp was designed for men with stronger wrists, and it would be quite easy by lengthening or otherwise altering it to make it more suited to the weaker wrists of the women. Thereby a considerable number of these sprains would be prevented, and a by no means negligible amount of wasted time be saved.

In that the work at factories B, C, and D was very similar in character, one would expect to find similar ratios between the women's and men's accidents. The sprains were nearly twice as numerous in the women as in the men at factories C and D, where 9.2-inch and 15-inch shells were made and showed a similar excess at factory B where 6-inch shells were made. Hence, it is probable that the liability of women to sprains is inherent and can not be altogether avoided by more suitable mechanical appliances.

421. Apart from the provisions of the employment of children act, 1903, which only apply to children up to the age of 14, there are no legislative provisions imposing restrictions on the weights which may be lifted by workers. The matter was considered by the departmental committee on accidents, who reported—

The danger of internal injuries to women from lifting heavy weights is a matter of great importance. To lay down, however, any detailed and definite provisions on the subject seems impracticable, as so much depends on individual cases and circumstances. The position in which the weight to be lifted lies, the shape of the burden, the manner of carrying it, the place in which it has to be carried, are all important factors. We suggest, however, that there might be some advantage in a general provision with regard to women similar to the provision in section 3 (4) of the employment of children act with regard to children. A provision that a woman shall not be employed to lift, carry, or move anything so heavy as to be likely to cause her injury might be useful, chiefly, perhaps, in calling the attention of occupiers to the matter and strengthening the hands of inspectors when dealing with cases in which they judged women liable to injury from this cause.

422. The Home Office, however, in their general order of September, 1916, prescribed that "a woman or young person should not be allowed to lift, carry, or move anything so heavy as to be likely to cause injury to them." The weight which can safely be lifted depends not only on the physique of the worker but on the position in which the weight lies, its shape, the manner of carrying it, and the place to which it has to be carried. Again, much depends on the acquisition of knack. Given, however, reasonable conditions and a good physique, women and girls over 18 have been found able to handle weights up to 50 pounds in the ordinary course of work without difficulty. Such a weight would, of course, be too great for women of less than normal strength, or if the weight is of awkward bulk or has to be raised to a special height.

423. If weights are properly adjusted to physical capacity, experience suggests that a woman can frequently perform as much work as a man owing to her capacity for quicker movement and sustained work. In order to prevent strain and to secure the best results attention should be paid to the following among other points:

(a) Adaptation of the size and shape of the burden.

(b) The provision of labor-saving appliances, such as overhead cranes or inclined planes.

(c) The size and shape of boxes, trolleys, or other receptacles and vehicles.

(d) Long handles and other methods of reducing leverage.

(e) Methods of reducing the height through which weights have to be raised—e. g., by the provision of benches for the temporary storing of shells by the machine.

(f) Instruction in the knack of lifting weights.

(g) Limitation of hours of employment.

(h) Careful selection of workers.

424. If adequate attention is paid to these points experience shows that dangers of straining can be very largely obviated. As showing what may be done the following report is of interest:

Women are engaged in making and finishing crucibles. The heaviest handled by one woman alone weighs 57 pounds. Lifting is intermittent, occurring in the intervals of manufacturing work. The girls have been carefully chosen for their good physique and appeared to lift the crucibles with complete ease. Thus of one factory it is reported that "the forewoman took pains to instruct the girls in the right way of handling the heavy crucibles. She said some required considerable instruction how to carry, as they often began by attempting to do the whole work with their forearms and wrists, bringing no other muscles into play and consequently quickly exhausting themselves, but practice soon helped them over this difficulty. If a girl could not acquire the knack of right handling she hurt herself and injured the crucibles and was taken off that work."

PROTECTIVE CLOTHING.

425. For women and girls protective clothing is essential where risk to health is involved from—

(a) Dust, dirt, or wet.

(b) Acid burns.

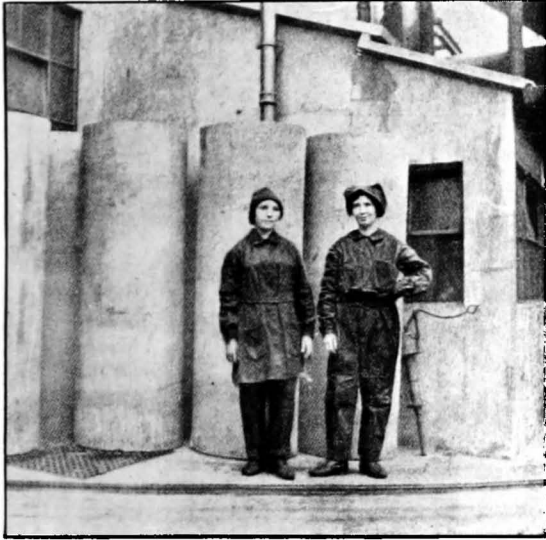
(c) Dangerous machinery.

(d) Work involving climbing.

(e) Exposure to excessive heat.

(f) Exposure to inclement weather.

426. Protective clothing is desirable for all women and girls. It adds to their smartness and neatness, and so to the general appearance of the factory. It also aids discipline and promotes esprit de corps.



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TYPES OF PROTECTIVE CLOTHING.



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TYPES OF PROTECTIVE CLOTHING.



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TYPES OF PROTECTIVE CLOTHING.



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TYPES OF PROTECTIVE CLOTHING.

427. There are four main types of costume¹—

(a) The overall dress, for general factory wear (see illustrations Nos. 1, 6, and 15).

(b) The trouser or knicker suit with tunic, for outdoor work, climbing ladders, etc., or for very dirty work (see illustration No. 11). These suits are not suitable for machine workers as the ends of the tunic are apt to catch in the machinery.

(c) The boiler suit, for dangerous work where close-fitting clothes are essential for safety (see illustrations Nos. 14 and 18).

(d) The impervious apron and bib, worn with either the overall dress or the trouser suit, for protection against wet, oil, acid, or the wear and tear of friction (see illustrations Nos. 5, 7, 13, and 16).

428. With the costume a cap should be worn for protection against dust and dirt, for safeguarding the hair from dangerous machinery, and for keeping the head dry out of doors. Accessories, such as gloves, veils, clogs, or respirators, are also necessary in the cases of certain processes, especially where there is a risk of fire or of poisoning from dust or fumes.

429. The proper selection of materials is important. Woolen materials are less inflammable and more durable than cotton, but for general use cotton materials such as drills, dungaree, or (when thin material is required) jean or linen are suitable. For resistance to moisture good waterproof cloth, oiled or American cloths, are obtainable. Aprons can be obtained of these materials, also of rubber or leather. Sound acid-resisting materials can be had for aprons, leggings, and clogs, also oil-proof materials for protecting machinists from the lubricating oil which penetrates ordinary clothing. For outdoor wear in wet weather a mackintosh or perhaps preferably a good woolen coat, trousers, and sou'wester hat, with leggings and strong boots are frequently provided. A corduroy suit is also suitable for all weathers, and is very durable. In some cases a mackintosh coat to wear over the cotton drill trouser suit may be enough. In explosive factories (except national factories) the clothing must be approved by the chief inspector of explosives at the Home Office, who supplies particulars respecting materials and fireproofing. The Ministry of Munitions give advice for other explosive and filling factories.

430. Protective clothing for men and boys is equally important, especially when they are engaged in processes involving exposure to dust, dirt or wet, acids or alkalis.

¹ These types of costume are illustrated and described in the Ministry of Munitions Journal for May, 1917, pp. 183, 184, as well as in a special leaflet issued by the ministry with the concurrence of the Home Office; this leaflet contains particulars of various types of costumes, gloves, boots, etc., which can be purchased through the explosives supply department, 37-41, Old Queen Street, Westminster, S. W. 1.

A memorandum on Protective Clothing for Women and Girls has been issued by the Home Office, illustrating different types of costume; a schedule is added stating in detail the type of costume suitable for different types of employment. The memorandum may be purchased through the usual channels.

431. Protective clothing should be provided by the employer. The cost of caps and overalls (within a maximum limit of price), at the rate of two to each woman worker, is allowed as a working expense for the purposes of Part II of the munitions of war act, 1915, and the rules thereunder. The employer should also be responsible for washing, mending, and renewing the clothing.

DRINKING WATER.

432. The committee consider it unnecessary to elaborate the reasons why an adequate supply of good drinking water should always be available in the factory. The following extract from a recent report issued by the United States Public Health Service is of interest:

Since so much body water is lost under conditions which provoke free perspiration, it is important that an ample amount of water be drunk to replenish the tissues thus deprived of their normal water content. Without this, their proper functions will be hampered and health and efficiency can not be expected. The worker should be furnished with an abundant supply of water, together with drinking facilities which are clean, attractive, and placed so as to be conveniently accessible at all times. The water should never be below 55° F. in temperature, as the drinking of cold water is likely to cause gastrointestinal disorders. The jet sanitary fountain is the best drinking facility. Though under ordinary conditions the amount of heat lost in bringing the temperature of water up to that of the body is small, this amount, by judicious drinking, can be increased. Water should be drunk in small quantities and at frequent intervals, not in large quantities at infrequent intervals.¹

433. An order² has recently been made by the Home Office under the Police, Factories, etc. (Miscellaneous Provisions), Act, 1916, section 7, under which, in all factories and workshops in which 25 or more persons are employed, provision shall be made at suitable points, conveniently accessible at all times to all persons employed, for—

(a) An adequate supply of wholesome drinking water from a public main or from some other source of supply approved in writing by the local authority of the district in which the factory or workshop is situated, which shall be either laid on or contained in a suitable vessel;

(b) (Except where the water is delivered in an upward jet from which the workers can conveniently drink) at least one suitable cup or drinking vessel at each point of supply, with facilities for rinsing it in drinking water.

434. Each drinking water supply shall be clearly marked "Drinking water." All practicable steps shall be taken to preserve the water and vessels from contamination.

¹ Public Health Reports, issued weekly by the United States Public Health Service; vol. xxxii, No. 50, Dec. 14, 1917. Washington: Government Printing Office.

² Statutory rules and orders, 1917, No. 1068.

SECTION XVII.—WELFARE SUPERVISION FOR WOMEN AND GIRLS.

THE NEED.

435. The war, and all the novel and strange conditions which it has created, has served to give a new perspective to many social problems, and to none more than to the problem of improving and maintaining the health of the industrial worker. The problem has many aspects, all of which have a direct or indirect bearing on the employee. There is the health of the infant and its mother, of the school child, and of the adolescent and adult worker. Regard must be had to mental good health as well as to physical. Apathy, lassitude, lack of interest in life may be as detrimental as physical ailments and defects and may equally involve an irreparable loss of efficiency. There is need not only for improved physical strength and power of endurance, but also for mental alertness, the development of individuality and the capacity for wise citizenship.

436. The committee are satisfied that the interests of employer and employed are in this respect identical. Apart from physical and mental health, the worker can not earn a sufficient livelihood or rightly use and enjoy its proceeds. Equally, the prosperity of industry is dependent upon the health and efficiency of the worker. Though the employer can not, as a rule, directly control some of the conditions, such as housing, that affect the welfare of his workers, there is yet much that he can do to improve and humanize the conditions of their employment.

(a) Preceding sections will have shown that the provision of a thoroughly satisfactory environment largely depends upon the initiative of the individual employer. Legislative enactments and statutory regulations, valuable though they are, can only prescribe minima. They can not take account of the varying circumstances of individual factories.

(b) Certain provision, e. g., of canteens, overalls, cloakrooms, lavatories, or first-aid appliances, may be of material benefit.

(c) Even though the provision is adequate and sufficient, constant care and attention on the part of the management are essential for effective maintenance. Though Government inspection can do much, it is necessarily intermittent and can not be sufficient in the presence of apathy or neglect on the part of the employer or workers.

(d) Regard must be had to the individuality of the workers and to the wide variations that exist in their physical and mental capacity and in their social circumstances and habits.

(e) Conditions of work may exist which are prejudicial to the health of certain sections of workers in the factory on account of the heaviness of the work or the conditions under which it is carried on. Partly on these grounds a wage system, though generally equitable, may cause unexpected hardship to particular individuals.

(f) Conditions prejudicial to health may arise through the existence of circumstances, causing avoidable irritation or discomfort either to the whole body of workers or to certain sections of them.

(g) The surroundings of the worker outside the factory also call for consideration. Account must frequently be taken not only of conditions of housing and transit, but also of circumstances peculiar to the social or family circumstances of individual workers.

437. As has been pointed out in Section II, it is no new phenomenon to industrial life in this country for employers to desire the promotion of the health and well-being of their workers, not only because such action may be profitable to themselves as well as for their workers, but because they recognize the right of the worker, as a fellow citizen, to be regarded not as a machine, but as a human being possessing an individuality of his own. Under modern industrial conditions the employer usually has neither the time nor, frequently, the experience to give the requisite personal attention to the many and complicated problems affecting the health and welfare of the workers. There has, therefore, been an increasing tendency, notably where women are employed, to appoint an officer specially for the purpose. This officer is generally designated "welfare supervisor" or "welfare superintendent." The idea underlying such appointments is not a new one, and it is of interest to note that in the summaries of the evidence given before the royal commission on labor, which was appointed in 1892, attention is drawn to the importance of securing a good moral tone among women workers. It is added—

In those cases where women overlookers or forewomen can be employed difficulties of this nature were obviated; hence, when this is possible, it was said to be a very desirable arrangement. Even where this is not possible, however, it was suggested that in all cases where a certain number of women are employed there should be a woman in a position of authority to whom all complaints concerning officials, health, sanitary arrangements, etc., can be brought in the first instance. The very natural dislike of women to approach men on these subjects was constantly brought forward by the witnesses. Were some carefully chosen woman put into this responsible position much of the danger and discomfort which is unavoidable under the present state of things would be removed and some of the chief difficulties connected with the employment of women would also disappear. This system is already adopted in a few of the best-regulated establishments.

438. Previously to the war, however, appointments of welfare supervisors were comparatively rare and were practically confined to so-called model factories or particular industries.

439. For the reasons given in Section IV, the stress and strain of the war have tended greatly to emphasize the importance of attention to all matters affecting health and welfare of women and adolescents. The appointment of the committee in September, 1915, afforded in itself striking evidence of the recognition by the State of the fact that it was a matter of national concern to secure that the personal health and physical efficiency of the worker were so safeguarded as to prevent not only immediate breakdown but permanent injury in the future. The employment of women in new industries, the number of women engaged for the first time in engineering works, their frequent employment in places remote from their own homes, and the increasing occupation of married women and young girls, have raised urgent problems which can not be neglected or overlooked. On the other hand, many of these problems could not be dealt with through the ordinary channels of factory management—at any rate, under war conditions—and special provision was necessary if the true causes of disability and discontent were to be ascertained and removed.

440. Such were the circumstances which led the committee in their memorandum No. 2 (Welfare Supervision),¹ which was prepared in January, 1916, to recommend that welfare supervisors should be appointed in all factories where women were employed. They recognized the risk involved in the rapid appointment of large numbers of persons of varying qualifications for the performance of new and largely undefined duties, but the urgency of the need made this inevitable. The policy recommended was that adopted by the welfare department shortly afterwards established at the ministry. The appointments of welfare supervisors have been made compulsory in all factories where TNT is used and have been actively encouraged in all munition factories. In this policy the committee had the cordial cooperation of the Home Office, who only permit women and girls to be employed at night where a welfare worker or a responsible forewoman has been appointed for their supervision. As the result, several hundreds of women welfare supervisors have been appointed during the past two years.

STATUS AND DUTIES OF WELFARE SUPERVISORS.

441. While the opportunities of useful work open to a welfare supervisor may be almost unlimited and can not in all directions be clearly defined, experience shows that it is essential that welfare supervisors should possess a recognized status and equipment and should have certain specified duties,² and, further, that they should

¹ Cd. 8151.

² A pamphlet on Duties of Welfare Supervisors for Women has been issued by the Ministry of Munitions (see Appendix J). Copies can be obtained on application to the ministry.

be directly responsible to the general manager, should act on instructions received from him and should refer to him direct on all questions of difficulty.

442. Before setting out the various duties which may be assigned to welfare supervisors, it may be well to enter a caution against certain misunderstandings which are liable to arise as to the aim and purpose of welfare supervision. In the first place, it will permanently succeed only in so far as it receives the support of the employer and employed alike, and it will fail in so far as any endeavor is made to conduct it in a spirit of patronage or superficial philanthropy. Secondly, any scheme of welfare supervision must be based on an adequate wage system. Without this failure is inevitable. Thirdly, welfare supervision is not intended to and can not replace trades-unionism. Welfare supervisors, if they are to be successful in removing adverse conditions, must be in sympathy personally with the workers and able to keep the employer informed of their circumstances and desires, both individually and collectively. They must not, however, interfere with the work of the trades-unions; they are, after all, the servants of the employer and can not as such be accepted as the authorized and official representatives of the workers, even as regards matters which affect only the conditions in the particular factory in which they are employed. Lastly, welfare supervision must not be regarded as in any sense a substitute for factory inspection by the State, whose duty it is to secure an agreed minimum of sanitation and safety in all factories equally and to enforce a standard of hours and of intervals.

443. What duties are allotted to any particular supervisor will depend to a considerable extent upon the circumstances of the factory and upon the age, circumstances, and characteristics of the workers. They will also in some measure vary with the capacity and status of the supervisor. The following include the principal duties which have been successfully undertaken in different factories:

444. (a) *Engagement of workers.*—The selection of women workers as regards their general suitability should be undertaken by the welfare supervisor, persons to be employed in a particular department being if necessary subsequently chosen by a foreman or other person responsible for the work from a technical standpoint. When workers are medically examined the supervisor should be informed of any physical conditions likely to affect their work. Whatever their exact duties in these respects may be, supervisors should always have an early opportunity of getting into touch with a new worker in order from the first to establish those personal relationships upon which the success of her work largely depends. A few words of friendly conversation may be of great assistance in making the new

workers appreciate the aim and the purpose of the work and in familiarizing them with their strange surroundings.

445. In the case of women and girls it is also important that the supervisors should be consulted as regards the character and general suitability as distinct from the technical qualifications of candidates for appointment as overlookers or forewomen.

446. (b) *Records*.—A record should be opened for each new worker containing information as to age, physical condition, home circumstances, etc. To this record should be added from time to time details of progress, ill health, broken time, and other matters likely to prove of value. Apart from their immediate purpose, such records may prove of material assistance in determining the suitability of the worker for other employment after the war.

447. (c) *Lost time, sickness, low output, incapacity*.—All such cases should be reported to the supervisor, whose duty it should be to investigate the causes, and, where practicable, to take steps to remove them. Experience has shown that abnormally slow work may be due to laziness, unsuitability or incapacity, and ill health.

448. (d) *Wages*.—Though the supervisor has no responsibility for fixing the wages, she should receive particulars of the wages earned by all workers, or, at any rate, by all those who fall below a certain level. The amount of the wage may afford a valuable indication of the progress of the worker. Further, low wages mean low output, and it is obviously important that the causes should be ascertained in each case. Low wages may be due to illness, fatigue, slackness, unsuitability of the worker for the job, difficulties of housing and transit, home troubles, and sometimes the inequitable operation of the wage system.

449. (e) *Dismissals or withdrawals*.—It is a common experience of industrial firms that large numbers of workers leave work for various reasons within the first few months of their employment.¹ This leakage represents a serious loss of efficiency, and all cases should be investigated by the supervisor. Departure may be due to ill health, change of residence, or marriage, or it may be due to general dissatisfaction, dislike of work, disappointment over wages, or a simple desire for change. Cases of proposed dismissal in particular should be carefully investigated in order to determine the real causes of trouble and to remove possible misunderstandings.

450. (f) *Working conditions*.—Supervisors should always be intimately acquainted with the working conditions in the factory (e. g., hours of work, wages, ventilation, heating, seats, lavatories, rest rooms and cloakrooms). Any complaints or representations should be fully and promptly investigated. In some instances the remedy

¹ See Appendix D.

for defects may lie within their competence. More often it will be their duty to bring them to the notice of the general manager or other officers, according to their nature or importance. These duties are fundamental, and the evidence shows that if wisely performed they do not, as has sometimes been feared, in any way undermine the authority of the foreman or other officials.

451. (*g*) *General discipline.*—As a rule the welfare supervisor is only responsible for the good conduct of the workers apart from their technical work; though she is free to visit the shops to supervise general behavior and to speak to individual workers, she is mainly concerned with maintenance of the necessary standard of conduct in the cloakrooms and lavatories, when going to and from the shops, and at meal times.

452. (*h*) *Night supervision.*—Specially close supervision of women and girls is needed at night, owing to the strain of the night shift and on moral grounds, and it should form an important duty of the welfare supervisor. Ordinary factory oversight is often more difficult at night than during the day and may become somewhat lax.

453. (*i*) *Home visiting.*—Where necessary and desirable, home visiting may be undertaken. Workers who are ill may be visited in order to ascertain that they are properly cared for—a matter often of considerable difficulty in crowded areas. Apart from this, visits may usefully be paid to the parents of the younger girls and the opportunity taken to discuss with them the merits and progress as well as the demerits of their children. Misunderstandings as to wages can be removed. Parents as a rule greatly appreciate periodical reports as to progress, conduct, and timekeeping. Minor offenses by girls can sometimes be better dealt with by the parent than through the factory organization.

454. (*j*) *Feeding arrangements.*—The supervisor should ascertain that workers are obtaining suitable and nourishing food, and that adequate and convenient facilities are available for its preparation, purchase, or consumption. Where mess rooms or canteens are provided by the firm the supervisor will often be charged with their direction.

455. (*k*) *Thrift and benevolent funds.*—The supervisor should assist in any scheme for encouraging thrift which may be established through war-savings associations or by other means. The arrangements, at any rate in the case of the younger workers, are generally most successful when organized in close connection with the payment of wages. They should be such as to attract those who are not naturally thrifty. The supervisor may also be called upon to assist with the formation of sick and benevolent funds among the workers, and may also be consulted as to applications for help from such funds.

The following account has been received of the benevolent fund established at Woolwich Arsenal:

This fund was opened in July, 1917. The absolute necessity for the existence of such a fund had for a long time past been one of my many aims. Over and over again I came up against the fact that with a fund to draw on I could do a great deal to help and ease those who were working under me in the arsenal. There are those who, through sickness of themselves or their families, get into financial and often absolutely unavoidable difficulties, as rent must be paid and children fed, even if the mother is laid up and unable to work. To secure this fund a huge fête was organized and when all expenses were paid there was a profit of £1,504 15s. 8½d. [\$7,323.04] in hand.

This fund does not allow gifts of money, except in exceptional cases; when a worker applies for assistance her case is thoroughly investigated, her home being visited by a supervisor, and a report sent in. If the case is satisfactory, a loan is granted, which has to be paid back at the rate of 2s. 6d. [60.8 cents] or 5s. [\$1.22] per week, without any interest being charged. No return is expected until the second pay day after the loan has been granted, and longer time is given if necessary. It is a rule that no claims for lost money or stolen purses or clothing are dealt with, the reason for this being obvious. During the six months, July-December, 963 applications for help have been received; of these 890 were granted assistance; this has meant an outlay of £1,388 8s. 11d. [\$6,756.87] and of this £319 9s. 8d. [\$1,552.41] has been repaid by small installments. All confinement cases are dealt with separately and not financed out of the benevolent fund at all.

The 890 cases assisted included temporary sickness involving absence for a week or more, 233; injury and back pay delayed, 101; surgical appliances, 37; absence through infection illness in the house, 39; sending sick children and husbands to convalescent homes and sanatoria, 81; assistance to new entries, 77; railway fares for holidays in distant places or in sudden emergencies, 56; purchase of boots, 43.

456. (l) *Training and instruction.*—Though supervisors do not usually themselves undertake the instruction of workers, they are frequently responsible for securing the establishment of suitable courses and for encouraging the workers to take advantage of them. At the present time special facilities for attendance at classes are not always easy to provide, though some firms have found it practicable to do so, while others have made arrangements for new workers to be instructed in the technical methods of the work they are to undertake and for them to be given a general outline of the aim and purpose of the work of the factory. Such instruction has proved to be valuable in promoting technical efficiency and in stimulating interest. It also affords an opportunity for determining the kind of employment for which the worker is likely to be best fitted.

457. (m) *Housing and transit.*—Supervisors should acquaint themselves with the facilities for housing available for the workers. It may be necessary to keep lists of suitable lodgings where this duty is not otherwise undertaken. The adequacy of means of traveling to and from the factory is a proper subject for the supervisor's at-

tion, as is also the consideration of local railway or tramway time tables in relation to the hours of changing shifts.

458. (*n*) *Recreation*.—Facilities for indoor and outdoor recreation are of extreme importance for the health and welfare of the worker. Where existing organizations are insufficient to meet the needs, the supervisor may have to take steps to secure some provision for organized games and evening clubs. Facilities for rest and recreation during intervals of work may prove of much benefit and be greatly appreciated. The conduct of arrangements for recreation should be so far as possible in the hands of the members themselves, and the position of the supervisor should, so far as possible, be one of advising rather than of controlling.

459. (*o*) *Cooperation with outside agencies*.—For an adequate performance of their duties it is essential that welfare supervisors should possess an intimate knowledge of the agencies—educational, social, industrial—outside the factory which are concerned with the life of the worker.

460. The duties outlined above, though mainly concerned with matters of health and individual welfare, are to some extent distinct from those usually intrusted to trained nurses or the medical staff engaged to render first-aid or subsequent treatment of accident and sickness. The advantage, however, of bringing the work of the nurse into touch with that of the welfare supervisor is manifest, and in suitable cases the duties of a welfare supervisor of women and girls may be properly undertaken by the nursing staff—increased and, if necessary, reorganized for the purpose. When the numbers are small and full-time service is not required the duties of a welfare supervisor may be undertaken by an existing member of the staff who possesses special qualifications for the work and is given the time and status requisite for their proper performance.

461. The following statements will afford some indication of the present purpose and scope of welfare supervision among women. Thus, a leading munition firm writes:

The welfare work has been organized on broad lines and its development left to the individual views of the management and welfare staff concerned in accordance with the special requirements of each factory or department and the nature of its work. Its aim has been to relieve the pressure of industrial life and protect the workers' interests both individually and collectively. The general policy has been to study, adapt, and improve existing conditions of labor on such practical lines as may be suitable to the requirements of the workers concerned, with a view to future progress and development. The North Country workers are more independent in spirit and advanced in thought than southerners, and strongly resent any suggestion of patronage or interference with their liberties; in consequence, the welfare worker must adapt herself to their requirements and not expect them to readily accept her views. The qualities most necessary to a successful welfare worker are good health,

common sense, justice, loyalty, love of humanity, and a sense of humor, and any training which has inculcated habits of discipline and application is very desirable, more especially shop training. The management do not allow the welfare workers to deal with any labor or wages questions or rates of pay, as they consider it essential that these should remain in the hands of the management.

Every female candidate applying for employment at these works is taken on through a labor bureau, who interview every girl and obtain reference as to character. In addition, each girl is examined by a trained nurse prior to being engaged. Should the nurse be doubtful about the physical suitability of the candidate, the works doctor is asked to decide.

462. A departmental supervisor at this factory describes her duties as including—

Engagement of labor.—Requisitions from foremen as to number of girls required, type, and class of work; interviewing girls recommended by foremen, forewomen, or other workers, and placing those approved in touch with labor bureau; change of work, if unsuitable, arranged with the concurrence of the foreman concerned; transfers to another department arranged, if desirable, and approved by foremen and supervisors concerned; restarters interviewed and approved or sent to doctor or labor bureau for medical report; signing on new starters, impressing them with the reputation of the shop for good work and conduct, and giving them useful hints; interviews with labor bureau respecting matters concerning employment or reemployment of women.

General.—Reporting to the departmental manager, as and when required, on any questions connected with shop discipline, and seeking his advice if any extreme difficulty or question of principle arises; consulting with shop managers and taking instructions on all matters concerning shop discipline; interviewing head foremen, forewomen, and others in reference to various matters concerning the girls, taking care that no action is taken by any supervisor without proper consultation and agreement with the executive authority concerned; investigating all serious complaints personally, and keeping in close personal touch with grievances, real or imaginary; receiving reports from and advising subordinate supervisors on matters concerning the shifts for which they are responsible; advising girls on any question, on her own application or through the supervisor in charge of her shift; interviews with medical officer of works re medical points arising; investigating, consulting, advising, and dealing with all kinds of problems, moral or otherwise, some petty but irritating, others of importance and affecting principle or precedent; visiting any special cases in infirmary or at home.

Social.—Attending committees of the girls re entertainments, and where required assisting in their organization. Seeking out and recommending cases for rest home or other assistance.

Office.—Organization and supervision of various records concerned with the girls, their overalls and other clothing, and of war-savings associations and other thrift funds. Countersigning all requisitions for clothing, cleaning, or other materials from stores.

Inspection.—Of shops, cloakrooms, dining rooms, and cookhouses, to see everything is in proper order; of shop supervisors' registers and records; of ambulance-room records, to see what girls have met with accident or were passed out sick; of medical certificates from absentees; of timekeeping records and lists of absentees.

463. The following statement, received from another important firm, affords some idea of how the work has developed during the war:

Taking up my duties on August 10, 1914, there were 13 girls employed in the factory on aircraft work. At that time the accommodations for girls consisted of 1 spacious cloakroom, 20 hand basins, and 30 lavatories, and this for the first six months became my headquarters, and as we possessed only a small, dingy mess room, which was used by the men, the cloakroom became office, mess room, sewing, and ambulance room. In February, 1915, a small portion of the men's mess room was partitioned off for the use of the girls, and at the same time a room was taken over and converted into a rest room and surgery, and this proved very valuable indeed, as just at this time we experienced much difficulty brought about by dope poisoning; in fact, two girls died as the result of poisoning. Therefore, a strict watch had to be kept on the health of the workers, helped by doctor's inspection once a fortnight. In addition, we had by this time another large cloakroom, consisting of 4 hand basins and 30 lavatories, fully equipped with the necessary sanitary arrangements. In our new building we now have a cloakroom in every department where girls are employed. This prevents waste of time, and sickness is also prevented, as the girls are not compelled to leave a heated shop. In September, 1916, a large drawing office was converted as follows: Rest room, waiting room, surgery, and office. In January, 1917, the sewing room was enlarged and we are now able to employ girls who may be temporarily unemployed by strikes or breakdown of machinery, and in numerous cases when the girls are indisposed but not ill enough to go off work. Since September, 1917, we have had in use a girls' recreation room, where they may spend their time when not on duty; that is, mealtimes both on day and night shift.

In addition, we have a female labor bureau, consisting of waiting room and interviewing room. We have for the benefit of the workers benevolent and hospital funds, girls' savings bank or holiday fund, clothing club, and have recently organized a girls' welfare fund. With reference to the social side, there are various organizations—girls' gymnasium class, tennis and hockey club, football team, home nursing and first-aid classes, and we now have a girls' ambulance corps trained at the works to render first aid in the shops. These are also on duty during air raids. On January 22, 1917, the new club and mess room was opened with accommodation for approximately 600 girls. There is also accommodation for 300 girls in the Y. W. C. A. A new feature which has been recently introduced—the want of which has been sadly felt—is that help should be given to employees whose wives are laid up owing to illness or childbirth. We have engaged the services of a couple of women whom we send out to do the housework in these cases.

464. Thirdly may be quoted the following extracts from an account supplied by a welfare supervisor of "A day of my life as a welfare supervisor":

One of the chief advantages of a welfare supervisor's life is its variety. Each hour brings its own difficulties, each day produces fresh problems, and each week opens up new possibilities. The scope of the work is limited only by imagination and ability and things accomplished serve as milestones on an endless road of possibilities. This variety makes the task of describing a welfare supervisor's day a difficult one.

At 9 a. m. I clock on (we all do this, from the manager downward) and start dealing with letters. These are of all kinds—postcards returned by absentees explaining why they are away from work, letters from other factories asking for the characters of women who have left us, letters from solicitors and the finance department of the Ministry of Munitions about compensation cases, letters from women and girls asking for work.

I read the report left by the assistant supervisor on night duty. Perhaps the shop has been too hot or too cold, there has been a theft in the cloakroom, an operator and a viewer have had a quarrel, a pipe has burst in the lavatory; there are also several complaints that the train from W—— arrives so late that the women have to run from the station to be at the factory before the gates close, and reach their work in an exhausted condition. * * *

The next business is to deal with absentees. Every morning a list of the previous day's absentees is sent from the time office and the cards are taken out of the current index and filed in a special drawer. After three days' absence each case is either visited or written to, and by the end of seven days we are in a position to know whether the worker is coming back or not. The assistant supervisor goes through the absentees each day and decides which are to be written to and which visited, and in the first case sends reply postcards asking for an explanation of absence and in the second gives the welfare visitor the cards of those who are to be visited. Before going off every morning the visitor discusses with me points arising out of her visits of the previous day, and in many cases we decide to ask for help from the welfare committee. This committee is a kind of benevolent society to which all workers subscribe and which gives grants in cases of necessity, hospital notes when special medical attention is needed, convalescent changes, etc.

Choosing labor can be a very skilled work when there is an ample supply to choose from and no great hurry in filling vacancies. Each worker should be just the right type for the work she is put to; she should be examined medically and her references taken up, or, in the case of young workers, her character from school inquired into. Few labor offices, however, are able to carry out this régime at the present time, and engaging is often reduced to eliminating the least fit. One rejects the old, the infirm, the undersized, the shortsighted, the dirty, the flashy, the anemic, and the corpulent, and the remainder are taken on for the jobs for which they are most suitable.

I must explain that ever since I came in at 9 o'clock there has been a constant stream of women from the shop with questions and complaints, and that to write one letter or engage one person without interruptions is quite unusual.

Mrs. A wants a job on days as her husband is ill and can not be left at night; Elsie B complains that the charge hand is always "shouting" to her; three viewers state that their rises are due but have not been given; two operators are not satisfied that their wages are correct, and the matter has to be thrashed out. In the one case I show the girl that she has calculated wrongly, and that she has been paid correctly; in the other I think the wages office has made a mistake, and I promise to see to it. * * *

Although I have not been in the shop, however my assistant has been there off and on all the morning since the shift started at 8 a. m., either in the little works office or walking about the shop. The women know they will find her in the office between 10 and 11 o'clock, and they go to her with difficulties and complaints and to get badges, etc. The forewomen, too, go to her for advice, and she is in close touch with superintendents and foremen, helping them to smooth over the many difficulties arising out of the employment of large numbers of both sexes. When she is not in the office she is walking round the

shop seeing that the girls are behaving well, wearing their caps, and are not loitering about the cloakrooms and lavatories, also that the latter are well supplied with towels, soap, etc.

I take with me into the shop notes of the matters I have to discuss with the superintendent and works manager, and when I have seen them I walk round and note new developments, the drinking fountains for which I have agitated and which are being put up—a new pattern of seat which is being fixed to the machines—a big draught from an opening which might be closed up, and the extra high sides for the slurry pans on the drilling machines which have been made and are giving great satisfaction to the operators.

On my way back to the office I call at the ambulance room and see that all is well there. The sister in charge tells me of a woman who has been in with bad varicose veins who should not be standing at her work; she tells me that one of the nurses wants to leave, and warns me that a woman has been in with an old wound which has broken out again, but which she is claiming to be a fresh injury for which she requires compensation. The ambulance room is in my charge, but it carries on mainly on its own.

My assistant comes back before 1.30 so as to be free during the last half of the dinner hour. Sometimes she has arranged a concert, and sometimes the members of the military band or the orchestra bolt their own meal so as to entertain the others, but none of these things happen as often as we would like, as, unfortunately, our canteen does not lend itself to entertainment. Occasionally we have a war-saving or other meeting, but here again we are hampered by the unsuitability of the building.

A little before 6 o'clock the matron comes down and speaks to me about towels and soap and overalls, and other domestic details. She acts as a kind of chief forewoman and frees the assistant supervisors and myself from a good deal of necessary work which does not require careful handling.

At 6.15 p. m. there is a meeting of the sports and recreation committee. Having held a most successful dance the night before (which, by the way, kept me up until after 11 o'clock, though I was only a wallflower), we decide to organize a series of whist drives for the various sections of the works, followed in each case by a few dances. The football section sends a report on the first half-season's play, and we get a satisfactory account from the choral society of the financial result of their performance of the concert version of "Merry England." A discussion on finance follows, and it is about 7.30 when we get away. If this imaginary day is a Tuesday, Wednesday, or Thursday, I am now free to go home, but two nights a week I go back to the factory after a hasty dinner and stay until 9 o'clock seeing the new people who are turning in for the night shift and making a final tour of the shop before the night supervisor takes over the work.

In conclusion, it may perhaps be of interest to note that the welfare staff consists, besides myself, of two shift supervisors, a matron and a welfare visitor, one adult clerk, a stenographer, and two office girls. In the ambulance room are a sister in charge, two fully trained and two partially trained nurses, and a clerk. The number of women we deal with is just under 3,000. It is only possible to manage with such a small staff of welfare supervisors owing to the presence of forewomen. There are eight of these, and they act as kind of liaison officers between the welfare supervisor and the works. They are only appointed with my approval, and I find that in many ways there are advantages in making use of them instead of increasing the staff of supervisors.

QUALIFICATIONS AND TRAINING OF WELFARE SUPERVISORS.

465. The duties of a welfare supervisor are many and difficult; she requires to be possessed of strength of character, tact, and broad-mindedness, such as will fit her for responsibility and will command the respect of workers and foremen. She should be of good standing and education, and should possess a good understanding of industrial conditions. Apart from these broad essentials much necessarily depends upon the conditions of work, the size of the factory, the nature of the management, the type and characteristics of the workers, the nature of the industry, and the conditions under which it is carried on. The duties of the supervisor may have an industrial or an ameliorative bias. Provided only that they possess the requisite qualifications, welfare supervisors can be and are drawn from all classes of the community. It has been suggested that there are five essentials for the work of a welfare supervisor—

(a) An intimate knowledge and sympathy with women and girls. This can best be acquired by such methods as teaching in a primary school, life in a settlement, work in a women's trade-union office, living at the same time in a poor neighborhood. Without this fundamental experience no one should take up welfare work.

(b) A careful study of industrial problems which affect women's labor—such problems as the displacement of men by women, married women's work, the educational needs of "young persons," the home life of women and girls, the working of such acts as the insurance acts and the workmen's compensation act.

(c) A knowledge, both theoretical and practical, of the health of women and girls and how it is affected by speed of output, the kind of commissariat provided, the questions of ventilation and heating, and questions of housing accommodation.

(d) A knowledge of the technical side of the work, indexing, filing, account keeping, domestic arrangements in rest rooms, cloakrooms; the organization of a factory, and the relations between general managers, managers, foremen, and forewomen.

(e) A conception of the right relation between the life of the factory with all its agencies for good, and the life of the community, the interaction of each upon the other. This involves a serious study of the social structure of the community.¹

466. The previous experience and knowledge possessed by persons desiring to become welfare supervisors will necessarily vary. Their experience may be mainly practical or mainly theoretical. Though there will be exceptions, it will generally be desirable that candidates should undergo a special period of training. During the past two

¹ Industrial Welfare Work, by Miss Hilda Cashmore; Geo. Gordon & Sons, Old King Street, Bristol. Price, 6d.

years the universities have provided a number of courses of training of a few weeks' duration, which have been attended largely by persons already provisionally selected by the Ministry of Munitions as suitable for employment, and in some cases in receipt of special allowances from the ministry. While these courses have been of practical value in meeting the temporary emergency, they have admittedly been provisional in character. The need for such emergency courses is, however, rapidly passing, and the committee desire to express the opinion that longer courses of not less than one year's duration should at an early date become the established minimum of training. They recognize the difficulty of persuading candidates to equip themselves by longer training as long as emergency courses are still in existence.

467. In considering the scope of courses of training it can not be too strongly emphasized that welfare supervision as it is known to-day is only a phase, and possibly only a temporary phase, of a much wider movement toward industrial betterment. The present time is essentially one of change and development. The welfare supervisor of the future may not be an officer appointed *ad hoc*. She may in future be a manageress or forewoman, or hold some technical position in the executive. Account must also be taken of the developments which may arise from the proposed establishment of joint industrial councils¹ of employers and workers. Apart from this allowance must be made for the wide variety in the types of post which the supervisor may be called upon to undertake. In any case the essential object must be a right outlook upon her future work; for its absence no knowledge, however large, of technical detail will compensate. The committee are accordingly of opinion that it is essential that any course of training should, while allowing for a special study of welfare problems, be grounded on a wide study of social questions. Subject to this institutions may properly be encouraged to elaborate their courses according to what each may conceive to be best for their students, regard being also had to the special bent of the teachers available, and the particular sphere for which they are preparing. The committee generally concur in the recommendations on this subject contained in the report made by a committee of university representatives in July, 1917, upon the selection and training of welfare supervisors in factories and workshops.² This report suggests that the course of training should fall into three main divisions, viz:

Lectures and class teaching.—The subjects to be dealt with would include some study of industrial history, the outlines of social economics and local government, modern institutions such as trade-unions or the cooperative movement, industrial law, including some knowledge of factory legislation, hygiene,

¹ See Interim report on Joint standing Industrial councils by the subcommittee of the reconstruction committee on relations between employers and employed. Cd. 8606, 1917.

² Published by P. S. King & Son (Ltd.), Orchard Street, Westminster. Price, 3d.

the health of the individual worker, and workmen's compensation. Special attention should be paid to the general organization of a factory, the duties of managers, the principal types of production, and the methods of remuneration, relation of factory organization to problems of continuation-school education. Some, at any rate, of the instruction on the duties of a welfare supervisor should be given by those who are actually engaged in the work.

Visits of observation.—These would have regard to public health, housing, conditions of factory life, poor law, hostels employment exchanges, etc.; they would be supplementary and explanatory of the lectures.

Practical work.—At least half the time of a social student should be spent upon practical work. This should be divided roughly into two sections, the first section aiming at giving the student an acquaintance with normal working-class life; in the second the future welfare supervisor should visit a considerable number of factories in which welfare work is carried out, and should, where this can be arranged, work under a welfare supervisor. Finally, it is desirable that wherever possible students should gain some actual experience of life as a wage earner in a factory.¹

468. At a recent conference² of welfare supervisors a speaker thus described the object of training:

Part of the real object of training, combined with association, was to make a standard of work and worker which would endure, and which would be a guaranty of good work in the future. The standard required was not merely one of expert administration, but of breadth of judgment, wise understanding, good sense, and all that general combination of qualities which belonged to the educated man or woman. Efficiency merely would not give the standard. Some professions had got efficiency but not the standard—for instance, nursing. Others had both efficiency and the standard, as the medical and legal professions. These had not been obtained by tests, examinations, or difficulty of training, but by pattern and length and character of the training. Some parts of the training might be necessary merely to compel thinking. The shortness of the training made it all the more necessary to include something which would bring out the capacity to think. Perhaps next to good judgment and fact, power to think quickly and sympathetically was most important. Only by contact with the mental struggles of other people could be obtained that sense of the relation of class to class, of the attitude of working people to social usages, their feeling about this or that. Only the study of the most human questions, i. e., mind (psychology), of aim (philosophy), of the struggle to make the best of life (social economics), could give this sense. * * * By training, much of the shortsightedness and narrowness which spoiled social work could be avoided.

469. If the committee are correct in their view that courses of training should be primarily based on a wide study of social problems, it may be anticipated that a large part of the course will be suitable for all students who are desirous of taking and are qualified by attainments to take a course of social study; and the committee

¹ Courses of the kind here contemplated have been, or are being, organized by or under the auspices of the universities of London (School of Economics), Birmingham, Bristol, Belfast, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Sheffield, and elsewhere. Provision is also sometimes made for short or part-time courses. Prospectuses of the courses can be obtained from the authorities of the universities concerned.

² Central Association of Welfare Workers, notes of addresses given at the conference on Jan. 12 and 13, 1918. Price, 1s.

would not favor an attempt to limit admission to any part of the course to persons who had been previously selected as likely to prove at the end of the course suitable candidates for the posts as welfare supervisors. Further, while particular candidates will doubtless from time to time be assisted from private funds to undergo a course of training with a view subsequently to taking up employment as a welfare supervisor, perhaps in a particular factory, the committee would be opposed to any scheme of granting financial assistance from public funds to candidates who undertook as a condition of the assistance to take up such an appointment on the completion of the course. Such a restriction is only justifiable (except to meet a special and temporary emergency) where the numbers required are large and the prospects of permanent employment are substantially secure.

SELECTION OF WELFARE SUPERVISORS.

470. Though the State may properly undertake responsibility for satisfying itself that adequate provision is made for supervision, and may require modification to be made where they are not so satisfied, the State can not in the opinion of the committee itself undertake responsibility for actual appointments, if only because it can not possess a sufficiently intimate acquaintance with the particular conditions of individual factories. Apart from this the State would only be justified in itself making appointments if it paid for the supervision provided; and it would appear obvious that welfare supervision—at any rate as it is at present conceived—could not be successfully carried out by a paid agent imposed on the factory from outside. Up to the present the welfare supervisors have been appointed and paid by the employer, and it seems probable that for some time to come at any rate the employer must ordinarily continue to accept ultimate responsibility if only that upon him rests the duty of securing that the conditions of employment within his factory are satisfactory. It may be anticipated, however, that the workers, whose confidence and support are essential to success, will to an increasing extent seek some voice in the selection.

471. The peculiar conditions which have justified the making of several hundred appointments of women welfare supervisors within the last two years, necessitated that some organization should be established through which employers could obtain information as to suitable candidates. To meet this demand the Ministry of Munitions established a special panel. Though this panel has undoubtedly served a useful purpose, the committee are not satisfied that it is desirable as a permanent arrangement. If admission to such a panel were at all narrowly limited it would probably fail to secure the confidence and support of employers. Apart from this, the fact that a

particular supervisor had been selected from the Government panel might subsequently prove an embarrassment if it became necessary to comment adversely on the provision made for supervision at the factory in question. Any agency established should in the opinion of the committee be entirely free of all Government control.

CONCLUSION.

472. The time has not yet arrived when any definite judgment can be passed on the developments of welfare supervision during the past two years. Still less can prophecy safely be made as to the future. For permanent success welfare work must gain the confident approval and support of the workers. At present their judgment is in suspense. The old antagonism of "capital" and "labor" makes the motive of the employer in appointing a welfare supervisor subject to the suspicion that he is seeking profit at the expense of his workers. Again, there is the natural objection to anything savoring of philanthropy. The demand is for justice not for charity. Fussy interference represents another danger. As a prominent employer has pointed out—

It would be a great mistake for employers to force themselves into the lives of the men whom they employ. We must avoid smothering them with our good intentions * * *. The point is that men must have a definite responsibility of their own, and we must not try to interfere with that in any way.

473. Further, there is the fear that the movement, whether deliberately or not, may be opposed to the development of the aim of trades-unionism. On the other hand, the following remarks of a representative trades-unionist at the recent conference already referred to, show a more favorable attitude:

Wages and hours, though of primary importance, were not the whole matter. Tone and atmosphere might still be wrong. There was still the relationship between the sexes in a factory to be considered, and also the shameful fact that there were still many men supervisors who were in charge of women in every respect. Also, though good wages and good hours always tended to raise the standard of life and manners, the connection was not always immediate. For instance, in the Lancashire cotton trade, where before the war women were best paid, standards of comfort were deplorably low. After all had been done in respect to wages and hours there still remained something to do.

There would be a great many other matters—for instance, dismissal and engagement of workers. Engagement was of most far-reaching importance, because bound up with the extraordinary difficult question of the slow worker, who was often slow because in an unsuitable trade. The welfare worker would after a time be able to select people with the precise qualifications necessary for the particular trade; would probably get rid of, substantially at any rate, the problem of the slow worker. Again there would be questions like the lifting of heavy weights, the danger of particular processes, etc. The welfare worker would be the intermediary between employer and employee. Any factory act, or any observation forced upon employers by the trade-union, could only be a minimum. The conscientious employer would still have to decide

how far he could go in advance of the minimum and would more and more need the expert advice that a trained welfare superintendent could give him.

The supervisory powers which, by degrees, the welfare worker would attain to, were very valuable. Canteens, rest rooms, clean water, overalls, etc., were invaluable, but would mean nothing unless there was somebody to see that each of these things was what it ought to be. In those things was the basis of welfare work. It was part of the functional management of a great factory. Sidney Webb had appealed for frankness. It should be known that the welfare worker was there for efficiency; she represented the management and not the worker. There was no shame in working on the side of efficiency, and in any system of industry efficiency would be necessary. The welfare worker who came forward in the name of efficiency, and to do what she could for the workers, would incur no misunderstanding or resentment on their part. If she were also able to work cordially with trade-unions and direct people to join unions any barrier between her and the workers would be broken down.

474. Considerable interest attaches to the following constructive proposals which were recently put forward in a memorandum¹ prepared by the joint committee of the Woolwich Trades and Labor Council and Woolwich Labor Party:

The statement of the duties of welfare supervision contained in memorandum No. 2 (Welfare Supervision) of the health of munition workers committee may be taken as a working basis for the purpose of welfare supervision. The memorandum states that "the duties here outlined are chiefly concerned with matters of health and individual welfare which are of immediate urgency to-day." Modification of or addition to these duties will doubtless be brought about by increasing experience, and by the changes which are likely to arise in the industrial system after the war; but we submit that the following conditions are essential to any scheme of welfare supervision that is to win the full confidence and support of the workers:

(1) Welfare supervision must aim primarily at promoting the welfare of the workers, and not at increasing the workers' output.

(2) In the interest of welfare supervision and of the workers, duties which conflict with welfare supervision must not be included in the work of welfare supervisors.

(3) Welfare schemes and supervisors must be under a democratic system of control in which the workers shall have equal participation with the employers.

(4) The established field of operations of trade-unions and their officials must be clearly and loyally recognized by welfare schemes and supervisors.

(5) Welfare supervisors should be drawn, as far as possible, from among the workers.

(6) Welfare supervisors should not be appointed without preliminary training or experience, such training to include a knowledge of trade-union aims and methods.

(7) The remuneration and hours of all assistants in welfare supervision work (e. g., canteen workers) must be of a trade-union standard.

(8) If Government control of welfare supervision is maintained after the war, such control must be transferred from the Ministry of Munitions to the Ministry of Labor.

We submit further—

(9) That there should be the maximum of efficient cooperation among local welfare schemes, especially with regard to small factories.

¹ Reprinted in the Woolwich Pioneer for Feb. 22, 1918.

(10) That there should be the maximum of efficient cooperation between local welfare schemes and the municipality, especially with regard to health, housing, transit, and recreation.

(11) That as welfare supervision will probably become a permanent and extending element of the industrial system, there should be held in each industrial center, one or more conferences, convened by the trade council, or, where there is also a local labor party, both bodies jointly, for the purpose of considering the aims, scope, and methods of welfare supervision; that such local conferences should be followed by a joint conference of the Trade-union Congress and the National Labor Party.

475. The committee can not escape the conclusion that unwise and unsatisfactory appointments have been made, that friction and misunderstandings have been created, and that complaints have at times been considerable in volume and extent. Further, it may be freely granted that many of these complaints were well founded, though their extent and importance must not be overestimated. More is frequently heard of one failure than of many successes. The problems at issue can not be solved in a day. If not entirely new, they are for the first time becoming of direct interest and importance to any large section of the industrial community. Allowance, too, must be made for the limited experience of industrial conditions inevitably possessed by many of the welfare supervisors when first appointed, and also for the difficulties due to the newness of many of the conceptions of industrial organization involved in the work, and to the absence of any substantial body of experience or tradition to guide welfare supervisors in their work. Failure where it has occurred has quite as often been due to slowness of the management or the workers to understand the aim and purpose of welfare supervision as to the incapacity or unsuitability of the supervisor. On the whole the committee are convinced that it can at least be said that the conditions of employment of women workers have been substantially and widely improved and that they are as a rule to-day greatly superior to those usually existing in industry before the war. The fact that in spite of the strain of the last three years there has not hitherto been a general breakdown of health is in no small degree due to the work of the welfare supervisors. There can too be no doubt as to the advantage derived from the presence of a person whose special duty it is to give constant attention to many matters which, though often trivial in themselves, are yet vital to the maintenance of a healthy environment. Again, it can not but be of service to the solution of future industrial problems that there should exist a large number of persons who are daily devoting their attention to an aspect of these problems which has too frequently been overlooked in the past but which can not safely be neglected. The experience and knowledge now accumulated must certainly prove a notable contribution to the wise handling of many questions vitally

affecting the future prosperity of the nation. The association¹ of welfare supervisors now being established should do valuable work in collecting and focusing information. The committee in fact are satisfied that the experiment of the last two years has been of inestimable benefit to the nation, and that in one form or another welfare supervision should certainly continue to play an important part in all future schemes for the industrial betterment of the race.

¹ The aim of the Central Association of Welfare Supervisors is defined in the constitution as being—

To promote the well-being of the workers by securing, in the cooperation with employer and employed, the best possible conditions of work. To help all efforts, inside and outside of the factory, to place the industrial relationship on a basis of goodwill and understanding.

The secretary of the association may be addressed at the School of Economics, Clare Market, W. C. 2.

District associations are also being formed in London and other industrial areas. The association has upward of 600 members.

SECTION XVIII.—WELFARE SUPERVISION FOR BOYS AND MEN.

WELFARE SUPERVISION FOR BOYS.

THE NEED.

476. The problems involved in the welfare supervision of boys, though in some measure similar to those which arise in the case of women and girls, are in certain respects distinct and call for special consideration and treatment. The employment of boys in engineering and other munition works, unlike that of women and girls, is not a new development arising out of the war. Nearly every firm has employed boys before the war. The war has not introduced a new form of labor for which employers might expect to be asked to provide new conditions, nor, again, has the war introduced difficulties in regard to boys which did not exist before. The war has only magnified the difficulties; it has not created them. High wages in certain occupations, large demands for boy labor, restlessness and the habit of wandering from one employer to another, the trouble of securing proper control, all these were boy problems during times of peace, but war conditions have emphasized the difficulties, while the need for conserving all possible labor has made their solution a matter of national importance.

477. The first and most essential object of welfare supervision among boys is to bring to bear upon them through the management a definite personal influence. They are at an impressionable age, when the influences to which they are subject will largely determine their ultimate outlook upon life. They are not adults; many are as young as 14, some are even younger. They are not old enough to be allowed unguided to control their own destiny. At the same time, existing conditions, such as high wages, the absence of the father or the elder brother, have tended to relax home control. Hours of work frequently prevent attendance at clubs or classes and healthy outdoor recreation is too seldom available. As might be anticipated under such conditions, the conduct of the boys is the subject of frequent complaint. From whatever aspect the matter is viewed, it is essential that the causes of alleged ill behavior and conduct should be ascertained and appreciated. It is only by such means that improvement can be obtained.

478. While at school boys have been accustomed to a sympathetic discipline and friendly interest. Similar discipline and interest should be present also in the factory. Where these are not assured

it is, as a rule, useless to secure the provision of what may be called the material apparatus of welfare. Facilities alone are inadequate; the boys must be led to avail themselves of the opportunities offered. Experience shows that canteens and mess rooms may be erected, but boys, in many cases, have not used them, preferring to consume "carried" food in some corner of the factory. Similarly, washing apparatus has been supplied, but left neglected or abused; towels have been converted into footballs and soap used as a handy missile. The first-aid arrangements may be excellent, but for minor injuries the boys will not trouble to make use of them. There are, of course, exceptions to these statements, but they are not sufficiently numerous to modify the conclusion that what the boys need most is definite personal influence.

479. Such personal influence can, in general, only be secured where definite duties with regard to the boys are delegated to some one individual. Collective and indiscriminate responsibility is unsuccessful. The mixed method, usually the practice, of leaving the boys to the control of the manager and foremen has been proved a failure in actual experience. The manager, even when possessing the necessary qualifications, has not the time to carry out the work. The foremen, not infrequently keenly interested in the boys, lack the requisite breadth of outlook and training. Their immediate concern is "output," and they tend to regard only the obvious and often superficial effects as distinguished from the more important but less arresting consequences of any action on their part. To take a single example: Experience has shown that boys are ill suited to stand the monotony of purely repetition work. To keep them long to one operation is to injure output by increasing lost time and frequency of leakage. But the foreman knows that a boy when transferred to a new job requires time before he becomes expert and that temporary loss of output is the result of transfer. He fails to appreciate that in the absence of such transfers output suffers more seriously. It is not possible, therefore, to count on securing the necessary personal influence from either the manager or the foremen. In small works, employing 30 boys or less, where the management are interested in the boys, this personal influence can often be secured without delegation of responsibility to an individual. Occasionally, in large factories, where welfare work has been of long standing and created its own atmosphere, the same may hold good. But such cases are rare, and, in general, and certainly where welfare work is being introduced, success depends on the presence of a definite individual, termed a welfare supervisor.

480. As a recent speaker has pointed out—

You can not expect a shop manager or the manager of a works to have any particular and peculiar intimate knowledge of one special section of his staff of

employees. Therefore, it seems to me only natural to demand that the boys' case shall be stated first of all to the man who understands them, who has made it his special business to know all about them, and to go intimately into a study of their nature. * * *

481. The committee, in their memorandum No. 2 on Welfare Supervision, recommended the appointment of a welfare supervisor wherever 100 boys are employed, and experience has shown that where there is this number a whole-time officer can be usefully employed. It is, however, only a minority of factories in which so large a number is employed, and it is therefore a matter of considerable practical importance to devise means for providing for welfare supervision in the numerous factories where only about 30 to 100 boys are employed. Various alternatives have been adopted in practice—

(a) A special whole-time officer is appointed and his services shared by two or more firms;

(b) A special officer is appointed who gives part of his time to other duties in the factory;

(c) An existing officer is relieved of part of his other work in order to give time to welfare supervision.

(d) The boys may be placed under the charge of the welfare supervisor for women.

482. A problem of great difficulty arises from the practice still prevalent in some districts under which the boys, though normally in the service of the employer, are for all effective purposes in that of the men for whom they work, and who engage them, dismiss them, and pay them. Their work is sometimes casual; the employers know little of their conditions and are inclined to contend that they have no responsibility for their welfare. It is, however, hoped that in two centers the experiment will shortly be started of a special institute for such boys in charge of a welfare supervisor. It is suggested that the institute should act not only as a center of recreation but also as a kind of labor bureau dealing with the difficulties arising out of the casual nature of the employment.

THE DUTIES OF THE SUPERVISOR.

483. While the duties¹ of a welfare supervisor of boys may usefully include most of the various matters specified in the preceding section for welfare supervisors for women, there are certain aspects which need to be particularly emphasized. It is essential that a wide view should be taken of this sphere and influence. He is concerned with boys in their critical stage of growth and development,

¹The ministry have issued a memorandum on the duties of a welfare supervisor for boys. Reference may also be made to The Boy in Industry, and Report of a Conference of Boy Welfare Supervisors. All of these documents may be obtained on application to the ministry.

and nothing which makes for their well-being should be regarded as alien to his duties. From his presence inside the factory he occupies a unique position for guiding effectually the careers of the boys under his charge, and experience shows that the wider his outlook the stronger his position. The following scheme prepared for a government factory illustrates the point:

The boy visitors' work is directed to improving the boy workers' moral and material well-being and to reducing the difficulties which slackness, ill discipline, etc., cause the factory staff.

The present abnormal conditions of work, high wages, lack of healthy recreation, and in many cases the absence of the father tends to thriftlessness, ill discipline, and other evils.

In fairness to the boy it should be said that bad timekeeping, etc., may be the outcome of genuine fatigue, illness, home troubles, or discontent. It is the business of the boy visitor to get at the root of these troubles by personal work amongst the boys and to inform the factory officials of the knowledge which his investigation of the boys' circumstances, home life, etc., will give him.

The boy visitor will, by personal guidance, work toward getting contented, well-disciplined boy workers, and the information he gathers will always be available to assist the staff in the smooth working of the factory.

(1) To meet new boys on entry and keep a record of the boys' progress and career in the factory.

(2) To deal with absence and bad timekeepers—first with the boy; then, if necessary, with parents.

(3) To see boys before dismissal or leaving, and, if necessary, to see the parents.

(4) To investigate shop and police reports and make recommendation thereon.

(5) To keep an eye on the feeding arrangements, dining halls, lavatory accommodation, etc., and to report and make suggestions thereon to the welfare supervision department.

(6) To inquire into and discuss with the boys their complaints and troubles, and, where necessary, present them on behalf of the boys to the proper authorities.

(7) To overlook the general conditions and health of the boys, and, where necessary, arrange for medical inspection.

(8) To suggest suitable candidates for convalescent homes after sickness or injury.

(9) Where necessary, to visit the homes of the boys who are evidently ill cared for, and report upon the home conditions, etc. To note specially the state of clothing and boots of boy workers.

(10) To encourage and arrange recreation, sports, etc., at spare times.

(11) To keep in personal touch with the boys by means of individual talks, meeting them at meal times, etc., and advising them in difficulties, encouraging them to thrift and well-doing.

(12) To gather information as to boys' characters and progress and capabilities for promotion, and for post-war employment.

N. B.—The boy visitor has no executive authority and his function is to assist the boy when he is in difficulty or trouble and to place his case in a very tactful way before the foreman or manager. It is emphasized that great tact is necessary in the relations of the boy visitors as the boys' friend with the foreman and officials. The boy visitor should clearly show to the officials that

his work will not in any way reduce their authority but will strengthen it and help to secure efficiency and discipline in the factory.

484. The first essential of success is that the welfare supervisor should gain the confidence not only of the boys and the management but also of the foreman and local trade-unions. He should keep in touch with all other persons and organizations in the district which are concerned with the wellbeing of the boy. He should establish friendly relations with the school authorities and the employment bureaus, also with any club organizations which may be available for providing healthy recreation. In order to encourage the interest and influence of the home, he should be in touch with the parent. Lastly, he should recognize a responsibility for boyhood in general, and not merely for the boy while still in his factory. Boys are continually leaving through the unsuitability of the work, reduction of staff, or other causes. He must regard his responsibility as continuing until the boy has found other occupation. Deterioration, now so common, can only be prevented by recognizing this continued responsibility.

485. *Recreation.*—The boy is in special need of change and variety, and adequate facilities for recreation are accordingly of primary importance. Where it can be arranged for, recreation during the dinner hour is valuable in the form of games indoors or football or cricket on some odd piece of ground adjoining the factory. In the main, however, the boy must rely for recreation on leisure time outside factory hours. Where, as is most frequently the case, local clubs are insufficient to meet the need, special provision should be made. In some centers schemes for the whole district are being organized largely on the initiative of the local welfare officer of the Ministry of Munitions, the organization being in the hands of a local committee, and are supported by contributions from employers on a capitation basis. Such schemes have much to commend them when they can be arranged. More often, however, if recreation is to be provided at all, it must be by one or more employers independently of any local club. Indeed, practically every welfare supervisor has in operation some recreation scheme for his own boys. The provision should include not only indoor games and amusements but also football, cricket, and cadet corps. Week-end camps have been organized with success.

486. *Training and instruction.*—Training and instruction are needed both for the immediate purpose of increasing the boy's interest in his work and so relieving its monotony, and also for improving his technical efficiency and his capacity for undertaking his future responsibilities as a man and a citizen. It is very desirable that boys on appointment should be instructed in the best method of performing their work, and, if possible, also in its aim and pur-

pose. By such means they would not only become more quickly efficient but interest may be stimulated and monotony relieved. Boys have normally entered on an occupation in which when men they hope to find a definite career. Their technical training—whether from the point of view of the nation or themselves—is a matter of importance. On the other hand, war conditions and the great increase of repetition work have not proved favorable to such training. There has been a tendency to keep the boy on the performance of a single operation. Certain employers, however, to the benefit of both output and the boy's training, have found it possible to vary the work and so provide at least some training. To an increasing extent also facilities are being given for attendance at technical and continuation classes, both during the day and in the evening. In such cases boys are generally allowed time off from the factory without loss of pay, and the fees for their instruction are paid by the firm. Thus, one welfare supervisor is able to report:

I have succeeded in getting every apprentice to attend evening technical classes two or three times per week. The managing director was very sympathetic toward this, and readily granted concessions which enabled me to obtain this splendid result. The boys are allowed to miss a quarter without loss of pay the next morning after attending evening school. When on night shift they go to school and then come on to work, thus missing a quarter. The employment of boys on night shifts is a difficulty we are up against all the time. Many of the other lads are attending evening classes with similar concessions. * * * I am arranging a series of lectures in scientific and general subjects and physics.

487. *Thrift.*—While the high wages now generally earned have undoubtedly been beneficial to health to the extent that they have brought good food and suitable clothing within the reach of all, they have undoubtedly encouraged some undue indulgence and extravagance. The possession of a large amount of pocket money is a serious temptation to indulge in thriftlessness and gambling. The need for saving against periods of sickness or other future difficulties is seldom appreciated. It is therefore of urgent importance that saving should be encouraged and its national as well as its personal aspect emphasized. The arrangements should be so organized as to attract the support of those who are not naturally thrifty. The rules should be few and easily understood. The collection of deposits should be made in close connection with the payment of wages, and should ordinarily be in the hands of the welfare supervisor, who, through his acquaintance with the boy and his home, can advise him as to the amount which he can properly put by. Upon the wisdom and tact of the supervisor rather than upon formal regulations should the restriction of improper withdrawals depend. If a boy thinks that he can not get his money out whenever he wants to, he may hesitate to deposit it.

488. The wide scope and variety of the duties which may be undertaken by a welfare supervisor are well illustrated by the following account by a welfare supervisor of how his time is ordinarily occupied:

Arriving at the factory in the morning, the welfare supervisor usually finds several boys waiting to see him in the hope of finding employment. Of these, some have probably been sent by the employment exchange, either in response to previous requests or on the chance of a vacancy existing. A glance at the notification of vacancies in different departments received from the foremen concerned, enables the boys to be roughly classified according to suitability for the jobs for which they may be needed. They are then interviewed separately and questioned closely. * * * His answers give some indication of his mental ability and intelligence, and may prevent a dull boy from being set to work which requires thought, or a bright intelligent boy from being allocated to a task which could as well be performed by one who is mentally dull. Each boy is required to give some account of his health. * * * If he has not just left school, he is questioned as to his previous employment, the number of changes he has made since leaving school, his wages and reasons for leaving. * * *

Full particulars of the boys engaged are entered on special record cards which provide also for entries dealing with their careers while at the factory.

The supervisor's attention may now be given to the weekly forms showing the time lost by the boys in the various departments. He probably finds that some have lost several quarters or have been absent during periods ranging from one day to a week. Where he is unaware of any reason, he makes a note so that the matter may be investigated later. Similarly the reports on attendance received from the local evening continuation or technical schools are dealt with.

The supervisor may now make a visit to the various shops, bearing in mind any boys whose timekeeping or irregularity at evening classes call for inquiry. He looks out for boys who have been recently engaged and makes a friendly inquiry as to their progress. Other boys are on the lookout for him, being anxious to make inquiries or complaints which perhaps would seem trivial to the foreman, but which the supervisor knows may be of real importance to a boy. The foreman also may have complaints or suggestions to make. If these matters can not be dealt with speedily on the spot, arrangements are made for special interviews. Such interviews take up a portion of each day. Every case of dismissal or of a boy giving notice is a matter for inquiry on the part of the supervisor, and he is frequently able to adjust matters so that both boy and foreman are satisfied.

The weekly visit of the Home Office certifying surgeon calls for the supervisor's presence, especially when boys are examined as to their fitness for night employment. He is in a position, from the knowledge gained at his preliminary interviews with the boys, to draw the doctor's attention to any physical weakness which, while of little importance in itself, may prove a danger to the boy as a result of his employment. He can arrange for a reexamination of boys whose health seems to be affected by working at night, and keeps a record of all cases where boys are declared unfit for any work other than in the daytime, so that arrangements may be made, if necessary, for the transfer of a boy to a department where there is no night employment.

On most days the supervisor has visits to make. These may be to local schools or members of care committees, but generally they are visits to the

boys' homes, made in order that parents may be consulted and made aware that an interest is taken in the boys, and that the cooperation of the parents with the supervisor is desirable. Matters of health, wages, timekeeping, progress, companionship call for such visits which are made, not for the purpose of lodging complaints, but in order that friendly inquiry may help to make things better for the boy and prevent him going astray at a critical period of his life. Experience shows that such visits are welcomed by the parents, while the boys sometimes ask the supervisor to call at their homes in order that the parents' consent may be given to some change which the boy desires.

In cases of accident or sudden illness the foremen send for the supervisor, to whom they leave the responsibility of seeing that proper treatment is given, either in the works ambulance room or, if necessary, at the local hospital.

After the night turn has commenced the supervisor makes another round of the shops, with the same objects in view which called for his earlier visit. He will also have been sought by some of the boys engaged on nightwork before they entered the shops.

In the evenings the boys' club calls for the supervisor's time. Football or cricket committees ask his advice or help; he has to see that the fixture list is kept full; he arranges evening concerts, billiard matches, or contests for which the club has facilities. It is here that he gets to know the boys well. * * *

489. The following statement recently received from a large munition works is also of interest:

In the early part of last year a cadet corps for lads between 16 and 18, and a boy scout troop for boys between 14 and 16 were started, and in both cases were restricted to lads employed in the factory; over 100 are enrolled in the former and between 60 and 70 in the latter. Some of these scouts have gone through a primary first-aid course, and several of them are learning the duties of auxiliaries to the fire brigade. They also render every assistance in their power on the occasion of any social or athletic event.

Whilst on the subject of boys, we would point out that every boy, on being engaged by our labor bureau to work in this factory, receives a notice asking him to call at the welfare department to see our welfare supervisor, who takes full particulars of the boy's circumstances and points out what facilities are suitable in each case, e. g., scouts or cadet corps, technical classes, etc.

At the present moment about 300 of our boys, as well as a good many girls, are attending evening classes. These boys are given facilities for getting away in time to attend such classes.

Every new boy is medically examined after he has been at work in the factory for a fortnight. At the Y. M. C. A. a gymnastic class is held for youths every Friday and Monday evening, and every Sunday afternoon a youths' red triangle club and tea.

CONCLUSION.

490. For the reasons already stated the need for the welfare supervision of boys has not been so readily recognized as in the case of women and girls, and progress has been slower. Time has been required for securing appreciation of the need by the foreman and the local trades unions as well as by the employer. Apart from this, under existing conditions, it has been a matter of considerable difficulty to find suitable candidates for posts as they were established,

though this difficulty has grown somewhat less as the need has become better known.¹ Over 150 appointments of welfare supervisors are known to have been made up to the end of April, 1918, and the committee have little doubt that the movement is now steadily gaining force.² As in the case of the welfare supervision of women it is as yet too early to form any final judgment as to the work now being done or as to the lines on which it is likely to develop in the future; The committee have, however, substantial grounds for the view that the work has commenced on sound lines. The need for overcoming initial indifference or opposition has not been without its compensating advantages, since it has tended to prevent hasty and ill-considered schemes or appointments, and thus to reduce causes for misunderstanding and suspicion.

WELFARE SUPERVISION FOR MEN.

491. Though the committee in their memorandum No. 2 on Welfare Supervision recommended the appointment of a welfare supervisor for men wherever 500 were employed, they have always recognized that the problems involved were much more difficult than in the case of women or boys, and they did not anticipate anything but a gradual development, even had the difficulties in the way of obtaining suitable men for the work been less insuperable than they are, and must continue to be, so long as the war continues. The whole question is intimately connected with that of the establishment of works councils, and it is interesting to note that so recognized an authority as Mr. Sidney Webb has recently suggested that³—

Such subjects as the cleanliness, ventilation, lighting, and temperature of the work place (upon which maximum efficiency depends much more than managers commonly realize); the hours of beginning and ending work; the intervals for meals; the dates of holidays; the welfare arrangements, including especially the accommodation for meals; the precautions against accidents; the benevolent funds; the workshop rules, and any arrangements about fines, deductions for breakages or inferior work, or charges made for requisites of work, or for hot water, etc., together with any alleged infringements of workshop rules or district agreements as to wages or hours, might all be considered with advantage by such a workshop committee, and brought to the notice of the management at a joint conference.

492. In the immediate future at any rate it appears probable that any welfare work among men will generally grow spontaneously out of the work of the welfare supervision for boys. In several instances already a boy welfare supervisor, usually at the request of the men themselves, has found himself called upon to deal with matters affect-

¹ For the assistance of employers the ministry have established a panel of suitable candidates.

² An association of boy welfare supervisors is being formed. The acting chairman is Mr. C. W. Hodder, Messrs. Denny & Co., Dumbarton.

³ The Works Manager To-Day, by Sidney Webb; Longmans Green & Co., 1917.

ing their welfare. He naturally sees much of them, and if of the right type soon establishes friendly relations with them. If a men's recreation club is started, he is likely to be asked to assist in its organization, or he may be selected to act as secretary of a workshop committee or works council. Often he is in charge of the first-aid arrangements, which are available for men as well as for boys. He is not infrequently consulted by men in regard to personal difficulties, and one welfare supervisor reports that he has had over 200 such inquiries in a few weeks.

SECTION XIX.—WELFARE OUTSIDE THE FACTORY.

493. In previous sections the committee have dealt mainly with the health and welfare of munition workers as affected by the conditions of employment inside the factory, and have only referred incidentally to other conditions of almost equal importance outside the factory, such as housing, transit, and recreation. The demands for labor in munition areas have involved the employment of large numbers of workers at places remote from their own homes, and have thus raised problems of first importance for the physical and moral welfare of the nation, and especially of women and girls. In the earlier stages of the War these problems were mainly left to the energy and initiative of private bodies and of individual firms, who took steps to provide hostels, to find lodgings, and to provide facilities for recreation. The local advisory committees appointed by the central advisory committee on Women's War Employment (Industrial), though primarily established to assist the local employment exchanges in the recruitment and distribution of workers, found themselves concerned with problems of transit, housing, and welfare. Much valuable work was performed through the agency of these various bodies and committees, but their usefulness was frequently limited by the lack of the requisite organization and funds. They were dependent for funds upon voluntary sources, but the localities in which by the action of the State the munition workers were concentrated were not always willing to contribute to what they often not unreasonably regarded as a matter of national rather than of local concern.

494. The committee, in their memorandum No. 17 (Health and Welfare of Munition Workers Outside the Factory), which was submitted to the ministry in January, 1917, thus summarized the position: By the agency of the State women and girls are being exported from their homes and imported into munition areas; by the agency of the State the liberty of the individual to throw up her work and to take her labor elsewhere is restricted.

495. On the State, therefore, the responsibility lies, not only for suitably housing these transported workers but also for securing the safeguards needful for their health and morals, the maintenance of which is essential to the nation.

496. Though the restrictions on the movement of labor have since been removed, the proposition still holds good that it is the duty of

the State to determine the nature and extent of the provision to be made in each area and to take such steps as are requisite for its attainment. Every advantage should be taken of existing facilities and experience possessed by local bodies, whether voluntary or statutory. In the opinion of the committee the aim should be not to supplant the work of these bodies, but to supplement and coordinate. In submitting the memorandum to the ministry the committee suggested that it was necessary not only to provide or aid the provision of hostels, maternity homes, and facilities for recreation, but also to arrange for the appointment of local officers, whose duty it would be to organize outside welfare in all its aspects in their particular locality. It was added that these officers were likely to need assistants for the inspection of lodgings, organization of recreation, and other similar purposes.

497. Though various departments of state—as, for example, the Ministry of Labor and the Home Office—are in various degrees concerned to secure a proper solution of the problems at issue, it is clear that the primary responsibility must rest upon the Ministry of Munitions as the department responsible for creating the need. In March, 1917, the Ministry of Munitions definitely recognized their responsibility for outside welfare, and through their Welfare Department arranged for the appointment of a number of extramural welfare officers. At present there are about 20 of these officers, who are stationed in the principal centers of munition work. Their duties to some extent vary according to the needs of each locality, but they are normally concerned with the following matters:

- (a) Provision for meeting girls and providing them with suitable lodgings;
- (b) Registration and supervision of lodgings;
- (c) Care of sick and stranded workers;
- (d) Day nurseries for children of munition workers;
- (e) Transit facilities; and
- (f) Provision of recreation facilities for women and girls and occasionally for men also.

498. As in the case of welfare supervision inside the factory, experience shows that these officers have many opportunities for useful work outside their specified duties. There is little doubt as to the valuable effects produced in a locality by the presence of a definite person to whom women and girls can apply for help in a moment of difficulty or emergency.

499. The problems connected with the welfare of the worker outside the factory may be roughly grouped under four heads:

- (a) The recruitment of suitable workers;
- (b) Housing accommodation and transit;

(c) Sickness and other personal questions; and

(d) Leisure.

500. It will be convenient to set out shortly the problems which fall under each of these heads, and to state briefly what is being done, and what, in the opinion of the committee, should be done to meet them.

THE RECRUITMENT OF SUITABLE WORKERS.

501. The problems involved in the recruitment of suitable workers and their conveyance to the place of future employment are primarily the concern of the Ministry of Labor.

502. *Only normally healthy, clean and wholesome-minded women and girls should be exported.*—In some cases women and girls received in lodgings and hostels have been found to be in such a condition of person and clothing that the assistance of the sanitary authority had to be invoked for cleansing or disinfection. In other cases women and girls have been imported who suffer from physical disabilities or are in an unsuitable physical condition. In some instances women of bad character have been associated in lodgings or hostels with respectable women and girls. Such instances, even if not numerous, exert far-reaching effect, and rumors spread quickly through a neighborhood, losing nothing by repetition, and cause many housewives to close their doors against munition workers as lodgers.

503. The committee accordingly suggest that all women and girls, before being exported, should be examined by a doctor or by a nurse working under his supervision. They are glad to learn that arrangements to this end have been made by the Ministry of Labor with the help of the Ministry of Munitions.

504. *Mothers of infants or of families of young children should not be exported.*—The arrival of mothers in a town accompanied by quite young infants, or three or four young children, having traveled long distances, is by no means uncommon—the mother is attracted, in the absence of the father on active service, by the prospect of high wages in munition works, and brings her baby or children with her. To find lodgings where these are not unwelcome, and where some one will undertake the care of the children while the mother is out at the factory, is no easy task. The committee consider that this practice of taking children across country by train to some distant munition area and leaving them to strangers all day or all night should be discouraged, and they suggest that inquiry into such matters should be made at the source of supply by the nurse mentioned above, or by voluntary helpers of experience.

505. *No woman or girl should be exported without a sufficiency of clothing or of money.*—Women and girls frequently arrive at munition centers without luggage or any clothing except what they are

wearing, and without any money; they are often hungry and thirsty, having had no food on a long journey. In some cases poverty is the cause, in many others the reason given has been that they had heard that everything necessary, including the first week's lodging, was provided free. As the first wages are not due for a week, and frequently are not paid until after 10 days or a fortnight (the first week's, or a few days' wages being kept back,) the plight of these women and girls in a strange town is not only uncomfortable but a serious danger.

506. The committee accordingly suggest that information should always be given at the employment exchange, verbally and by printed notices, that sufficient change of clothing, as well as money for emergency expenses on the journey, must be taken. When the need is proved, financial help should be forthcoming from a fund administered locally, safeguards being taken for the refunding of the loan out of wages. The practice already sometimes adopted of giving advances pending the first payment of wages might be extended.

507. *Travelers across country should be seen off and met at the station.*—The need for this protection of those unaccustomed to travel, especially if the distance is great, is well recognized. Where such services have not been organized, serious inconvenience and evil has arisen in many instances. To meet these difficulties, arrangements are generally made for local agents to see the women and girls off by train, receive them at the station on arrival, and direct them to their employment exchange or lodging. In some cases arrangements have been found necessary for meeting parties in the course of their journey, when they have to change stations or trains. The Ministry of Munitions have made an arrangement with the Travelers' Aid Society for meeting workers at junctions, and also on arrival, and conducting them to their lodgings. Where necessary, light refreshments are provided. At one junction a special canteen has been established by a local committee.

HOUSING ACCOMMODATION AND TRANSIT.

508. Suitable and sufficient board and lodging should be provided for all exported women and girls not otherwise provided for. For this purpose there should be provided—

- (a) Reception or clearing houses;
- (b) Lodgings;
- (c) Hostels; and
- (d) Convenient means of transit.

509. *A reception or clearing house* should be provided for any women and girls arriving without having secured lodgings, and for whom such can not be found before nightfall, or whose circumstances

or condition make it difficult to allot lodgings without further inquiry. Such a clearing house has already been provided in some districts, generally with the help of the Ministry of Munitions, and is, indeed, essential in localities where large numbers of women and girls arrive by train from distant places, often late in the day, without any arrangements having been previously made for lodgings. The house needs to be suitably equipped for receiving all classes. It should be under the charge of a lady superintendent with considerable experience in dealing with women under any emergency; she should preferably have had some nursing training, and be a person of kindly, tactful character. The inmates should have separate cubicles, adequate washing and bathroom accommodation, and facilities for washing clothing should also be provided. Good plain appetizing food and a cheerful, warm sitting room are necessary. A homeless woman or girl, full of vague fears at taking up unaccustomed work, especially in an explosive factory, may spread uneasiness and even alarm among her associates. Depression and fear are contagious, and have been known to cause many to return home the day after arrival. But cheerfulness and courage are also contagious, and the influence of a lady superintendent or voluntary helpers among new arrivals at a reception hostel is of great value. The stay is generally only for a night or two—a week should, unless the case is exceptional, be the maximum—the inmates being found suitable lodging at the earliest moment. At some of these reception hostels arrangements are made with the factory to refund the cost of board and lodgings from wages on the first day by consent of the employee.

510. *Lodgings* with or without board in a family is the readiest and generally the most acceptable arrangement for women and girls. In most centers of munition work some efforts have been made to obtain information as to possible lodgings, visits being paid and lists of lodgings prepared. To begin with voluntary effort was mainly relied on for this purpose working under a voluntary organization or local advisory committee. Experience, however, proved that for an efficient list constant visiting was necessary in order to secure up-to-date information as to lodgings actually vacant, and as to those which were suitable in character. Difficulties also sometimes arose from overlapping of different agencies, and in their memorandum No. 17 the committee, while cordially recognizing the value of the work being done, suggested the necessity for a larger and more elaborate organization than could be carried out by voluntary effort, and they urged the desirability of establishing some system of billeting analogous to that employed for army purposes. During the past 12 months the ministry have established special lodgings committees in 8 of the principal munition districts, and 100 lodging inspectors

have been employed in dealing with the many problems involved in the satisfactory housing of large numbers of girls in lodgings.

511. On the 24th of May, 1917, the billeting of civilians act, 1917, was passed "to make provision for the billeting of persons engaged on work of national importance for the purposes of the present war." A central billeting board was established, consisting of representatives of the Government departments concerned and of other suitable persons.

512. The method by which the board proceeds is to set up a local billeting committee on which are represented the local authorities, the local lodgings committee (if one already exists), the employers, and the workers. An executive officer (who may be a man or woman) is appointed, who with the assistance of investigators makes a house to house canvass of the town and afterwards as an officer of the committee adjusts as far as possible any complaints which arise between landlady and tenant. Where the problem is chiefly concerned with men a male officer is appointed; where it is chiefly concerned with women there is usually a woman officer. The local committee has power to fix scales of payment for lodging and accommodations subject to the approval of the central board, and to guarantee payment, up to a reasonable extent, of charges incurred by defaulting lodgers. Machinery is in operation for recovering such charges from the defaulter, but in no case has it yet been found necessary to prosecute under the act. No compulsory billeting has yet taken place, and though compulsory powers are contained in the act, they are probably unworkable in practice.

In the areas referred to them, the amount of accommodation which would be obtained by compulsory billeting is, generally speaking, so slight as to be negligible, practically all the available lodgings being obtainable by voluntary means when once the payment of rent is guaranteed. A surprising number of voluntary lodgings has been forthcoming even in the most congested areas when once a house to house canvass has been made, and on one side the patriotism and good feeling of the people as a whole has been appealed to, and on the other they have been secured against loss. In one of the most crowded centers 900, and in another 1,500, additional lodgings were found to be available after such a canvass. In one area, where the importation of additional labor has decreased, it has been found possible, in conjunction with the medical officer of health, to relieve the worst cases of overcrowding. This, of course, is only possible in cases where the supply of billets exceeds the number required to satisfy the demand of imported workers for accommodation.

In cases where the Ministry of Munitions has already been employing lodgings investigators under the extramural welfare officer a

certain number of these investigators are usually transferred to the billeting board. An arrangement is come to whereby cases of hardship and distress which the billeting officer comes across in lodgings are referred to the welfare officer for assistance, and she retains one or two of her original staff to assist in dealing with these. The billeting officer and the welfare officer are therefore in close touch in all questions relating to lodging accommodation and are often able to be of considerable use to each other.

513. *Hostels.*—In most areas, however, the problem is one not of lodgings but of housing. The towns were underhoused before the war, and the importation of large numbers of munition workers has simply served to accentuate a problem which already existed before the war. In a number of areas the Ministry are accordingly assisting local authorities and private firms to carry out new schemes for increasing the permanent housing accommodation of the locality. But such schemes are not in themselves usually sufficient, and it has been found necessary to supplement them by the provision of temporary dwellings, hostels, and hutments. Prior to the war hostels were provided by firms for the accommodation of their workers. A number of boarding houses for educated working women and for workmen were also in existence. In addition, voluntary bodies and private persons had provided hostels intended to afford decent accommodation for girls with low wages; these were of necessity not run on a commercial basis. Conditions arising out of the war have led not only to increased provision by voluntary bodies, but have caused the Ministry of Munitions, acting either directly or through private firms, to erect temporary hutments, providing in some instances for many thousand workers. Such provision is not to be regarded as in any sense a permanent solution of the housing question, but simply as a temporary measure essential for the health, comfort, and efficiency of the workers who have been temporarily imported, not only into manufacturing towns but also into villages and rural districts. The following account of the experiences of a single district represents conditions which are by no means unique:

Owing to the great influx of workpeople into this comparatively tiny village, it soon became apparent that housing would have to be arranged. We therefore centered our efforts on this, with the result that we caused houses to be built on the Garden City principle, and there are now houses standing which were built by our own instigation, to the number of 625 on one estate, and on the other 100. In addition to this, we scoured the neighborhood and rented as many large unoccupied houses as we could lay our hands on. In this way we are now in possession of over 70 hostels, where we house 1,600 people. The state of affairs at present is such that we have a long waiting list of people who desire to reside in the place. As soon as sanction is obtained we shall immediately start building houses, of which quite 1,000 are absolutely necessary.

514. For various reasons hostels have not always been popular. The objections most commonly put forward by women and girls and by their trades-unions have included the following:

(a) Girls dislike the idea of living in large communities or of spending their leisure hours with the persons with whom they work and with whom they may have no sympathy or social affinity.

(b) However well organized a hostel may be, some restrictions on personal liberty are inevitable.

(c) Where a hostel is provided by a private firm the girls are subject to the control of the firm during the whole 24 hours. If they lose their job they are likely at the same time to lose their place of board and residence.

(d) Hostels are not always self-supporting, and girls object to being "beholden" to anyone, most of all to the firm by whom they are employed.

515. More recently the numbers seeking admission to the hostels have steadily increased. It is not easy to determine how far this increase is due to a change of attitude in regard to the above points of objection, or, on the other hand, to improvements in the organization and management of the hostel and to the greater difficulties attending housekeeping in lodgings. In any case there can be no doubt of the essential importance of special care and attention being bestowed on the planning, equipment, and management of hostels. Some detailed suggestions on these points are given in Appendix F and only one or two points need be referred to here.

Much depends upon the personality of the superintendent and upon the character of her assistants and staff, who should be carefully chosen and controlled. As much freedom as is compatible with good order should be allowed; the inmates are independent workers not living under any community rule. The bedrooms should be separate self-contained cubicles. The dining and recreation rooms should be bright, airy, and well warmed. In addition the need should be recognized for rest and companionship of a few friends, and should be met by the provision of a sufficient number of small sitting rooms. The absence of these has doomed otherwise satisfactory hostels to failure, since many women and girls soon tire of organized recreation night after night, and having worked hard in a factory for many hours crave the quiet rest of a room more nearly resembling home.

516. *Transit.*—The suitability of the lodgings and housing accommodation of a district is closely affected by the existence of reasonable facilities for traveling between the place of residence and the factory. The committee have been greatly impressed with the extent to which health, temper, timekeeping, and output suffer, when to the day's work is added the discomfort and fatigue of long walks in bad weather or in darkness, the long waits resulting from inconvenient

services, overcrowded railway carriages, trams, and buses. Admittedly the problems involved in the conveyance of large numbers of workers at particular times of day are not easy of solution and are increased by difficulties of staff and rolling stock created by the war, but experience conclusively proves that additional and more conveniently timed services can be provided; shelters at tram and omnibus termini have been erected. In some districts special fleets of charabancs have been provided. In the darkness of early morning and at night, if no lights are allowed on the railways, workers should not be crowded together in the darkness, and separate compartments for women are desirable.

517. To sum up the evidence collected by the committee and the results of their medical inquiries have emphasized the large extent to which the capacity and efficiency of the worker are affected by unsatisfactory conditions of housing and transit—conditions which frequently existed before the war, though they have undoubtedly been accentuated since. Sufficient attention does not appear to have been given to the matter in the past, but it is essential that these factors should be taken into account in determining the best conditions of employment in different factories and areas. There can be no doubt that provision of better housing accommodation and of more rapid and convenient means of transit would have a beneficial effect on the industrial efficiency of the country.

SICKNESS AND OTHER PERSONAL QUESTIONS.

518. *Arrangements for sickness.*—Large hostels have, as a rule, a small hospital with a nurse. Smaller hostels should be provided with sick rooms to which the patients may be removed if nursing and attention are needed beyond what the servants can render. But illness, even of quite a temporary character, presents more difficulty among women and girls in lodgings in a strange place. For lodgers living with the family and sharing a room or a bed with other lodgers illness is a great misfortune, and may through neglect become very serious; it may, if infectious or contagious, be a source of danger to others and cause absence from work of many who are needed at the factory. Home visiting by the factory supervisor and the better organization now generally established have undoubtedly served to bring such cases to the notice of welfare officers and to secure suitable treatment. They have also served to bring to light cases of girls who are sufficiently unwell to be out of work for a few days or sometimes longer, but who are not ill enough to require hospital treatment. Here again action is necessary to prevent hardship and distress. In one instance an arrangement has been made with a Government hostel under which a certain number of beds are reserved for these cases and

are filled on the recommendation of the outside welfare officer by girls who need rest and good food for a day or two. A certain number of rest homes have been established to which workers can be sent, and special provision for sending them to convalescent homes has also been made.

519. *Stranded workers*.—A certain number of girls come to munition centers not through the agency of the employment exchange and are either unable to obtain work or have after a short experience proved unsuited to the work and become stranded, often without money enough to return home. Such girls frequently require assistance to obtain other and more suitable work or to return home. Where girls are dismissed through no fault of their own they are under certain conditions provided through the ministry with repatriation railway warrants.

520. *Maternity cases*.—The numerous and urgent problems involved in the care and treatment of maternity problems have already been discussed in Section IV, and need not be again referred to. The question involved in the provision of day nurseries for the children of munition workers are also discussed in that section.

LEISURE.

521. *Recreation*.—Emphasis has already been laid on the importance of recreation in providing the relief from monotony and the change of environment which are essential aids to recovery from fatigue. The question is one of special importance in areas where large numbers of workers have been congregated, and are thus deprived of the means of recreation to which they are accustomed. Especially should the leisure of the week-end be provided for. This important matter can not be left to chance. If opportunities of wholesome amusement, refreshment, and recreation are not provided, the public houses and less desirable places of entertainment may benefit, but everybody else suffers.

Until recently there has not been in any munition area a systematic attempt to cope with the problems of industrial recreation, or even to coordinate the activities of such organizations as exist. The committee are, however, glad to recognize the increased attention now being paid to the subject. The clubs established are very varied in character and provide for men and women, as well as for boys and girls. In addition to the usual games, indoor recreation includes concerts, dances, theatricals, lectures, cinemas, classes of various kinds, including physical exercises, dancing, and dress-making. Open-air provision includes games, swimming, and open-air camps. Mixed clubs for men and women are increasingly popular, and most of the central schemes referred to below contain at

least one mixed club. The need should not be overlooked for providing small clubs easily accessible to tired workers, who desire quiet occupation, and may not wish to journey to more central institutions. In more than one instance, it has been found practicable to arrange for well-to-do residents to offer hospitality in their own houses during Saturday and Sunday to parties of women and girls, and to allow the use of their gardens in summer. Such facilities are greatly appreciated, and may do much to remove class prejudices and misunderstandings.

Recreation schemes are generally of one of two kinds: Central schemes available for all workers in the district, and factory schemes which are confined to the workers in a particular factory.

522. In a considerable number of areas, central recreation schemes have been set on foot through the cooperation of the civic authorities, existing agencies, the employers, and the workers. It is indeed an essential of the success of any recreation scheme that the workers should take a large share in the management, and that care should be taken to provide what they themselves desire. Arrangements have been made for cooperation with the juvenile organization committees, which are being established throughout the country by a central committee under the auspices of the home office. These committees are being encouraged to deal with adults as well as juveniles, and so to facilitate the establishment of schemes embracing the whole industrial population of a town. Under certain conditions (see Appendix K), contributions by employers to recreation schemes may be written off as a working expense.

The most detailed central scheme which has yet been worked out is that of Birmingham. There is a finance committee, of which the Lord Mayor is chairman, an executive committee on which are represented various organizations and individuals interested in recreation. The city is divided into 14 areas, each of which has its own area committee consisting partly of employees; each committee has a representative on the central executive committee. The finance committee has complete control over all the funds raised and applications for funds come to it from the executive committee which is responsible, for weighing the various claims of the different areas or different organizations one against the other. Girls' and boys' clubs, recreation halls, playing fields, and open-air concerts are among the activities supported. The following statement by the welfare supervisor of a local factory affords some indication of the value of the work:

"Welfare work in Birmingham is very much helped by the extremely good clubs started by the Civic Recreation League. There is one near our factory to which a large number of our girls go, and I have found it the very greatest help to me in my work. In this club the girls have drilling, dancing, singing, embroidery, dressmaking, millinery, dramatic, and shorthand classes, and, in summer, rambles, cycle rides, swimming and tennis in connection with it. I go myself regularly. A club of this sort is more satisfactory than one belonging and limited to employees of the works; it is more of a change for the girls. They can meet friends who go to other factories; with larger numbers it is possible to run a greater variety of classes. I can not speak too strongly of the importance I attach to these clubs, and any success I have had in my work I attribute largely

to the very pleasant conditions under which I got to know a large number of girls out of work hours at the Civic Recreation League Club. It is neither comfortable nor good discipline to talk to the girls more than is absolutely necessary in work hours, and unless one does talk to them they will never dare to come for help and advice on the many small points that are always cropping up in a large factory. One shop has a ladies' football club, but I am hoping that next year the Civic Recreation League may have started hockey and netball teams and that the girls will join those instead. I feel most strongly that the 'playing of game' idea is in many cases lacking, and any possible kind of organized game should be encouraged in every way."

In other centers, instead of one big comprehensive scheme being set on foot at once, a small central club has started as a nucleus, and from that developments have gradually sprung. In one case a girls' club was first set on foot, a boys' cadet corps speedily followed, and the town in question is now contemplating an ambitious scheme for a people's palace. A most encouraging sign has been the interest and cooperation of the trades-unionists, both men and women, in certain areas as soon as they have realized the elasticity and freedom of the schemes.

523. Central schemes are, on the whole, to be preferred where they can be established, but in many cases, owing to the isolated position of the factory, the lack of local initiative or other causes, provision for recreation can only, or, at any rate, can most conveniently be made in connection with a particular firm. It forms, indeed, a natural development of the work of the welfare supervisor, and the committee are convinced that their activities have proved of the highest value and have been widely appreciated. Factory schemes are, however, liable to be objected to by the workers on the ground that they represent an endeavor on the part of the employer to bind them to the firm, or because they object to being tied to the works during their leisure time. Apart from this, a proportion of the employees may live at such a distance from the factory that they are unable to avail themselves of factory clubs. In such cases employers have sometimes found it desirable also to contribute to central schemes if they exist.

524. The following account has been received from a firm whose works are situated in an isolated position:

On the social side everything possible is being done to interest and amuse our employees after working hours. We have a good works orchestra, and our brass band is being organized, as there is plenty of talent in the factory. This neighborhood suffered a very severe blow when the theater was burnt down. We are compelled to fall back upon a cinema annex (which is merely a large drafty marquee) and our Y. M. C. A. hut as the only available buildings outside the factory in which to hold entertainments. Our two mess rooms are in constant demand for socials and dances and whist drives, which are held almost every Saturday night, the proceeds from which are always devoted to some charitable object, such as the entertainment of wounded soldiers and sailors, etc. The employees support most generously any collection lists which are sent round the factory for charitable purposes. We had a four weeks' collection for Christmas parcels for soldiers and sailors on active service which realized over £600 [\$2,919.90]. We also raised over £400 [\$1,946.60] for the Victoria buffet fund, and at the end of last year £438 [\$2,131.53] was collected to entertain the wives and children of men from the neighborhood who have gone to the front. This enabled us to entertain 1,800 mothers and children on the two consecutive

Saturdays—January 26 and February 2. A visit from the Coldstream Guards Band was very much enjoyed by our workers a few weeks ago, and a novelty in the form of a recital by Mark Hambourg and the Gresham Singers last Sunday afternoon was highly appreciated by some 600 of our employees. At the Y. M. C. A. hut we have a concert every Thursday evening and a lecture every Tuesday evening and a mid-day lecture every Wednesday.

Club.—With regard to sports, our athletic club was thoroughly reorganized last spring. The following sections are now in full swing: Cricket, football, harriers, hockey, gymnastics, wrestling and boxing, and rifle club. We also hope to start in the near future bowls, tennis, quoits, and a swimming club. Ladies and boys are included in these sections as well as men. For instance, the rifle club has a membership of 490 men, 53 ladies, and 51 boys, and the football section 492 men and 60 boys. We also run a ladies' football team. There are also about 80 lady members of the hockey section. Altogether we have about 1,400 members of the athletic club. We are at present running an association football league in the factory in which 18 teams are competing.

A new sports ground has just been acquired, and we should in the near future be fully equipped with good playing grounds for the various branches of sport. Throughout, our chief difficulty has been the securing of sufficient grounds for play. The above-mentioned grounds are a desirable estate situate close to the church, comprising about 45 acres in all, with a large private residence; the latter we intend fitting up as a maternity home (should we obtain the necessary grant from the ministry). The circumstances surrounding the purchase of this ground are extremely gratifying, inasmuch as we have the assurance of the workers here that the whole of the money will eventually be contributed by themselves. Not only is the proposition one of welfare from an athletic point of view, but a good housing venture, as it is proposed to build in due course.

Magazine.—In July last we started the works magazine, with the double object of (1) saving paper and labor by avoiding the printing and circulation of notices on every variety of topic throughout the factory; and (2) giving the employees some idea of what is going on in their midst and to keep before them the facilities that are offered them for recreation, etc. The magazine seems to be answering its double purpose very satisfactorily; 8,600 copies of the special Christmas number were sold, and the sales in an ordinary month are now between 7,000 and 8,000 copies. An abundance of subject matter is contributed from all parts of the factory, and the advent of the magazine is eagerly looked forward to each month, proving the need of such a channel to break down class prejudice and build up cooperation.

525. The following statement gives some account of what is being done for the women workers at Woolwich Arsenal:

About 18 months ago, bearing in mind that many of the women and girls employed in the Royal Arsenal were living in hostels or lodgings away from home, I drew up and inaugurated a scheme to provide for them social and educational facilities out of arsenal hours. The result has more than passed my expectations, as during the above-named period some hundreds of the women workers have availed themselves of the opportunities offered. As many of the workers are engaged in processes necessitating a sitting position while at work, it seemed to me that provision should be made to counteract any ill effects that might accrue from long hours of sedentary work; therefore I arranged that gymnastics, physical exercises, Morris and country dancing be included in the scheme. During the summer months swimming is also included. I am sure that it is far better for women and girls to perform health-giving exercises under wise and trained supervision than for them to walk about the

darkened streets of the neighborhood aimlessly. Many workers are engaged in purely mechanical processes, and for these I felt that opportunity should be given for them to use their reasoning powers and to develop their intelligence. Therefore I arranged for classes in dramatic literature and elocution, thus giving students a taste for good reading.

A large proportion of the women being engaged on more or less dangerous work, I felt it would be wise for them to have some knowledge of first aid, home nursing, etc. These classes are most popular and have attracted large numbers, many of whom presented themselves for special examination and were granted certificates of proficiency by the London County Council.

I desired to launch my scheme without incurring expense or increased liability on the part of the Ministry of Munitions. I applied to the London County Council for the loan of a neighboring school and met with a ready response. On guaranteeing a sufficient number of students, the council offered to provide and remunerate instructors and instructoresses, and even appointed a responsible mistress to take charge of both the teaching staff and students and to keep in close touch with me as regards the carrying out effectively the details of my scheme. A charge of 1s. [24.3 cents] per student per subject is made for each session. In order that the hours of work at the arsenal are not in any way interfered with I arranged that classes should sit both shifts, the hours of instruction being from 5 to 6 for the night shift, and from 8.15 to 9.15 for the day shift. The curriculum includes such subjects as gymnastics, physical exercises, Morris and country dancing, singing, dress and blouse making, etc. I may add here that the men employed in the arsenal are permitted to join the singing, and the addition of their voices enables the class to enjoy the rehearsal of four-part glees, choruses, etc. This class also has rehearsed Elgar's *Banner of St. George* and assisted in the chorus of the mystery play *Eager Heart*.

At varying times the students arrange social gatherings on Saturday evenings; each member of the class is allowed to invite a nonmember, and the girls are specially encouraged to introduce their male friends. In addition to the monthly socials, twice at least during the season, the members of the gymnastic classes give displays at the town hall and in this way further recruits from the arsenal to the classes are obtained. The literature class also contributes a public performance, producing scenes from standard plays and authors. But though a large number can and do attend these classes, there is a far larger number who have no time for recreation except on Sundays. I therefore, in cooperation with Mr. Howard Jones, organized Sunday concerts at the Woolwich Town Hall, for which we obtain the best talent possible, and at which we endeavor to reach a very high standard and tone. These concerts have done untold good; but now that the factories are closing half days on Saturdays, I am proposing to drop the Sunday during the summer months and organize Saturday afternoon outings into the country.

Several hockey and football clubs have been organized throughout the winter under the supervision of some of my staff.

The members of the various classes and clubs from time to time have given performances for the entertainment of wounded soldiers. Another outcome of the scheme has been the inauguration during the winter season of a series of dances under welfare supervision.

526. What may be done on a smaller scale by an energetic welfare supervisor is illustrated by the following account:

We are in need of recreation rooms; we have to use our dining rooms for all recreation schemes. In these dining rooms we have a cinema box and stage.

We have concerts, dances, or whist drives all through the winter months every Saturday night. The girls' club runs a gymnasium class on Wednesday evenings and a dance every Monday, to which men and nonmembers are allowed to come on payment of 3d.

527. In 1915 the Maharajah Scindia of Gwalior generously gave a sum of £6,000 for munition workers. Up to the present about three-quarters of this sum has been distributed by the welfare department of the Ministry of Munitions on the development of schemes for recreation, including lectures and concerts in clubs and canteens, pianos, lantern slides, books or pictures for clubs, organization of recreation, and a holiday camp for boys.

528. *Facilities for divine worship*, religious instruction, and spiritual ministrations according to the convictions of the various denominations are no less worthy of consideration for munition workers than for the Army and Navy. The existing local provision may not always be adequate or conveniently situated.

529. *Public order*.—To bring large numbers of young people into any locality must increase the difficulty of maintaining public order and good behavior at all times. Just as in university towns there are proctors and in military centers there are military police, so where large numbers of women and girls are assembled for munition work women police and patrols are required. Special dangers beset young women away from home and friends; the impossibility of excluding altogether from those who flock into munition areas some women of bad character, the necessity for subduing the lighting of streets and courts and open spaces, and the change of shifts at the factory early and late—all contribute to conditions of difficulty for which trained women are well adapted. A large number of women police are employed by the Ministry of Munitions inside factories; in one area eight are employed by the ministry in the town itself. In many towns women police are now working successfully under the chief constable; they are uniformed and trained as recognized members of the force, and in some towns they are "sworn in." Women patrols have been found very useful working in cooperation with the police. They are more especially helpful in dealing with young girls whose thoughtlessness may be placing them in the way of temptation. In the report of H. M. inspector of constabulary, Home Office, 1918, it is stated that 7 counties and 24 cities show women as part of the actual strength of the police force. The inspector mentions in his report the duties allotted to women police. Among them "the maintenance of public decorum among girls upon whom the presence and advice of women in authority has a more restraining influence than those of a man." He also comments on the good work done by women patrols, and writes: "The success of the women patrols will, to my mind, provide strong argument for the employment of women in the regular police force."

530. *The encouragement of sobriety among the population* is an important branch of the welfare work; questions as to the number and the status of the public houses in munition areas, the hours during which drink may be sold, and other matters of a like nature, arise for consideration and action in accordance with the needs of each locality.

531. Much has been done to improve the health and increase the efficiency of the munition worker by the reduction in excessive drinking which has been brought about through the restrictive measures of the central control board (liquor traffic) under the chairmanship of Lord D'Abernon and of which the committee's chairman (Sir George Newman) is a member. The statistical evidence which is at present available with regard to the effect of these measures deals with the general population, and does not include data having specific reference to munition workers as a distinct class. It may, however, be assumed without question that any general movement in the prevalence of alcoholism must necessarily affect the industrial classes as much as, if not, indeed, more than the other sections of the community; so that, if there has been any considerable decrease in alcoholic mortality and alcoholic disease in the population at large, it is clear that there must have been a corresponding, or even greater effect of the same sort in the case of munition workers. And the statistical evidence that such a decrease of alcoholism has, in fact, occurred is definite and convincing. Thus, taking the figures for the prewar year 1913 as the basis of comparison, the returns of the registrar general show that the mortality from chronic alcoholism, which in 1914 showed a slight decrease in the case of females and a slight increase in the case of males, fell in the following year by 22 per cent in men and by 19 per cent in women, and in 1916, when the restrictive orders of the control board were in operation over the greater part of the country the number of deaths from this cause dropped by no less than 44 per cent and 54 per cent in males and females, respectively. This downward movement continued in 1917, the figures for the 12 months being 67.8 per cent below the 1913 standard in the case of men, and 69.1 per cent in the case of women. Deaths from cirrhosis of the liver show a similar decrease, though smaller in degree, as would naturally be anticipated, having regard to the chronic nature of this affection and the limited extent to which its progress can be delayed even by rigorous abstinence from alcohol.

532. Statistical data of a comparable character referring to alcoholic disease are unfortunately very scanty, but, so far as they are available, they fully agree with the mortality returns of the registrar general in showing a marked and progressive decrease of alcoholism during the last three years. Thus, in certain localities where it has been possible to obtain records of the cases of delirium tremens over

a term of years, it has been found that the prevalence of this unequivocally alcoholic disorder has fallen by as much as 81 per cent between 1914 and 1917. In Liverpool, for example, the cases recorded in each year within this period numbered as follows: 1914, 511 (366 males, 145 females); 1915, 421 (263 males, 158 females); 1916, 205 (128 males, 77 females); 1917, 99 (71 males, 28 females). Official statistics of alcoholic mortality and alcoholic disease do not, of course, furnish any measure of the absolute amount of ill-health and inefficiency due to excessive drinking; but this fact does not detract from their value as indicating by their fluctuations the general movement of alcoholism, and its reaction to the influences which tend to increase or diminish its prevalence. Regarded from this point of view, the statistics quoted above justify the inference that the unprecedented reduction in the death rate from alcoholism and in the incidence of the graver forms of alcoholic disease since the enforcement of the restrictive measures of the control board, is a sign and index of a corresponding decrease in the less serious and less obvious effects of intemperance on the health and working energies of the munition worker. And this inference is fully borne out by the testimony of employers of labor and by the evidence of competent observers who have had opportunities of investigating the effect of liquor control on the condition of the industrial worker and his output. The liquor board not only reduced the hours of sale, but concentrated them at the workmen's meal times and also imposed restrictions upon the sale of spirits, credit sales, and the habit of treating.¹

¹ See first [Cd. 8117], second [Cd. 8243], third [Cd. 8558], and fourth [Cd. 9055] reports of the central control board (liquor traffic).

SECTION XX.—SUMMARY OF CONCLUSIONS.

533. The committee consider that it is both desirable and convenient that they should conclude their final report by shortly summarizing the various principles enunciated, the conclusions arrived at, and the recommendations made in the various sections of the report. While there can be no doubt that since the appointment of the committee in September, 1915, the issue of their memoranda, the action of the central departments concerned, and the trend of opinion among employers, workers, and the public generally have combined to secure a very substantial improvement in the conditions of employment, it would be a very grave mistake to assume that all is now well, or that further care and attention are not still essential if a serious breakdown of industry is to be avoided. Further, while the committee have of necessity been primarily concerned with the health and physical efficiency of the munition worker under the abnormal conditions created by the war, they are strongly of opinion that the principles underlying right action at the present time are permanent and not merely transitory in importance, and should be accepted also as fundamental to all schemes for industrial health and betterment after the war. One of the vital and pressing problems before the country at the present moment and in the immediate future is the question of the health and contentment, the capacity, status, and efficiency of the industrial worker, whose contribution to the commonwealth is of ever-growing importance.

For convenience of reference the summary follows the order of the sections of the report.

I.—INTRODUCTORY.

(i) Since the committee were appointed in September, 1915, there has become apparent an increased appreciation of the importance of the whole question of industrial hygiene; there is no doubt that the environment and conditions of employment of the worker are vastly better than they were, though there is still much need for further improvement. Apart from the quickening of the national consciousness and sense of responsibility resulting from the war, this development may be attributed to three main causes, the widespread adoption of the recommendations contained in the committee's memoranda and reports, the establishment of a health and welfare section at the Ministry of Munitions and the increased powers for se-

curing the welfare of workers conferred upon the Home Office by the police, factories, etc. (miscellaneous provisions), act, 1916. (See paragraphs 1-10.)

II.—PRELIMINARY AND HISTORICAL SURVEY.

(ii) The problems concerned with the well-being of the worker are not new, though they have been accentuated by the war. Ever since the first beginnings of the modern factory system these problems have received increasing attention from the State, the employer, and from the workers themselves. Many of the questions considered in this report are intimately connected with wider social and industrial questions which fall outside the terms of reference of the committee.

(iii) The work of the committee has been greatly embarrassed by the limited extent to which in the past scientific investigation has been made into the various problems affecting industrial efficiency. Inquiries into the effect of industry upon health have been largely limited to special inquiries conducted into particular "dangerous" trades. There has existed no permanent official body charged with the duty of continuing these inquiries or of investigating the effect upon health of industries which, though not technically "dangerous," may still exercise a potent influence upon health and physical efficiency. Research is greatly needed into the relationship of occupation to fatigue, invalidity, and mortality. It is only within the last 20 years that medical officers have been appointed to the factory department of the Home Office, and the limited number of those officers has made it inevitable that their activities should be largely confined to questions of immediate administrative importance. It is greatly to be hoped that permanent provision will be made for a wider and more continuous investigation of the influences of industry upon health than has hitherto been practicable. (See paragraphs 11-50.)

III.—THE RELATION OF FATIGUE AND ILL HEALTH TO INDUSTRIAL EFFICIENCY.

(iv) The subject of industrial efficiency in relation to health and fatigue is in large degree one of preventive medicine, a question of physiology and psychology, of sociology and industrial hygiene.

(v) Fatigue is the sum of the results of activity which show themselves in a diminished capacity for doing work. Fatigue may spring from the maintained use of intelligence, the maintenance of steady attention, or the continued use of special senses. When the work is monotonous fatigue may appear in the psychological field; monotony may diminish capacity for work; on the other hand "interest" may increase it.

(vi) Fatigue should be detected and its causes dealt with while it is still latent and before it becomes excessive. The tests of fatigue are diminished output, the failure of concentration as shown in increased accidents and spoiled work, staleness, ill health, and lost time.

(vii) Without health there is no energy; without energy there is no output. More important than output is the vigor, strength, and vitality of the nation. The conditions essential to the maintenance of health are, first, personal conditions or those favorable to the body itself (e. g., food, fresh air, exercise, warmth, and adequate rest), and, secondly, a satisfactory environment (e. g., a safe and sanitary factory, suitable hours of work, good housing accommodation, and convenient means of transit). (See paragraphs 51-82.)

IV.—THE INDUSTRIAL EMPLOYMENT OF WOMEN.

(viii) In considering conditions of employment of women as compared with those of men account must be taken not only of physiological differences but also of those contributions which women alone can make to the welfare of the community. Certain ailments and forms of physical disability to which women are liable are readily caused, or at least accentuated, by lack of attention to their special needs.

(ix) Up to the present there has been no marked breakdown in the health of women in industry. It is probable, however, that the strain has been greater than is at present apparent, having been hitherto counteracted or disguised by certain factors, such as improved food and better factory environment, welfare supervision, and the dropping out of the physically weaker. Undoubtedly many women are only able to keep working by a total abandonment of all recreation or social intercourse.

(x) Certain conditions of employment are essential if the risk of future breakdown is to be avoided, including short hours of work conveniently arranged, medical supervision (including rest rooms, first aid, etc.), careful selection of workers, good food, a favorable factory environment, sympathetic management and supervision.

(xi) In the case of married women, to the strain of their work must generally be added the strain involved in housework, as well as in family worries and anxieties. Consequently they are less able to bear the strain of employment, and special attention is necessary to the conditions of their work, particularly in relation to the period of pregnancy and the care of young children. Any general prohibition of their employment is impracticable, but it should be confined so far as possible to "light" work, and the possibility might be considered of allowing them some relaxation at the beginning and end of the day and also during the dinner interval, as is sometimes done in certain industrial districts and also in France. The committee de-

sire to draw special attention to the conclusions of their medical investigators. (See paragraphs 83-115.)

V.—HOURS OF LABOR.

(xii) At the beginning of the war there existed a marked divergence of opinion as to the length of hours that men could profitably work, but there was a widespread belief that long hours produced a larger output, though not necessarily proportionately so. Men, and especially the more highly skilled workers, were frequently employed for as much as 90 hours a week. In January, 1916, the committee provisionally recommended that the average weekly hours of employment of men should be limited to 65-67; that is to say, a 13-14 hour working day.

(xiii) In the earlier stages of the war many women were employed for over 70 hours a week, but there was a much smaller divergence of opinion as to the length of hours which was productive of the greatest output, and the committee in January, 1916, provisionally recommended that the hours of women should be restricted within the limit of 60 prescribed by the Factory and Workshops Act, 1901, and that the employment at night of girls under 18 should be limited so far as possible.

(xiv) In view of the extent to which boys are employed to help men, the committee in January, 1916, provisionally recommended that they should be allowed to work for the same hours as men, but it was urged that, so far as possible, boys under 16 should not be employed for more than 60 hours or at night.

(xv) The scientific data collected for the committee and the experience gained during the past two years combine to support the view that the length of hours of employment provisionally recommended two years ago are now too long and can be reduced without loss of output.

(xvi) By economizing time, apart from any increased rapidity of working, the hourly rate of output can be considerably increased.

(xvii) Though hours of work have been much reduced during the past two years, the time is ripe for further substantial reductions. What the extent of the reduction should be in any particular case can only be determined after considering a number of factors, such as the physical or mental strain of the work, the extent to which the pace of the work is governed by the machine, the factory environment, the physical capacity, the age, sex, and experience of the worker, the suitability of the food taken by the worker, the arrangement of hours of work, and conditions outside the factory (e. g., housing and transit). (See paragraphs 116-162.)

VI.—SHIFTS, BREAKS, SPELLS, PAUSES, AND HOLIDAYS.

(xviii) Provided that the weekly hours of employment are reasonable, it follows in practice that the daily hours of employment will also be confined within moderate limits.

(xix) The daily employment of workers is organized, either in single shifts, or in double shifts, or in three shifts. From the point of view of output single shifts are open to objection owing to the large number of hours during which the machinery lies idle. Double shifts are the form of employment most commonly adopted. Though night work is open to serious objection, at any rate for women and adolescents, double shifts under reasonable conditions are undoubtedly productive of increased output, since they enable the machinery to be employed for the greater part of the 24 hours.

(xx) Wherever possible an interval should be left between the two shifts. The shorter hours of employment involved are widely recognized to be advantageous from the point of view both of the health of the worker and of output. Apart from this, opportunity is afforded for cleaning and ventilating the shops.

(xxi) The three-shift system, especially for women, has much to commend it where it can be organized. The difficulties involved arise in combining the hours of men and women workers, from the shortness of meal intervals, from the workers' fear that shorter hours will mean smaller wages, and from the benefit of the shorter hours being lost through misuse of leisure time or by its devotion to housework duties. The numerous instances in which the three-shift system has been successfully organized show that these difficulties are ordinarily surmountable.

(xxii) The ordinary daily hours of work are organized either under the "two-break" system or the "one-break" system. Under the former system work usually commences at 6 a. m., and the normal breaks are half hour for breakfast and one hour for dinner. Under the latter system the work commences after breakfast, at 7 or 8 a. m., and there is frequently only a single break of one hour for dinner, though a break for tea is sometimes necessitated by the hours of work.

(xxiii) The evidence suggests that work before breakfast is a mistake. Only the minority of workers can put in their best work before having a proper meal in the morning. The time lost often causes serious disorganization, and even where the discontinuance of work before breakfast involves a small reduction in the nominal hours of employment the loss is generally more than made good by the reduction in the time lost.

(xxiv) Many women and young persons can not profitably be employed for the full spell of five hours on continuous work allowed by the factory act.

(xxv) Even where the spell is somewhat less than five hours, employers frequently allow short intervals for refreshment in the afternoon and also in the morning. These pauses not only provide an opportunity for refreshment, but a period of rest and recovery from fatigue and a break in the monotony of work.

(xxvi) All workers engaged on active work take voluntary rest periods, generally quite unsystematically. It is desirable that these rests should be replaced by authorized rest pauses systematically determined.

(xxvii) All workers should be allowed periodic holidays—preferably of several days' duration. They are equally important for the management and foremen. They also afford an opportunity for repairs to plant and machinery. (See paragraphs 163-189.)

VII.—SUNDAY LABOR AND NIGHT WORK.

(xxviii) At the commencement of the War Sunday labor, especially for men, was widely adopted in the hope of increasing output. The evidence, however, proves conclusively that Sunday labor is unpopular, uneconomical, and not productive of increased output.

(xxix) In accordance with an early recommendation of the committee, Sunday labor is now almost entirely confined to sudden emergencies, repairs, attending furnaces, and certain continuous processes. Constant scrutiny is, however, necessary in order to secure that such exceptions as continue are confined within the narrowest limits. Where Sunday labor becomes necessary, arrangements should be made by a system of relief shifts that no individual worker is employed more than six days in the week.

(xxx) Even for men night work is open to serious objection. It is uneconomical owing to the higher charges for wages, lighting, and heating. Lighting is generally inferior and supervision more difficult. Adequate sleep by day is difficult, owing to dislocation of ordinary habits or from social causes. Social intercourse and recreation can hardly be obtained except by an undue curtailment of sleep. Continuance of education is generally impracticable. Finally, it is unnatural to turn night into day.

(xxxi) Night work for women and girls has been illegal for over 50 years. Although inevitable for adult women under existing conditions, it should be stopped as soon as it ceases to be essential. Night work for girls under 16 has now been entirely stopped; for girls between 16 and 18 it has been largely curtailed and should be ended as soon as possible.

(xxxii) Night work for boys is only legal in certain continuous processes. It has already been curtailed for boys under 16, and should be altogether stopped. The committee fully indorse the

arguments against the employment of any boys under 18 at night which were put forward in the report of the departmental committee on the Night Employment of Male Young Persons in Factories and Work Shops,

(xxxiii) There is no uniformity of practice as to how long a worker should remain on the night shift at any one time. A week is the commonest period, but much depends on the social conditions under which he lives. Investigations suggest that continuous night work is productive of less output than the system under which a worker is engaged on day and night shifts alternately. There is no evidence that the output of a continuous day shift balances this inferiority. (See paragraphs 190-211.)

VIII.—LOST TIME AND INCENTIVE.

(xxxiv) Time may be lost through the failure of the worker to attend the factory regularly, or it may be lost at the factory by slackness at the beginning or end of the spell, unregulated rest pauses, or lack of material.

(xxxv) The causes of lost time (as ordinarily understood) may be broadly divided into those that are mainly inherent (e. g., sickness and accidents external to the factory, bad conditions of housing and transit, bad weather, domestic duties, or lack of material), and those which are mainly controllable (e. g., sickness and accidents of factory origin, drink, indifference, discontent, overtime and Sunday work, lack of work).

(xxxvi) The proportion of lost time due to sickness is generally greatly underestimated.

(xxxvii) The causes of lost time should be carefully ascertained and remedies sought.

(xxxviii) Incentives to work include patriotism, a good factory environment, social amenities, instruction of the new worker, suitable and sufficient rest pauses, and wages.

(xxxix) Wages are probably the most important incentive. No wage system can afford an effective incentive unless there is a healthy body of workers. The system must be easily understood and properly adjusted. The incentive fails if the workers can obtain too easily the money required to meet their social aspirations, or if the hours of work prevent their spending the money earned. (See paragraphs 212-219.)

IX.—FOOD AND CANTEENS.

(xl) The requirements of the body for food are largely affected by the amount of physical energy expended in daily work and by the environment of the worker. Growing boys and girls require rela-

tively more food than adults. For the maintenance of industrial efficiency the worker must have food which is adequate in amount, nutritious, fresh, digestible, and appetizing.

(xli) Apart from any question of shortage of food supplies many workers do not obtain suitable food owing to domestic difficulties, distance of the home from the factory, night work, and ignorance of the need (in the case of women).

(xlii) Carried food is unsatisfactory owing to the limitation in the kinds of food suitable. Further, the food is necessarily cold and may deteriorate easily. Means of heating up food are useful, but are inadequate because such food loses nutritive value. The heating up of any large number of meals is difficult to do satisfactorily.

(xliii) The only satisfactory solution of the problem of providing suitable food at low prices for large numbers at convenient times lies in the establishment of industrial canteens. Apart from the suitability of the food provided the essentials for success of a canteen include accessibility, the convenience and attractiveness of the premises, prompt service, convenient hours of opening, and a system of management acceptable to the workers.

(xliv) At the end of 1917 there were about 840 canteens in munition works and docks. The committee are strongly impressed with the value of the facilities thus afforded, and are convinced that they have very materially contributed to the maintenance of the health of the worker, to the prevention of a serious breakdown under the strain imposed by war conditions, and to increased efficiency and energy and corresponding output. Though the need for canteens has been accentuated by war conditions, it is in a large measure a permanent one. (See paragraphs 220-261.)

X.—SICKNESS AND ILL HEALTH.

(xlv) An undue proportion of sickness in any group of workers usually represents amongst those not actually sick lessened vigor and activity which can not fail to reduce output.

(xlvi) Conditions of industrial occupation may affect health by reason of long hours of work, cramped and constrained attitudes, prolonged or excessive muscular strain, bad ventilation and lighting, dust and fumes. To the influences of occupation upon health must be added the predisposition to disease arising from the absence of personal hygiene.

(xlvii) Medical inquiries suggest that the principal forms of minor ill health to be found amongst male workers are headache, footache, muscular pains, sleepiness on the night shift, and nervous symptoms; amongst women workers indigestion, headache, anemia, and muscular pains.

(xlviii) Records of sickness, broken time or diminished output should be carefully kept and scrutinized. For a correct appreciation of their significance account must be taken of various causes of fluctuation, such as climatic conditions, approaching or recent holidays, patriotic enthusiasm, long hours, and Sunday labor.

(xlix) Any sound system for dealing with industrial disease must be based on the principles, first, that prevention is better than cure, and, secondly, that the treatment, to be imposed effectively, must deal with the beginnings of the disease. It follows that the preliminary safeguard should be to extend to all workers the preliminary medical examination already provided for in certain munition works and especially in those where dangerous substances are manipulated. Such an examination is especially necessary at the present time owing to the strain involved by present conditions of employment and owing to the large number of persons who are taking up industrial employment for the first time; but such examinations are likely to be always desirable where the work involves special strain and particularly so in the case of women. There is a similar need for the periodic reexamination of such workers.

(1) The present provisions of the factory act for the certification of the physical fitness for employment of children and young persons can hardly be regarded as adequate. The factory's certifying surgeon has seldom any previous knowledge of the case. The value of his certificate would be greatly increased if it were only given after consideration of the medical records in the possession of the school medical service, and closer cooperation appears to be desirable. At present these records are seldom available. Provision is now seldom made for periodic reexamination, but it is extremely desirable having regard to the effect of entry into industrial life. The departmental committee on the night employment of male young persons emphasized the need for periodic examinations once at least in every six months, and recommended that records of the results should be kept.

(li) The second preventive measure is to reduce to a minimum unfavorable conditions of environment. Thirdly, arrangements should be made for adequate medical and nursing schemes. Medical attendance is usually obtainable under the national insurance system, but nursing can only be obtained by the employment of one or more trained nurses to undertake duties in the factory by night as well as by day. The duties of the nurse would include supervision of the health of the workers and especially of those temporarily indisposed, following up cases of sickness and taking charge of first-aid treatment of injuries. Such arrangements have been instituted in many munition factories, especially where women are employed, and have proved of great value to employers and employed alike. (See paragraphs 262-279.)

XI.—INJURIES AND ACCIDENTS.

(lii) A grave amount of disablement is caused by accidents such as fractures, open wounds, and injured limbs, but probably an even larger amount of interruption to work is caused by slighter injuries, such as scratches and burns, which may, however, become serious if neglected. The principal causes of accidents are speed of working, fatigue, psychical influences, nutrition, and alcoholic consumption, lighting, and temperature.

(liii) A large number of accidents are preventable, and it is to the interests of all parties that the number should be reduced. However complete the installation for securing the safety of workers, success must largely depend upon the intelligent cooperation of workers and foremen, and their help should be secured in studying causes and methods of prevention.

(liv) However effective may be the methods of prevention adopted, some accidents will occur. It is accordingly important that in each shop there should be one or two workers trained to render first aid in case of accidents. Leaflets of instruction and advice should be issued.

(lv) Though in many factories good provision has been made for the treatment of accidents, great improvements should result from the recent Home Office order requiring employers in certain industries to provide and maintain—

(a) First-aid posts or local dressing stations for every 150 workers; and

(b) An ambulance room or central dressing station wherever the total number of employees is 500 or more. The room is to be in charge of a nurse or other person trained in first-aid work. Records of all cases treated are to be kept. Provision is also to be made for the conveyance to hospital of the more serious cases. (See paragraphs 280-298.)

XII.—EYE INJURIES.

(lvi) Injuries to and diseased conditions of the eye are a widespread cause of inefficiency. The principal causes are accidents from flying particles and impacted bodies arising from grinding and similar operations, injuries due to exposure to intense heat and eyestrain from inferior lighting, uncorrected errors of refraction, or other causes.

(lvii) The principal measures of prevention are the provision of eye guards or goggles, good lighting, examination of eyesight, and the provision of suitable spectacles. Accidents if neglected may easily cause serious incapacity, and they should receive immediate attention from a doctor, or, failing him, a qualified nurse. (See paragraphs 299-314.)

XIII.—SPECIAL INDUSTRIAL DISEASES.

(lviii) From the point of view of munition work TNT is much the most important of the "dangerous" occupations, both on account of the serious effects which may result and the large numbers of workers employed. It may be absorbed through the skin or through the digestive tract or by the inhalation of fumes or dust. Poisoning normally takes one or more of the following forms: Dermatitis, digestive troubles, blood changes, and liver degeneration (toxic jaundice). The occurrence of poisoning depends to some extent upon personal idiosyncrasy. The great majority of workers are insusceptible, and remain so, but a few are affected, but not always those who, owing to ill health and malnutrition, might be expected to be specially liable.

(lix) The conditions of employment in the manufacture of TNT are governed by a Home Office order, while its use and manipulation are governed by Regulations of the Ministry. The principal means of prevention adopted are: The reduction to a minimum of dust and fumes, constant medical supervision, limitation of the period of exposure, provision of ample and suitable food, special working costumes and suitable cloakrooms, and washing facilities.

(lx) Other substances in the manufacture and use of which special precautions are necessary include lead, fulminate of mercury, tetryl, aeroplane dope, picric acid, poisonous gases, and nitrous fumes. The preventive measures adopted are on similar lines to those for TNT. (See paragraphs 315-351.)

XIV.—CLEANLINESS, VENTILATION, HEATING, AND LIGHTING.

(lxi) A high standard of cleanliness is essential not only for health but because it has an important bearing on the self-respect of the worker.

(lxii) Flooring should be smooth, hard, durable, and impervious. Wooden flooring should be provided for standing on, as causing less fatigue and being more conducive to warmth and dryness of the feet.

(lxiii) The object of ventilation is to provide air which is pure, clean, stimulating, and refreshing. The air should be cool and dry, not monotonous in temperature, and moving rather than stagnant. The principal impurities are carbonic acid (principally important as affording an indication of the efficiency of ventilation), volatile substances given off from the skin and alimentary canal of human beings, bacteria, dust, and fumes.

(lxiv) The ventilation and heating of every workshop presents a separate problem. There should be adequate cubic capacity, louvers or other definite openings into the outside air, supplemented by the use of doors, windows, and fans.

(lxv) What is the best temperature depends on the work and habits of the worker. Sedentary workers may require a temperature of about 60° F., though it may be somewhat higher if the air is in motion.

(lxvi) Some one person should be made responsible for securing the proper use and maintenance of any installation for ventilation and heating.

(lxvii) Lighting should be adequate, reasonably uniform, shaded from the eyes of the worker, and should not cause extraneous shadows. Windows should be cleaned regularly. (See paragraphs 352-387.)

XV.—SANITATION, WASHING, AND CLOAK ROOMS.

(lxviii) For the proper maintenance of health it is essential that the sanitary accommodation should be adequate, conveniently arranged, and kept thoroughly clean.

(lxix) Washing is beneficial to the health, efficiency, and self-respect of the worker, and there is a growing demand for the provision of facilities. The installation must be adequate in amount, readily accessible, and easily maintained. Washing troughs are generally to be preferred to separate basins. An ample supply of hot and cold water, nailbrushes, soap, and towels are other essentials.

(lxx) The provision of baths is recommended where workers are employed on hot or dusty processes. In such cases they may prove an effective antidote to muscular rheumatism.

(lxxi) Cloakrooms are necessary for health, especially of women and girls. They should be close to the canteens, lavatory, and sanitary accommodation. Separate lockers should be provided for each worker. There should be ample accommodation for changing clothes and boots and for the drying of clothes. They should be kept thoroughly clean and ventilated. Means should be taken to prevent petty pilfering or theft. (See paragraphs 388-412.)

XVI.—SEATS, WEIGHTS, CLOTHING, AND DRINKING WATER.

(lxxii) Protective clothing, though essential for certain types of employment (e. g., those involving dirt, dust, damp, heat, or dangerous machinery), is desirable for all workers, and especially for women and girls. It adds to their smartness and neatness, and also aids discipline and esprit de corps.

(lxxiii) Whatever the nature of their employment, workers should have opportunities of sitting down from time to time. Comfortable seats should also be provided for use during meal hours, and for workers who are temporarily indisposed.

(lxxiv) Apart from their inferior physical strength, women are more liable than men to strain from sudden muscular effort. To obviate this, attention should be paid to the size and shape of burdens, receptacles and vehicles, labor-saving contrivances, to the knack of lifting, and to hours of employment.

(lxxv) The committee fully indorse the policy underlying the order recently made by the Home Office requiring the provision of adequate facilities for obtaining drinking water in all factories. (See paragraphs 413-434.)

XVII.—WELFARE SUPERVISION FOR WOMEN AND GIRLS.

(lxxvi) Under modern industrial conditions the employer usually has neither the time nor, frequently, the experience to give the requisite attention to many of the special problems affecting the health and welfare of women workers. There has, therefore, been an increasing tendency to appoint a special officer for the purpose, who is generally called a "welfare supervisor" or "welfare superintendent."

(lxxvii) The stress of war conditions, the widespread introduction of women into industry, and the increased employment of married women and young girls greatly increased the need for adequate supervision and led the committee to recommend in January, 1916, the appointment of welfare supervisors in all factories where women were employed.

(lxxviii) The welfare supervisor should have a clearly defined status and definite duties, and should be directly responsible to the manager. What her exact duties may be will, to some extent, depend upon the circumstances of the factory and her own capacity. Experience, however, shows that her duties may properly include the engagement of workers (so far as their general suitability is concerned); keeping of records of individual workers; investigation of cases of lost time, sickness, low output, or wages, incapacity, dismissals or withdrawals, working conditions, home visiting, feeding arrangements, training and instruction, housing, transit, and recreation. They should not interfere with the work of trades-unions.

(lxxix) The welfare supervisor must be of good standing and education, and must possess strength of character, tact, and broadmindedness, such as will secure the confidence of the management as well as of the workers; provided only that they are possessed of the requisite qualifications, they can be and are drawn from all classes of the community.

(lxxx) It is, as a rule, desirable that welfare supervisors should have undergone a preliminary course of training of not less than one year's duration, which should, while allowing of a special study of welfare problems, be grounded on a wide study of social questions.

A large part of the time should be devoted to practical work. Neither admission to the course nor financial assistance should be conditional on the student subsequently taking up welfare work.

(lxxxii) Welfare supervisors should not be appointed by the State. They will probably continue for some time to come at any rate to be appointed by the employer, as the person responsible for the maintenance of satisfactory conditions of employment, though the workers are likely to an increasing extent to seek some voice in the selection. Though the establishment by the Ministry of Munitions of a panel of candidates has been justified as a temporary expedient, it is not desirable that any department of State should do so as a permanent arrangement.

(lxxxiii) The time has not yet come when a definite judgment can be passed on the development of welfare work during the past two years, still less is it possible to prophesy as to future lines of development. The confident support of the workers has yet to be obtained. Undoubtedly unwise appointments have been made; complaints have been considerable and often well founded, though their importance may have been overemphasized. On the other hand, some mistakes were inevitable in the initiation of what was largely a new enterprise in industrial organization. The conditions of employment of women have vastly improved. It has been and is likely to be of material advantage that there should exist a body of persons specially concerned to promote the health and well-being of the worker. (See paragraphs 435-475.)

XVIII.—WELFARE SUPERVISION FOR BOYS AND MEN.

(lxxxiii) The problems involved in the welfare supervision of boys are not new though they have been accentuated by the war. The essential remedy is personal influence. The influences to which they are subject will largely affect their permanent outlook on life. High wages, restlessness, lack of control, all have demoralizing influences, which specially need control at the present time.

(lxxxiv) Personal influence to be effective must ordinarily be exercised by some one individual, and the committee in January, 1916, recommended the appointment of welfare supervisors wherever 100 boys are employed. Experience has shown that for this number of boys a full-time appointment is desirable. Where, as is more often the case, a smaller number are employed, a part-time arrangement is usual.

(lxxxv) The duties of a welfare supervisor for boys may usefully include most of those specified in the case of women, but nothing which makes for their well-being should be alien to his duties. The wider his outlook the stronger is likely to be his position. It is

specially desirable that he should keep in touch with all other persons and bodies in the district who are concerned with the well-being of boys. Recreation, training, and instruction are matters calling for special concern.

(lxxxvi) The need for the welfare supervision of boys has not been so readily appreciated as in the case of women and girls, and time has been required for obtaining the support of the foremen and the local trade-unions as well as of the employer. These initial difficulties have, however, not been without their advantages in preventing hasty or ill-considered schemes, and while it is as yet too early to form any final judgment the work appears to have started on sound lines.

(lxxxvii) The problems of the welfare supervision of men are much more difficult, and only gradual development is to be anticipated. The whole question is intimately concerned with the growths of works councils now being so widely discussed. In the immediate future at any rate any welfare work among men is likely to grow spontaneously out of that for boys. (See paragraphs 476-492.)

XIX.—WELFARE OUTSIDE THE FACTORY.

(lxxxviii) The State being responsible for the employment of large bodies of workers, and especially women, in places remote from their own homes, has a special responsibility for their welfare outside the factory. The Ministry of Munitions have placed in the principal munition areas a number of officers specially charged with the duty of looking after the health of the worker outside the factory; they deal with such matters as housing and transit, sickness, and recreation.

(lxxxix) It is of the utmost importance that only healthy, clean, and wholesome-minded women should be exported. Mothers with young children should not be exported. No woman or girl should be exported without a sufficiency of money and clothing. Travelers across country should be seen off and met.

(xc) In all large centers clearing hostels should be provided, in which women can be housed until other accommodation can be found for them.

(xci) Lodgings with or without board in a family is generally the readiest and most acceptable means of housing women and girls. An organized system is required for providing suitable lodgings and keeping them under supervision. In the more important areas this work is generally undertaken through officers of the Ministry of Munitions, or by local billeting committees established by the central

billeting board under the billeting act. Under that act payments for rent and board can be guaranteed. No use has hitherto been made of the power of compulsory billeting, and it is doubtful how far it is workable in practice.

(xcii) In most areas the problem, however, is one not of lodgings but of housing, and existed before the war. Assistance has been given in some areas to local authorities for the provision of additional permanent accommodation, but in the main the requisite housing has had to be provided by the establishment of hostels and hutments.

(xciii) Hostels have not always been popular. Objection has been taken to living in large institutions or under the control of the employer; also to the restrictions on individual liberty which are involved. Some workers only use them on account of the lack of other decent accommodations and the difficulty of housekeeping under present conditions. It is of particular importance that the planning and management of hostels should be thoroughly satisfactory. In Appendix F detailed suggestions are given.

(xciv) Sickness, however temporary, among girls in lodgings involves much hardship, and may become serious if neglected, and special steps should be taken to deal with it. Action is also necessary in the case of girls thrown out of work or otherwise stranded, often through no fault of their own.

(xcv) Recreation is an essential aid to recovery from fatigue, and adequate provision for it should be made, especially in those areas where large numbers of imported workers are employed. Much attention is now being given to the subject and facilities are steadily increasing. Where they can be organized central schemes available for all workers in the district are to be preferred. More often, however, provision depends upon the initiative of an individual firm and its workers, and most welfare supervisors are concerned with schemes for recreation.

(xcvi) The maintenance of public order, notably in centers where large numbers of girls are assembled, has led to the employment of women police and patrols. They have done valuable service, both inside the factory and outside the factory; also in assisting the regular police.

(xcvii) Much has been done to improve the health and increase the efficiency of the munition worker by the reduction in excessive drinking which has been brought about through the restrictive measures of the central control board (liquor traffic). (See paragraphs 493-532.)

534. The committee desire to place on record their warm appreciation of the unfailing courtesy, the devotion to duty, and the ability

of their secretary, to whom they offer their best thanks for the assistance he has rendered them in the performance of their task.

(Signed)

GEORGE NEWMAN, *Chairman.*

THOMAS BARLOW.

GERALD BELLHOUSE.

A. E. BOYCOTT.

J. R. CLYNES.

EDGAR L. COLLIS.

W. M. FLETCHER.

LEONARD HILL.

SAMUEL OSBORN.

ROSE E. SQUIRE.

MAY TENNANT.

E. H. PELHAM, *Secretary.*

APRIL, 1918.

APPENDIX A.—LIST OF PERSONS WHO GAVE EVIDENCE OR OTHERWISE ASSISTED THE COMMITTEE.

(a) The persons giving evidence before the committee included the following, many of whom have also assisted the committee in other ways:

London: Mr. F. S. Button, Mr. A. B. Swales, Amalgamated Society of Engineers; Mr. R. J. A. Pearson, Messrs Vickers (Ltd.), Erith; Mr. H. S. Adams, Messrs. The Projectile Co. (1902) (Ltd.); Capt. Pasley, Messrs. Eley Bros. (Ltd.).

Birmingham: Mr. J. E. Harston, H. M. I., deputy superintending factory inspector for the Birmingham district; Miss Hilda Martindale, H. M. I., His Majesty's senior lady inspector of factories under the Home Office for the Midland division; Mr. George Ryder, Amalgamated Society of Engineers; Mr. George Wilkinson, Amalgamated Society of Tool Makers; Councilor John Beard, Mr. John Whiston, Mr. J. E. Grobey, Workers' Union.

Sheffield: Mr. William Ireson, Messrs. Thomas Firth & Sons (Ltd.); Mr. G. H. Wilkinson, chief assistant overseer of the townships of Sheffield and Eccleshall; Mr. William Marshall, Messrs. Vickers (Ltd.), Sheffield; Mr. A. J. Bailey, National Amalgamated Union of Labor; Mr. Green and Mr. R. E. Jones, Amalgamated Society of Engineers; Mr. M. Humberstone, National Steel Workers' Association, Engineering and Labor League; Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways.

Newcastle-on-Tyne: Mr. Thomas Bowmaker, Amalgamated Society of Engineers; Mr. E. Gilbert, Blacksmiths' Society; Mr. I. D. Hebron, Pattern Makers' Society; Mr. J. Wile, Brass Founders' and Turners' Society; Mr. D. S. Marjoribanks, Messrs. Armstrong, Whitworth & Co.; Miss E. Sadler, His Majesty's senior lady inspector of factories; Mrs. Fawcett, National Federation of Women Workers; Mr. G. B. Hunter, Messrs. Swan, Hunter & Wigliam Richardson (Ltd.).

Glasgow: Sir W. Weir, formerly director of munitions for Scotland; Mr. Harold D. Jackson, Messrs. Barr & Stroud (Ltd.); Mr. H. J. Wilson, His Majesty's inspector of factories; Dr. Alexander Scott, medical referee for industrial diseases for the west of Scotland district, workmen's compensation act, 1906; Mr. G. Moore, Mr. Walter Hicks, Mr. R. Polgreen, representative munition workers.

Representatives of women workers: Miss Lois Young, secretary National Federation of Women Workers; Mrs. Gibb, Miss Fanny Workman, Miss Anna Howatt, Miss Nellie McGregor, workers; Miss Vines, His Majesty's senior lady inspector of factories for Scotland.

Woolwich arsenal: Royal gun factory department—Messrs. Cardwell, Keir, Mills, Savage, Stratton; mechanical and inspection department—Messrs. Isley, Taylor, Blake; royal laboratory—Messrs. Pendley, Falconer, Franks, Cage, Hill; royal carriage department—Messrs. Thompson, Leighton, Wallis.

Manchester: Mr. Robert H. Coates, United Machine Workers' Association; Miss A. Tracey, His Majesty's senior lady inspector of factories; representatives of the National Union of Gas Workers and General Laborers—Messrs. Eccles, J. Cummings, masterman; Mrs. Annot E. Robinson, women's war interests committee; Mr. Edward Hopkinson, Messrs. Mather & Platt; Mr. M. A. McLean, the British Westinghouse Electric & Manufacturing Co.; Mr. E. Reid, Sir William Armstrong, Whitworth & Co.

Coventry: Mr. C. Greenway, Amalgamated Society of Engineers; Mr. W. T. Smith, Toolmakers' Society. Representative of the trades council—Mr. Chater, secretary. Representative of the workers' Union—Mr. Morris. Representatives of the Coventry branch of the National Federation of Women Workers—Mrs. Lewis, Mrs. H. E. Givens. Representatives of the Women's Cooperative Guild and the women's hostel committee—Mrs. Collington, hostel committee; Miss Selina Dix, president women's hostel committee; Averal C. Wilks, Mrs. Eleanor Kirkman Gray, Annie E. Corrie, women's hostel committee; Mrs. Mary A. Keene, president Women's Cooperative Guild, poor-law guardian; Mrs. Mary Biggs, Emily Chalker, hostel committee and poor-law guardian; Hon. Mrs. Baillie, chairman voluntary committee on supply of labor; Mr. A. Wall, Coventry Labor Exchange. Dr. T. M. Legge, Home Office; Mr. Leon Gaster, honorable secretary Illuminating Engineering Society; Mr. John Hodge, M. P., secretary British Steel Smelters, Mill, Iron, Tinplate, and Kindred Trades; Mr. C. E. B. Russell, chief inspector of reformatory and industrial schools; Dr. E. F. Armstrong, D. Sc., technical adviser and managing director of Messrs. Crossfield & Co., and of William Gossett & Son; Mr. T. North, superintendent, Vickers & Co., Crayford; Mr. J. J. Mallon, Miss Macarthur, National Federation of Women Workers; Mr. P. B. Brown, director and general manager of Messrs. Hadfields (Ltd.), Sheffield; Right Hon. Sir W. Mather, Messrs. Mather & Platt. Representatives of the following bodies concerned with the welfare of women and girls—Women Police Service, National Association for Women's Lodging Homes, National Association for Women's Lodging Houses, Young Women's Christian Association, Church Army, Salvation Army, Catholic Women's League, League of Honor, National People's Palace Association.

(b) Persons who assisted in the medical inquiries conducted by the committee included the following:

(i) Medical officers: Dr. Ethel Stacey; Dr. Beatrice Webb; Dr. Ethel Williams; Dr. Mabel Campbell; Dr. L. M. Chesney; Dr. Margaret Thackrah; Dr. Mary Phillips; Dr. Rhoda Adamson; Dr. Lillian Wilson, board of education; Dr. John Bradley; Dr. Ada Whitlock, Home Office.

(ii) Inspectors and others: Mr. P. A. Heath; Miss E. G. Woodgate; Miss C. M. Thompson; Miss E. M. Gardner; Miss Howatt; Miss Workman; Mrs. George Young; Mrs. Osborne, M. Sc.; Miss Gordon; Mrs. Bankes; Miss Miller; Miss Irene Whitworth, Home Office; Miss H. C. Escreet, Home Office; Miss Isabel Taylor, Home Office; Miss Elizabeth Macleod, Home Office; Miss Carbutt, Home Office; Mrs. C. D. Rackham, Home Office; Miss E. G. Colles, board of education; Miss G. M. Broughton, Ministry of Munitions; Miss Hilda Walton, Ministry of Munitions.

(c) Amongst other persons who have by the submission of memoranda or by other means, placed their special knowledge at the disposal of the committee were:

Lord Leverhulme; Mr. B. Seeborn Rowntree; Mr. A. H. Self and Miss Lillian Barker, C. B. E., Woolwich Arsenal; Mr. A. Maitland Ramsey, ophthalmic surgeon, Glasgow; Dr. Elizabeth Butler, National Filling Factory, Georgetown; Miss Hilda Cashmore, Bristol University Settlement; and Miss Elizabeth Macadam, University of Liverpool; Mr. R. A. Bray, Viscount Dunluce, and Miss G. E. Hadlow, Ministry of Munitions; Mr. A. F. Agar and Mr. P. R. Higgins, canteen committee of liquor board.

**APPENDIX B (I).—A FURTHER INQUIRY INTO THE HEALTH OF
WOMEN MUNITION WORKERS.**

BY MISS JANET M. CAMPBELL, M. D., M. S. (A SENIOR MEDICAL OFFICER OF THE
BOARD OF EDUCATION.)

In accordance with the instructions of the health of munition workers' committee, an inquiry was arranged in the autumn of 1917 to follow up the medical investigation of the health of woman munition workers which had been made in 1915 and 1916, and with a view to ascertaining in a general way the effect of continued munition work upon the health and physique of women.

The inquiry was carried out by Dr. Lilian Wilson (one of the medical officers of the board of education), Dr. Mary Phillips and Dr. Rhoda Adamson, assisted by Miss E. G. Colles (board of education), Miss Hilda Walton (welfare department, Ministry of Munitions), Mrs. George Young and Mrs. Osborne, M. Sc. The factory conditions were reported on by His Majesty's factory inspectors, Miss Irene Whitworth, Miss H. C. Escreet, Miss Isabel Taylor, Miss Elizabeth Macleod and Miss Carbutt. Miss Gordon, Mrs. Bankes and Miss Miller of the welfare department gave assistance in following up workers who had left the factory. Every endeavor was made to secure comparable results, and the following report has been compiled from the accounts written by the investigators.

GENERAL ARRANGEMENTS.

The inquiry was made at eight factories at which the general conditions may be regarded as reasonably typical. Five of them were chosen on account of the heavy nature of the work done by the women. At all the factories the management and welfare staff were most courteous and considerate and gave every facility for the inquiry.

The women examined were chosen at random and were not selected on account of physical weakness or strength. As a general rule, only women who had worked for at least nine months were seen. A considerable number was drawn from heavy operations likely to cause strain or fatigue, and from operations at which women had only recently been tried. The proportion of married women seen was also intentionally high. No compulsion was exercised and women were free to refuse to be examined if they wished. The numbers examined were as follows:

Factory No. 1 (northeast coast).....	193
Factory No. 2 (Midlands).....	264
Factory No. 3 (Yorkshire).....	116

Factory No. 4 (London)-----	157
Factory No. 5 (Yorkshire)-----	199
Factory No. 6 (Midlands)-----	73
Factory No. 7 (near London)-----	67
Factory No. 8 (near London)-----	114
Total -----	1,183

DESCRIPTION OF WORK UNDERTAKEN BY THE FACTORIES.

FACTORY No. 1 (NORTHEAST COAST).

Workers were selected from nine departments doing heavy work and including the following processes:

Six-inch shell, all machine processes.

Eighteen-pounder shell, a few of the heavier machine processes, copper bending, gauging, filling with shrapnel.

Making fuses, most machine processes.

Cartridge cases, shoveling coke in brass casting shop, oiling machinery and wheeling bogeys in rolling mill on acid tanks in annealing shop, automatic presses, all heavy machine processes.

Traffic department, unloading and loading wagons—18-pounder shell only.

FACTORY No. 2 (MIDLANDS).

Shells.—Women are employed on practically all processes of manufacture of 9.2 and 6 inch shells in various stages of heaviness. They are also employed on overhead cranes and as slingers.

Guns.—About 60 women are employed as assistant operators to men on machines in this section. The work is less heavy than that of the shells, as the articles manufactured are very large and the work consists of machine minding pure and simple. Some of the operations take as long as 10 hours.

FACTORY No. 3 (YORKSHIRE).

The main part of the factory is used for the manufacture of 4.5-inch and 60-pounder shells. A small part is used for the manufacture of gun parts.

The great majority of the workers concerned in the output of shells can be divided into three classes—machine operators, laborers, and inspectors. The factory is arranged in such a way that so far as possible the first process starts from the right-hand side of the factory, on which the rolling way for billets is situated, and the shells are then worked gradually along toward the left. With the exception of the initial process of centering, the machine operator is not concerned with the transit of shells, and her heavy work consists in lifting the shells in and out of the machine and in the necessary "tightening up" of the machine. No lifting tackle is provided for the 4.5 shells, but it is provided for the 60-pound shells up to the process of fuse-hole boring, when the shell is reduced in weight to 53 pounds 4 ounces. The centering is done on rather a different system. All the laboring and machine work is done by a

gang of four women to each machine, so that in addition to lifting the shell into the machine they load up the trolleys and pull them toward the tables and unload them at the tables.

The primary work of the laborers is the moving of shells from one process to another. This is done by means of trolleys onto which the shells are loaded. In the early processes the trolleys and the tables onto which the shells go are about the same height so that in most cases the shells can be rolled on and off the trolleys instead of being lifted. This considerably lightens the work, but the trolley loads seem in many cases to be unnecessarily heavy. As the shells proceed down the shop and gradually become lighter, the trolleys in many cases are lower, and shells, owing to lack of table space, are stacked on the floor, so that they have to be lifted up constantly from the floor to tables about 3 feet high. By this time the 4.5 shells have been reduced in weight to under 30 pounds, but the 60-pound shells still weigh about 50 pounds.

FACTORY No. 4 (LONDON).

Women are employed on about 30 different processes, on lathes, milling and drilling machines, examining, cleaning, and checking, and also in the tool room. Although the majority of the work entails handling 6-inch shells which weigh 130 pounds in the rough and nearly 90 pounds in the complete state, practically all the heavy handling is done by men, and the placing of the shells in the machines is done by sliding them down a sloping plane so that there is no particular strain placed on the workers when they are actually handling the shells.

FACTORY No. 5 (YORKSHIRE).

Factory (a) is engaged in the manufacture of 9.2-inch shells, and women are machine operators on most operations. Owing to the size of the shell (the initial weight of the forging is about 440 pounds) women were not employed as laborers or shell movers in this factory until recently. Now, since the introduction of the rolling bench and hydraulic cranes, the men laborers have been extensively replaced by women who assist in craning up the shells with the women operators. Some women do their own craning in. As a result of the introduction of the aforementioned rolling bench system the energy required for laboring has been considerably reduced and the shells have merely to be craned from the bench to the machine, instead of, as formerly, from the ground. Men fix practically all the shells into the machines and all through skilled men act as tool setters.

In Factory (b) 6-inch shells are made. Women are at work on practically all the operations to which the shell is submitted and these vary very considerably in time occupied per shell, and in the skill required. The forging at its heaviest stage weighs about 130 pounds, and before it leaves the shop its weight has been reduced to about 86 pounds. The machine operator fixes her own shells in the lathe, and the methods of fixing vary very considerably from automatic clamps

to chucks, the fastening of which requires a series of violent jerks at the end of a long crowbar.

FACTORY No. 6 (MIDLANDS).

The women are engaged in making fuses. The work is light in character and in itself involves little or no physical strain.

FACTORY No. 7 (NEAR LONDON).

The firm is now mainly engaged on gaines and gaine caps, having only a small number of 12 and 14 pound shells in hand to finish a contract. Therefore practically all the work is light. The women are employed on turning the shells throughout after the first two operations (cutting off and roughing out); melting and centering fuse plugs; parting off, drilling, screwing, and forming gaines; boring, screwing, and forming caps; besides lacquering and inspection.

FACTORY No. 8 (NEAR LONDON).

The firm makes and assembles ball bearings which consist of "races" and balls or rollers, and in some cases of "cages" and balls, and vary in size from those having a bore of 5 millimeters to the large ones with a 12-inch bore, whilst the balls vary from one-sixteenth of an inch to $4\frac{1}{2}$ inches in diameter. The women are engaged in making and assembling the small ones throughout, but only on some lathe processes and on viewing parts of the larger ones. They are employed on the automatic and semiautomatic machines, grinding on the presses, viewing, gauging, ball viewing, assembling, testing, and packing. It is all unskilled or semiskilled work and does not entail any heavy lifting, but is monotonous and in certain cases demands great concentration.

HOURS OF WORK.

Most of the work is done on the two-shift system. Typical hours are given below:

FACTORY No. 1 (NORTHEAST COAST).

Day.—7 a. m. to 6.30 p. m. Monday to Friday, 7 a. m. to 12.30 p. m. Saturday; meals, 12 m to 1 p. m., 4 to 4.30 p. m. (10 minutes for tea)—total, 55 hours.

Night.—7 p. m. to 6.30 a. m. Sunday to Friday; meals, 11 to 12 p. m., 2.30 to 3 a. m. (10 minutes for tea)—total, 60 hours.

FACTORY No. 7 (NEAR LONDON).

Day.—7 a. m. to 7 p. m. Monday to Friday, 7 to 12 a. m. Saturday; meals, 10 to 10.10 a. m., 12 to 1 p. m., 4 to 4.20 p. m.—total, 57½ hours.

Night.—7 p. m. to 7 a. m. Monday to Friday; meals, 10 to 11 p. m., 3.30 to 4 a. m.—total, 52½ hours.

FACTORY NO. 8 (NEAR LONDON).

Day.—7 a. m. to 6 p. m. Monday to Friday, 7 to 12 a. m. Saturday; meals, 8.30 to 8.45 a. m., 12 to 1 p. m., 3 to 3.15 p. m.—total, 52½ hours.

Night.—7 p. m. to 6 a. m. Monday to Friday; meals, 10.30 to 11 p. m., 3 to 3.30 a. m.—total, 50 hours.

At Factory No. 2 (Midlands) the work is arranged on both two and three shift systems. Broadly speaking, the supervisors (e. g., foremen, tool setters, etc.) work two shifts, the day shift 11 hours, the night shift 13 hours, with mealtimes of 1 hour and 1½ hours, respectively. The actual operators work on a three-shift system, the shifts being slightly uneven, and a mealtime of half an hour being given in each case. Where men and women work together on a lathe the women work the same hours as the men.

At Factory No. 3 (Yorkshire) practically all women work on the three-shift system:

Morning shift.—Monday to Friday, 7 a. m. to 2.30 p. m.; meals, 10 to 10.30 a. m. Saturday, 7 a. m. to 5 p. m.; meals, 1 hour. Weekly total, 44 hours.

Afternoon shift.—Monday to Friday, 2.30 to 10 p. m.; meals, 6 to 6.30 p. m. Weekly total, 35 hours.

Night shift.—Monday to Friday, 10 p. m. to 7 a. m.; meals, 2.30 to 3 a. m., and about 10 minutes for tea at 11.40 p. m. Weekly total, 42½ hours.

At Factory No. 5 (Yorkshire) until June, 1917, women in factory (a) were working on 8-hour shifts with a half hour meal break; the men being on 12-hour shifts—so that each set of men worked with two sets of women each day. In June, 1917, a change over was made—the hours then being 10 hours' shift for day and 11½ for night work. Work starts at 8 p. m. on Sunday and finishes at noon on Saturday. It is noticeable that the night shift is of longer duration than the day shift, and the work in addition includes a long Sunday night. No reason has been discovered as to the object of having longer night work than day other than that this scheme of hours fits in with the existing train service, for this factory is situated some four miles out of the city in almost rural surroundings. It is not unlikely that the train service could readily be modified to suit the convenience of the large numbers of daily workers if it were proved desirable to equalize the length of shift. There can be little doubt that from an efficiency point of view it is desirable, where other than automatic work is being done, that the shifts should be of equal duration, as the worker must be tuned to a certain speed dependent on length of shift, and a variation in duration of shift weekly must necessitate some loss of efficiency.

In factory (b) the hours are as follows:

Shift.	Time.	Meals.	Longest period without break.	Total hours worked per week.
DAY.				
Week day.....	6 a. m. to 6 p. m..	9 to 9.30 a. m.; 1 to 2 p. m.; unofficial break, 3.45 to 4 p. m.	3½	59½
Saturday.....	8 a. m. to 1 p. m..	9 to 9.30 a. m.	3½	
NIGHT.				
Sunday-Friday.....	6 p. m. to 6 a. m..	9 to 10 p. m.; 1.15 to 1.45 a. m.; unofficial break, 3.45 to 4 a. m.	3½	63

Just at the time of the investigation the question of shortening the hours had been considered and practically decided on, when it was announced that the matter had been postponed. In order to fit in the working time of the men on two shifts with that of the women on three, the working hours of the women on the new shifts were to be 7½, 7½, and 6½. This reduction of hours to 6½ naturally caused many of the women to feel that they would not be able to earn a "living wage."

An endeavor was made to ascertain the views of the women themselves on the question of the two and three shift systems. The main objection to the eight-hour shift seems to be that less money can be earned. On the other hand, the short shift is obviously more convenient for women with children and home duties and provides a reasonable opportunity for rest and recreation.

The factory No. 2 (Midlands) report states "the general impression was gathered that married women prefer shorter hours, as they like to undertake the management of their own homes without outside assistance. The unmarried women, on the other hand, evidently feel that they ought to be helping in home work when they are not at the factory, and prefer the increased pay of the longer shift to indefinite unpaid home duties. One point raised against short shifts was that on two out of three shifts workers were always about at 10 p. m. either ceasing afternoon work or starting on the night shift, and with decreased lighting and lonely roads some found the journey a considerable strain to their nerves. On the whole, it appeared that there is less disturbance to home life if the shorter shift is in use, but the question of strain for individual women needs careful consideration, as the 8-hour factory shift, in addition to heavy household work, involves a heavier day's toil than factory work alone through a 12-hour shift when it is obviously impossible to undertake home duties."

The report on factory No. 1 (northeast coast) states: "On the point of shorter shifts (e. g., the substitution of eight-hour shifts I gathered that many shop managers would welcome it and would expect to obtain the same output in two eight-hour shifts as they do at present, but that the many difficulties in the way include (1) the strong opposition of the men fitters and tool setters; (2) the objection of the women themselves, who are in most shops on the premium-

bonus system, and who would object to the lower wage (this objection does not hold in the piecework shops); and (3) the reorganization of the transit arrangements which in a factory of this size would be a big problem. Many women themselves told me that they could easily produce the same output in an eight-hour shift. In all cases there appeared to be considerable waiting about for work owing to the work not coming through quickly enough from the men on the previous process. In one shop at least the daily output is limited, and when the girls have finished they hang about the shop sometimes for an hour or an hour and a half—being on the premium-bonus system (which is based partly on a time wage) they have to put in their hours at the shop. In no shop on the premium-bonus system did it appear to me that much work was done during the last hour of the shift."

At factory No. 5 (Yorkshire): "The general impression gathered from the women in factory (b) is that the large majority would be glad to return to the eight-hour shift, even though their weekly earnings were reduced. A minority, composed of very strong women who had reached middle age after hard-working lives and the younger single women with no home ties, are satisfied with the 12 hours, and feel quite able to continue at this rate and to earn their present rate of pay. There were on 12-hour shifts, many who openly wondered how long they could continue to work under present conditions, and a few definitely intended to give up munition work this winter, as they felt the long hours were ruining their health.

"The general impression gathered from the women in factory (a) is that there is a greater appearance of well-being and satisfaction with the work and hours. The weekly earnings for each process appear a little higher than those earned in corresponding processes in 6-inch shells."

NIGHT SHIFTS.

As a rule day and night shifts were worked alternate weeks. At factories 7 and 8, however, only a proportion of the workers were required for night work and there was no regular alternation.

At factory No. 8 (near London) 16 permanent night-shift workers were examined. Nine were classified as A and six as B. Workers in class A had worked continuously on night for periods varying from 3½ to 11 months, the average time being 4½ months. The average time of the remainder was also 4½ months. The nutrition and general health of the night workers examined (and they were picked at random) was much better than that of the day workers. This is probably because it is only the stronger girls and women who "can stick it." There is no regular alternation of day and night work, and if a worker agrees to go on night she is left on until she "knocks up." It was said that numbers of girls had had to give up night work because they could not stand it. Several had left because they were not allowed to change to day work.

The night workers examined were satisfactory. Their feeding is better on night shift, as they have two good hot meals, one before coming out in the evening and a good breakfast. The breakfast of the day workers is nothing but tea, bread, and butter, as they have to leave so early that there is no one to prepare a meal for them. The majority of the night workers apparently preferred night because of the long week end. They work five nights and rest from Saturday morning till Monday night. Even those who complained that they were tired at the end of the week said that they got rested during the week end.

At factory No. 7 (near London), where there is also no regular alternation of day and night work, 19 workers on different processes were examined. Twelve were classed as A and seven as B. The average time worked continuously on night was 13.5 months in class A and 15 months in class B.

On the whole night work was not unpopular among the women, partly because of the higher wages earned, partly because they found more opportunities for shopping and personal affairs. Most workers found no difficulty in sleeping during the day, though many, for reasons which were not often unavoidable, did not allow themselves sufficient time for sleep. Work on Sunday night was disliked, few women cared to spend Sunday in bed and many used this day for heavy domestic work for which they had no opportunity during the week.

SEATS.

Although in some cases seats had been provided for use when workers have proper opportunity for resting, this was by no means general. For example—

The report on factory No. 1 (northeast coast) states: "There is a great grievance in certain shops. Sitting is generally not allowed and in many cases this appears to cause quite unnecessary fatigue to the workers. There is no provision of stools or benches except for certain drilling machines and benches where the work must be done sitting. No stools are provided for workers on such processes as rough turning (6-inch shell and 18-pounder shell) and on certain automatic machines where the worker might often sit for some minutes at a time."

The report on factory No. 4 (London) calls attention to the lack of seating accommodation.

At factory No. 7 it is stated that "only the viewers and lacquering girls have stools; in none of the other shops is provision made for sitting, though I noted many times when workers were waiting either for the tool setter or material." Many women complained that they could not sit down while waiting for work as no seats were provided and they were not allowed to sit. In this factory the proportion of tired and swollen feet was noticeable. On the other hand, the report on factory No. 8 states: "In nearly every department seats were provided for the workers; some had metal backs for support, while some were merely stools."

The provision of seats and the use made of them unfortunately often appears to depend too much on the caprice or prejudices of individual managers and foremen, who do not yet realize that, if suitably used, seats reduce fatigue and do not encourage habits of idleness and slackness. Seats are particularly needed where the operations are long and can not be accelerated, where waiting is apt to occur for material or assistance and where the two-shift system is followed.

NUTRITION.

Canteens had been established in connection with all the factories visited and on the whole were suitable and convenient, though not

always as popular with the women as had been hoped. In spite of the provision of cheap, appetizing dinners, many women still prefer to bring the main portion of their food from home, merely supplementing this with "extras" or tea from the canteen.¹ On an eight-hour shift a disinclination to purchase a full meal is understandable. The shift is relatively short and allows time for meals at home, while the factory meal time is only half an hour and does not correspond with any of the ordinary principal meals of the day.

At factory No. 2 (Midlands), for example, only 20 of the workers stated that they used the canteen entirely, getting their dinners there. The remainder took their solid meals at home, and brought sandwiches, cake, and bread and butter to the factory, getting "what they fancied," in the canteen, and making tea there. This incomplete use of the canteen may be attributable to the short meal times to which workers have grown accustomed on the three shifts, and to the consequent difficulty of serving rapidly enough to allow proper time to eat.

Factory No. 5 (Yorkshire). At factory (a) the girls take all their meals in the canteen—a fair proportion actually buying all their food there; that is, to say, on day shift they buy good breakfasts and good dinners, whilst the remainder bring their food from home, often prepared dishes which they can warm up in the canteen and which they supplement with small purchases at the canteen. On night shift the usual plan is to have substantial food before leaving home, many having a good meat meal often with the members of the household who have returned from day work. They make this their main meal and purchase light suppers and breakfasts during the night or bring light meals with them. The women have certainly learned the lesson, and act on it, that they can not continuously work at their strenuous occupations unless they get adequate food. Occasionally one would say "we are really doing men's work, we can not expect to do it on bits of thing that would keep us going at home, we have to have real meals." These inquiries were made at the time when the great difficulties in obtaining certain provisions arose and many of them told of the hardships which were being experienced by themselves or their mothers in obtaining food. It was common at this time for the women to leave work in the early morning after the 11½ hours of night shift, with perhaps two hours' traveling in addition, and line up in the food queues in order to obtain supplies. In many cases this resulted in the women not getting home until midday, so that their rest was hopelessly interfered with. At this time, too, the weather was very cold, heavy snow having fallen.

The women on the heavy work in factory (b) have also realized that they require substantial food, if they are to carry out their duties continuously.

Of the women interviewed the following analysis gives roughly the system in food taking:

- 124 good meals every day at home.
- 24 buy good meals at canteen.
- 64 buy some light food at canteen.
- 45 buy no food at canteen.

An interesting comparison between the two factories is to be noted. The average wages are lower in factory (b) though the hours are longer. A relatively small proportion is buying full meals at the canteen and a relatively

¹ Since the inquiry was made the difficulties of shopping have become greatly accentuated and the demands for food at canteens has correspondingly increased.

Large proportion buys nothing at all at the canteen. Apparently the higher wages insure a greater expenditure on food by these workers on heavy operations.

On the 12-hour shift and at nights the practice of buying a full meal seems to be increasing, and in some cases if more were done to meet the wishes and tastes of the workers the meals would probably become much more popular. It is not an easy task always to satisfy and meet the likes and dislikes of factory workers unused to restaurant meals and very ready to criticize, but at the same time there is room for improvement in canteen management.

For example, one factory has a canteen to seat 4,000. It is run by an outside caterer so badly that very few will use it. The supervisor offered to take it over, but was refused. The caterer has been reprimanded, and it is hoped the management will be improved.

At factory No. 4 (London) the canteen is too small to hold the workers, the food is only fairly good, the service is inadequate, especially at night, and the tea is particularly bad and strong.

In other cases, although the food at the canteen is good, the workers, through force of habit, prefer to take their meals in the shops. This is unsatisfactory from every point of view, but it seems practically impossible always to exclude them from the shops in certain factories.

Typical prices are as follows:

	d.	Cents.
(1) Meat and vegetables-----	9	[18.3]
Soup-----	2	[4.1]
Pudding-----	3	[6.1]
(This is considered too dear for some girls.)		
(2) Boiled beef and vegetables-----	6	[12.2]
Steamed pudding-----	2	[4.1]
Custard-----	1	[2.0]
Rice pudding-----	1	[2.0]
Soup with dumpling-----	2	[4.1]
Bread and cheese-----	$\frac{1}{2}$	[1.0]
(The food appeared well cooked and of good quality.)		
(3) Tripe and onions-----	4	[8.1]
Savory (a kind of rissole)-----	2	[4.1]
Fish-----	5	[10.1]
Pudding-----	3	[6.1]
(The quality of the food seemed good, but the dinner is not often purchased, although there is a big trade in meat pies, cakes, beverages, chocolate, etc.)		

The nutrition of the workers was generally satisfactory, except in the case of factory No. 8, where "the nutrition was very poor and the diet unsuitable and insufficient for women working long hours. Bread and butter and tea formed too large a part of the dietary, and 41 out of 114 examined were considered to be suffering from under-feeding." This malnutrition is due mainly to long established habit

and can not be ascribed to war conditions. It may be hoped that the well-managed canteen, which the firm have now provided, will encourage a better and more substantial dietary.

TRANSIT.

Convenience of transit varies greatly. At factory No. 1 (northeast coast) the difficulties of transit still form an unsolved problem. Of 193 workers examined 39 walk to work, 64 travel by train, 2 by the factory bus, 1 by boat, 1 cycles; the remainder travel by tram. The journey occupies 1 hour or more in 41 cases, 2 hours and more in 19 cases, 3 hours in 3 cases, 4 hours in 1. The train service is stated to have improved, but the tram service is still wholly inadequate and unsatisfactory. The large majority of workers, men and women, is obliged to use the trams, and the extreme overcrowding and bad air are certainly responsible for much of the tiredness among the women. The crowding in itself may be dangerous, and one girl examined had recently been seriously crushed and injured in the attempt to find a place.

At factory No. 2 (Midlands) a considerable number of workers (118) are able to walk or cycle to and from the factory if they wish. The remainder come by bus or train. Thirty-eight workers complained of difficulty in transit or mentioned conditions which involved considerable addition to their hours of work in getting to and from the factory. The decreased service of trains proves most inconvenient in certain cases; workers who arrive by train may have to wait an hour at the factory before their shift begins. In one instance a worker on the afternoon shift (2.30 to 10 p. m.) arrived regularly at her home at 12.30 a. m., and for the morning shift (7 a. m. to 2.30 p. m.) she rose at 4 a. m. The tram service varies. Many of the workers have no complaint to make, but on some lines cars are crowded, and women stand habitually, traveling an hour each way.

At factory No. 3 (Yorkshire) practically all the workers came by car or train:

	15 minutes and under.	15-30 minutes.	30 minutes-1 hour.	1 hour and over.	Walk.	Tram or train.
A.....	4	25	32	2	4	59
B.....	4	18	24	.....	5	41
C.....	.....	4	2	1	.....	7
Total (118).....	8	47	58	3	9	107

Certain trams were said to be crowded, and the women complained of the cold and fatigue of waiting in queues at the end of the day's work.

At factory No. 4 (London) 114 out of 157 were able to walk home; 138 take less than 10 minutes for the journey and only two more than an hour.

	15 min- utes and under.	16-30 minutes.	30 min- utes-1 hour.	1 hour and over.	Walk.	Bus or train.
A.....	64	37	10	1	83	29
B.....	16	18	6	1	28	13
C.....	2	1	1		3	1
Total (157).....	82	56	17	2	114	43

At factory No. 8 (near London) 90 out of 114 walk home, and in 88 cases the journey occupies less than 30 minutes. The firm has arranged for a special train morning and evening, and should any fare exceed 4s. [97.3 cents] weekly the firm pays the excess.

LOST TIME.

No attempt was made in the course of this inquiry to obtain accurate data in regard to lost time and its causes. In the case of women working long hours there are clearly numerous more or less legitimate reasons for broken time in addition to temporary ill health. There is, for example, genuine fatigue and the not unnatural desire for an occasional "day off." There are also domestic duties or emergencies in regard to the home or children which, in the case of married women, almost necessarily exert a prior claim to the factory.

At factory No. 1 (northeast coast), for example, the report states: "I gathered on all hands that most workers deliberately stay away from work one day a week or a fortnight; this is sometimes for domestic reasons, but often because they feel the need of a day's rest. The timekeeping records are consequently bad. In two shops where the timekeeping is much better I found that this was due to the strict discipline; any girl who stays away for a week, except it be on sick leave, loses her machine—she is put on some time work, such as laboring, and has to wait her turn to get a machine again. It is interesting that these were the only shops in which I had emphatic complaints from the girls as to the length of hours. Roughly speaking and simply from the general statements given, the timekeeping in these two shops was 50-75 per cent better than in the other shops."

At factory No. 5 (Yorkshire), the information given by the workers themselves indicated that the lost time at factory (a) was low. There was in general a high sense of duty in this respect, great pride being taken in the possession of a "clean slate," both in respect of absence and lateness. Occasionally a woman stopped away as she was "just done up" or "dead beat" and felt that she must rest. The records of time lost during the last six months (since the introduction of longer hours) compared with the records for the previous two months when the women were on eight-hour shifts, show a rise in the total percentage of time lost which must be due largely to increased fatigue.

In factory (b) there is the same pride in many of the women in having "no broken time" to show. The machine operator who is fond of her work dislikes very much to stay away, for she is always anxious lest she should have "her machine taken away." Some cases were noted of women who took "breakfast time," because they felt "too done up" to come, but felt that the three hours extra rest they would obtain would set them up for the rest of the week.

WELFARE SUPERVISION.

In all factories visited welfare superintendents had been appointed who were charged with the general oversight of the physical well-being of the workers.

At factory No. 1 (northeast coast) the lady superintendent has a large staff of supervisors allocated to the different shops. Each supervisor has under her at least one assistant supervisor and an adequate number of attendants for clogrooms, cookhouses, etc. The workers say that conditions have much improved since the appointment of these officers and evidently regard them as valuable acquisitions. Welfare supervisors have nothing to do with the management of the canteens, and the ambulance arrangements are in charge of the firm's medical officer. The ambulance rooms are staffed by nurses and first-aid attendants who have no relation to the welfare supervisors.

At factory No. 2 (Midlands) a welfare supervisor with three shift supervisors under her is in charge of the welfare work. The department is a branch of the labor department of the factory and the welfare supervisor is consulted by the management on questions concerning women. There are two surgeries in charge of nurses which can be used as rest rooms, if required.

At factory No. 3 (Yorkshire) there is a welfare staff of 19. This includes the head welfare superintendent, 15 supervisors in the works, 1 in the record office, and 1 for engaging the workers. The various processes are divided into five sections and each of the 15 supervisors has her own section under her control on each shift. She has a desk in the middle of her section and is therefore always accessible to the women. Of late a large number of athletic and social societies have been instituted in connection with the factory, and a welfare committee, which brings matters to the notice of the management, has also been formed. Various classes are also soon to be started in cooperation with the local education authority.

An extremely well-equipped surgery with a separate department for men and women is in charge of the firm's medical officer and staffed by nurses.

At factory No. 5 (Yorkshire) the care of the workers at factory (a) is in charge of a well-developed welfare department under the control of a lady supervisor and assistant supervisor. In each shop there is a shop supervisor who takes a personal interest in the women. A night matron has charge of the welfare of the girls during the night shift. A good spirit of comradeship has been developed amongst the women due to the energy of the welfare department. Games, football, and cricket on Saturdays and sports meetings are participated in by the women with great enjoyment. The welfare work at factory (b) is under the direction of a lady supervisor and assistants, and working in the shops under the direction of the lady supervisor are the shops supervisors.

At both factories all the women who are engaged are required to undergo a medical examination by a woman medical officer within the first week or two after engagement. Practically all the women who are employed have been examined, or will have been, in a very short time. Recommendations of the medical officer as to transference of women to light work are attended to by

the lady supervisor and any other recommendations made by the medical officer are followed up by the welfare department.

At factory No. 7 (near London) the welfare superintendent does not engage or dismiss workers but interviews them after the assistant manager has taken them on. She is responsible for first aid and supervises the mess room. She engages mess-room and lavatory attendants. For first aid the supervisor has a well-fitted Red Cross box in her surgery for the treatment of minor injuries. Serious cases can be taken to the hospital close at hand. In her absence a lavatory attendant applies bandages, etc.

At factory No. 8 (near London) two welfare supervisors have been appointed, but they have not as yet any very effective grip of their work. The canteen is not under their control and the first-aid arrangements are separately managed. The present ambulance room is only temporary. It is well equipped, but there is no waiting room. Different hours are arranged for men and women. Three nurses take spells of eight hours each.

GENERAL HYGIENE.

Apart from the long hours usually worked and difficulties of transit in some cases, the general arrangements for the health and comfort of the workers appear reasonably good in most cases. The conditions of the shops as regards ventilation, heating, lighting, removal of fumes, etc., have often been much improved, and special contrivances have been designed to ease the strain of heavy work. The cloakrooms, lavatories, etc., are usually fairly satisfactory, though there is often no provision for drying wet garments. Overalls of a suitable pattern are now generally provided, together with special means of protection (clogs, waterproof aprons, etc.) for women carrying out wet or dirty operations. Rest rooms for workers temporarily indisposed are usually available, although they are probably not made full use of. In the person of the welfare supervisor an officer exists to whom women may bring personal complaints or requests for advice or help. The organization is by no means perfect, but it represents an immense advance on the conditions which obtained two or three years ago.

An endeavor is often made by the factory to arrange lodgings for workers. It is found that women usually prefer to live at home, even though this entails a long daily journey, than in lodgings close at hand.

At factory No. 8 (near London) as the number of women employed increased and it became necessary to draw workers from a distance the housing question became urgent. The firm persuaded the local authorities to make a canvass in the town and find out the householders willing to take lodgers and the prices they would charge. The names are kept on a card register and given to workers who require rooms. Unfortunately the register has not been kept up to date. The firm has also provided two small houses to be used as reception houses, one for men and one for women. These are placed under the management of the canteen supervisor, and workers may remain for three nights while looking for permanent lodgings. A woman cleans both houses and cooks, the charge being 2s. 6d. [60.8] per day. The houses are well kept,

are furnished with single beds, not more than two in a room, and chests of drawers. Each house has a bath with hot water.

MEDICAL EXAMINATION.

The arrangements were generally similar to those of the previous inquiry. Each woman went first to the assistant investigator, who asked various questions in regard to general and social conditions, and then to the doctor who made the medical examinations. Except at factory No. 5 (Yorkshire), where the medical officer was personally known to many of the women, this examination was necessarily somewhat cursory in nature, partly because of the circumstances under which the inquiry was conducted, but mainly because it was essential to avoid alarming or irritating presumably healthy women by requiring much undressing or by making a searching examination. The inquiry was voluntary and its results depended entirely on the success with which the investigators were able to overcome the shyness or even suspicion of the women. For example, in some factories where numerous dismissals happened to be taking place, the workers naturally supposed that the inquiry might be intended to weed out the most unfit. In another factory in a town where the medical officer of health had recently published a report on ill health and especially "chest trouble" among munition workers, a number of those who were not in the best of health refused to be examined as they feared subsequent action. No detailed examination of the chest was made as a routine. The doctors endeavored to elicit the medical history by sympathetic inquiries.

As before, the workers were classified into three groups, A, B, and C. A denotes apparent good health; B denotes some signs of fatigue or ill health; C denotes marked fatigue or ill health.

England.	Number of workers examined.	A (healthy).		B (slight fatigue).		C (marked fatigue).	
		Number.	Percentage.	Number.	Percentage.	Number.	Percentage.
Factory No. 1.....	193	110	56.9	70	36.2	13	6.7
Factory No. 2.....	264	199	75.3	53	20.07	12	4.5
Factory No. 3.....	116	83	54.3	46	39.6	7	6.03
Factory No. 4.....	157	112	71.3	41	26.1	4	2.5
Factory No. 5.....	199	77	38.6	114	57.2	8	4.02
Factory No. 6.....	73	45	61.6	19	26.02	9	12.3
Factory No. 7.....	67	35	52.2	30	44.7	2	2.9
Factory No. 8.....	114	51	44.7	52	45.6	11	9.6
	1,183	692	58.4	425	35.8	66	5.5

CAUSES OF FATIGUE IN WOMEN WORKERS.

The cases classified as "C" were those regarded by the medical officer as definitely unfit for the work they were doing. In some instances the physical condition appeared due to the nature of the

work alone, but in most to heavy work combined with domestic duties and perhaps mental anxiety.

The cases classified as "B" were those in which signs of weariness and the beginnings of ill health were obvious to the examiner. No scientific tests of fatigue were applied. The opinion formed was based upon appearance, signs or symptoms of ill health, physical and social history, etc. At times obviously tired women were loath to admit any signs of fatigue, for example, at Nottingham, as they feared dismissal. Tiredness and "nervousness" were common complaints among these women. At factory No. 1 (northeast coast) where all the workers had been working for at least a year, and many for over two years, a number of workers stated that one of the first signs of fatigue noticed by themselves is that they "dread the belt." Sleeplessness and restlessness were relatively common; indigestion, loss of appetite, headache, etc., were often associated with the tiredness. Some had definitely lost weight, many looked pale, thin, and worn.

Among the special causes of fatigue may be mentioned heavy work, especially when associated with long hours, age and general unsuitability for particular work, length of service, insufficient attention to "welfare" inside the factory, home duties, mental anxiety, transit, dietary, etc. Some of these have been referred to already; others may now be considered in some detail.

(a) HEAVY WORK AND LONG HOURS.

As an example of fatigue due to these causes, the results of an examination of 199 women at Leeds may be mentioned.

At factory No. 5 (Yorkshire) of 146 women employed on 6-inch shells the medical officer reported that 51 were physically fit and able and willing to continue at the present pressure of work. Of these the greater number were women living in lodgings or in homes where they had no work to do after their munition shift; a few had spent many years as charwomen, working hard for little remuneration, and these looked upon the regular long hours of munition work as a well-paid rest. Of the remainder 95 women showed signs of fatigue varying from those who were moderately tired and unable to spare any energy for recreation to those who were completely exhausted and unfit for recreation or work. Of these, seven were entirely broken down in health.

The most noticeable point about these women was a general appearance of weariness and loss of tone. There seemed to be a general want of alertness, as though it needed a definite effort of concentration before they could bring their minds to bear upon any given question. Many had the appearance of a rapid loss of weight, and those who did not know their weight could remember that their clothing had to be definitely taken in to make it fit the present waist measurement.

Women suffered from loss of appetite, with fullness and epigastric pain after food, having the appearance of atonic dyspepsia in varying degrees. A few suffered from cough, the result of bronchitis, which was started or aggravated by work in a munition factory. Many showed signs of cardiac insufficiency,

with weak heart sounds, irregular in time and force, while a few had definite cardiac dilatation. Some of these women were dyspnoeic while at rest, and more were definitely so on moderate exertion.

The evidence of nervous fatigue varied from staleness, with loss of interest in or inclination for amusement or work in the milder cases, up to exhaustion of a marked degree, with nervousness, loss of control of temper, and depression in the more marked cases. The loss of voice occurring in women, especially on the night shift, appears to be the outcome of exhaustion and loss of tone.

The general impression gained from these women (working on 12-hour shifts) suggests that they are not physically fit to continue indefinitely on these long hours. Some will voluntarily leave at an early date, and others from economic necessity will continue to work above their strength and will become permanently damaged members of society. The ones who will remain at work at all costs are those who have many dependents. These threaten to become prematurely old, losing all the joy of life and continually haunted by the fear of a breakdown in health.

As regards the examination of 53 women working on 9.2-inch shells (10-hour day and 11½-hour night shifts) they can not by any effort lift them from place to place as they do in the case of the 6-inch shells. The chucks of the machines are tightened by men, and the result is that though the shells are heavier and the machines larger the women actually carry out lighter work than they do when working on 6-inch shells. Of those examined, 23 were physically fit, and again those were usually women with few home duties. The remaining 27 showed signs of varying degrees of fatigue. But their fatigue, generally speaking, was not so obvious as the fatigue of those on the lighter shells.

At factory No. 2 (Midlands) where the women are engaged on 9.2-inch and 6-inch shells (eight-hour shifts usually), it appears that the processes which caused most strain were those of boring, drilling, and rough-turn body. The latter involves an upward jerk to tighten the shell in the machine, which the majority of women find fatiguing, especially on night work or during menstruation. On the other hand, seven young women and four elder workers of an especially wiry type had suffered no inconvenience of any kind beyond a temporary muscular stiffness.

At factory No. 3 (Yorkshire) the women are engaged on 4.5 and 5 inch shells (eight-hour shifts); 24 workers on the rough-turn body process were examined for the purpose of comparison with findings at other factories where similar work is undertaken. It was observed at factory No. 2 (Midlands) that robust young women suffered little inconvenience at this work beyond temporary stiffness, but that there was a tendency to cause pelvic disorder in elderly married women with weak abdominal muscles. Here it appeared usual to employ younger women. Seventeen out of 24 examined at this factory were under 24 years of age and only two women were 30 years old. Some of the more delicate workers had found this work too heavy and had been transferred to other operations. There were four cases of dysmenorrhœa, seven of irregularity of menstruation, where it was said that the complaint had arisen or had become worse since working at the factory.

It is evidently most desirable that workers should be carefully selected for heavy work, such as rough-turn body, ripping, and centering, if undue fatigue or physical injury is to be avoided. The length of the shifts is clearly of great importance.

(b) AGE AND GENERAL UNSUITABILITY FOR WORK.

Other things equal, workers under 18 and those of middle age may naturally be expected to show fatigue more readily than those in the prime of life.

Young workers.—At the previous inquiry considerable fatigue was manifested by girls under 18 who were working exceptionally long hours under somewhat unfavorable conditions. A large number was not examined in the course of the present investigation, but in the factory where these findings were noted the conditions of work and comfort have been greatly improved and the fatigue has diminished accordingly.

At factory No. 7 (near London) nine workers under 18 were examined, eight were classified A and one as B. Their general condition was satisfactory. One strong girl of 16 is in the foundry sand placing, another girl of 17 has already worked three years at munitions.

Middle-aged workers may be divided broadly into two divisions: (1) The thin, wiry women who have worked all their lives and stand heavy work more easily than many younger and apparently stronger women; and (2) the women who may appear strong and well-nourished, but whose abdominal muscles are lax and flabby from lack of exercise, frequent childbearing, etc. The latter type is apt to suffer unduly from fatigue or internal injury when on heavy machine work or on operations which entail jerks or the lifting of heavy weights.

(c) LENGTH OF SERVICE.

It is only to be expected that workers employed for long periods under arduous conditions will tend to show increasing signs of slackness and fatigue. The reexamination of workers at factory No. 6 (Midlands) who had already been examined twice before is of interest in this connection, although the numbers are small.

	January, 1916.	July, 1916.	October, 1917.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
A.....	38	52.6	56
B.....	49	33.7	22
C.....	13	13.7	22
Total examined.....	100	80	27

The figures indicate that women showing slight signs of fatigue in 1916 are now feeling increased strain.

(d) INSUFFICIENT ATTENTION TO WELFARE.

It is obvious that discomfort inside the factory—for example, damp floors, no seats, cold rooms and lack of ventilation, unsatisfactory arrangements for meals, etc.—will tend to cause avoidable fatigue and minor ailments.

At factory No. 4 (London), for example, many of the women who complained of special "tiredness" on the night shift stated that they brought their own food instead of purchasing a hot meal from the canteen. The night service of this particular canteen was evidently so bad that workers had often given up the attempt to obtain food within a reasonable time.

The conditions of factory (b) at factory No. 5 (Yorkshire), where a large number of women appeared definitely fatigued, is another case in point.

In the shell shop there is considerable congestion. The number of machines installed is probably much too high, leaving the alleyways too narrow, with the result that the continual passing up and down of the bogies with and without shells, bookers, gaugers, laborers, sweepers, barrows, etc., causes an unpleasant overcrowding. The factor most to be criticized in the building is the existence of wooden galleries, which are used as a fuze department and in which approximately 400 people are constantly at work. The presence of these galleries removes all feeling of air space and gives a depressing overcrowded sensation in the shops. The hanging of clothes in the shops, the absence of provision in cloakrooms and elsewhere for shoes and garments which are changed by the girls, contributes to the sense of congestion.

Large gates at the one end swing open to admit truck loads of forgings. Until recently these gates opened directly on to the machines in this part of the shop, giving rise to pronounced fluctuations in temperature and in the cold weather to great discomfort of the workers. But recently a high screen has been erected which should be some protection against the sudden changes of temperature.

As to the general cleanliness, sweepers are continually at work, but the crowded state prevents the work being carried out as well as might be. The splashing of the cooling liquor from the machines leads to an unwholesome dampness of the floor; sawdust is sprinkled to absorb the wet and standing boards are provided, but too much wet remains lying about.

(c) HOME DUTIES, ETC.

The relatively large number of married women now employed increases the amount of fatigue likely to be observed among the workers. A certain proportion of these women are the recently married wives of soldiers and have no children or domestic responsibilities. The majority, however, are older women with children and homes of their own.

At factory No. 2 (Midland), 105 out of 264 women were married, 56 had young children, and about half of these were doing heavy housework. Fourteen women had sick husbands at home, in some cases needing special diet. As a rule the children were left with neighbors or were sometimes taken charge of by other relatives.

At factory No. 3 (Yorkshire), 48 out of 116 women were married; 37 had children at home. Of the latter, 20 were classed as A, 15 as B, and 2 as C; 18 had heavy housework and 26 lighter home duties. Of the 18, 7 were classified as A, 8 as B, and 3 as C, while of those with lighter housework 18 were A, 7 B, and 1 was C.

At factory No. 8 (near London) only 16 out of 114 women were married. Eight had children at home and 5 were doing considerable housework. Two of these were classified as A, 2 as B, and 1 as C.

At factory No. 4 (London), 53 out of 157 women were married; 26 had children at home and of these 21 were classified as A, 4 as B, and 1 as C. Of 26

married women who had considerable housework, 18 were classified as A, 7 as B, and 1 as C. It may be added that there was little evidence of fatigue in this factory.

Married women are often fully competent physically to carry out duties at the factory. It is only when these duties are supplemented by home work after long hours of factory work, by the difficulty of making proper arrangements for the children during their absence, by the ever-increasing difficulty of shopping during the limited interval, and often by worry or anxiety in regard to husband or relatives at the front that the burden becomes too heavy to bear without mental or physical damage. If married women must be employed, either because they need money to support themselves or their families or because the Government needs their labor, some special arrangement ought to be possible by which they could be relieved of a portion of the work which now devolves upon them.

GENERAL AILMENTS.

TABLE OF CHIEF DEFECTS DETECTED.

	Fac- tory 1.	Fac- tory 2.	Fac- tory 3.	Fac- tory 4.	Fac- tory 5.	Fac- tory 6.	Fac- tory 7.	Fac- tory 8.	Total per- cent.
Number examined.....	193	264	115	157	199	46	67	114	1,156
Percentage of defects noted.....	100	100	100	100	100	100	100	100	100
Digestive system:									
Indigestion (pain, flatulence, etc.).....	23	15.5	25.5	16.5	24.5	13	31	37.5	23.5
Constipation.....	14.5	7	9.5	14.5	16	26	16.5	12	12.5
Teeth:									
Several carious.....	31	26.5	20	29	32	17	24	29	27.5
Oral sepsis.....	8	10.5	13.5	5	20.5	8.5	7.5	3.5	10.5
Artificial teeth.....	32	15.5	20.5	12.5	36.5	10.5	18	10.5	21.5
Nervous system (tired, nervous, irri- table).....	30	13	20	18	26.5	15	15	17.5	20
Headache (frequent).....	42	13.5	33.5	24	19	28	59.5	41	28.5
Anemia.....	13	12	23	14.5	22	15	22	50	20
Aching and swollen feet.....	10	5.5	4	3	21.5	.....	19.5	9.5	9.5
Muscular pains (including rheuma- tism).....	14.5	8	20	7.5	14	4	28	14	12.5
Nose and throat (pharyngitis, un- healthy tonsils, etc.).....	5.7	2	3.5	18.5	3	2	10.5	22.5	7.5
Eye strain, etc.....	6	2.5	22.5	5	5.5	17	15	17.5	8.5
Disorders of menstruation.....	35	17.5	27.5	25	19.5	28	37	29.5	26.

Digestive disorders.—Loss of appetite and pain after food were the most common symptoms. Constipation was comparatively seldom complained of. This was partly due, no doubt, to the fact that aperients (salts or seidlitz powders) are often taken as a routine.

At factory No. 7 (near London) 21 out of 67 complained of indigestion, and here bad cooking and catering seemed the main cause. Bread and butter and tea formed far too large a portion of the dietary.

At factory No. 8 (near London) 43 cases of indigestion were noted among 114 examined. This was not due to bad teeth, but seemed caused partly by hurrying over meals before a long bicycle ride, by bad cooking and an inadequate dietary and partly by fatigue. Forty-one girls were noted as underfed.

Decayed teeth and oral sepsis were common, especially in some factories, though as far as the workers' own statements went they ap-

peared to have little direct effect upon the digestive system. Sooner or later they are bound to affect the health adversely and are indeed responsible for malaise, headaches, etc., with which the workers do not associate them.

At factory No. 6 (Midlands) some of the youngest workers had excellent sets of teeth and had been educated in good habits of dental hygiene, thus illustrating the effect of the school medical service which in Birmingham pays special attention to the care of the teeth.

At factory No. 4 (London) "the women are paying increased attention to dental hygiene. During last year several had visited the dentist and had carious teeth out and plates in."

At factory No. 2 (Midlands) "the teeth were usually extremely bad, dental hygiene seemed unknown and pyorrhoea occurred in most of the women over 30 years of age. Considerable reluctance was shown at the prospect of a visit to the dentist and conservative treatment was rarely sought in time even by young girls of otherwise good appearance. There was a general impression that stopping always hurt more than having a tooth out and as a result no treatment was sought."

At factory No. 8 (near London) the teeth were exceptionally good. Only 33 out of 114 had carious teeth, and it was noticed that those who had bad teeth lived out of the district.

Headache is probably often merely a symptom of general tiredness and may be caused or aggravated by noise in the factory and bad conditions of transit (e. g., Newcastle), insufficient fresh air and exercise. In other cases it appeared to be associated with anemia or with digestive disturbances.

At factory No. 7 (near London), where the factory is old and crowded with machines, 40 out of 67 complained of headache, many attributing it to the noise of the machinery; the long hours and constant standing also made them "so tired and headachey."

At factory No. 8 (near London) 47 out of 114 complained of headache, and it was often attributed to noise. For the most part the girls were unused to factory life. The high temperature at which the work has to be carried out in some of the rooms is also responsible for headache.

Anemia was seldom marked in type and usually no special treatment was being obtained. At factory No. 4 (London), for example (where little fatigue was observed), only 3 well-marked cases were observed, and 20 slight ones, among 157 women. At factory No. 5 (Yorkshire), on the contrary, where there was much fatigue, 45 cases were noted among 199 women. An exception was also noted at factory No. 8 where 57 out of 114 girls suffered with anemia, which in 19 cases was severe with dyspnea and hemic murmurs. Many of these girls were under 18, their diet was unsatisfactory, and the conditions of their work in hot, stuffy rooms would naturally predispose to anemia.

Muscular pains and swollen feet.—Muscular pains, aching back, shoulders and arms were often experienced at the commencement of

factory life, and afterwards tended to disappear as the worker became accustomed to the physical exercise. In other cases, however, where the work was heavy and the worker not robust, muscular pains were frequently complained of toward the end of the shift and especially after night work.

The prevalence of swollen or aching feet appears to depend a good deal on the conditions of work and especially on the nature of the floor and the provision of seats.

At factory No. 7 (near London), for example, the heating of the factory was not good and the floors were complained of as uneven and wet, making the feet very sore. Muscular pains and swollen, aching feet were common.

At factory No. 5 (Yorkshire) many women in factory (b) complained of sore or swollen feet which they attributed to standing on a concrete floor; the condition was sometimes improved by the wearing of clogs or standing on a board. Varicose veins were relatively common among the older workers and often associated with aching legs and feet and swollen ankles.

GYNECOLOGICAL CONDITIONS.

Disorders of menstruation occurred with some frequency and appeared to be associated particularly with heavy work, especially if other causes of fatigue were present. They usually took the form of dysmenorrhea, which in some cases had appeared since factory work had commenced, menorrhagia or increased frequency.

The dysmenorrhea did not seem as a rule to be severe in type, but the pain was sufficient to cause considerable tiredness and malaise even when it did not entail absence from work.

At factory No. 1 (northeast coast) 58 out of 185 complained of dysmenorrhea, for which 15 lost time every month, 10 suffered from menorrhagia. Serious complaints having been made of the bad effect of the work in a particular shop on menstruation, 11 girls about whom the supervisor was concerned were specially examined in this respect. Of these 4 cases were normal, 6 had dysmenorrhea, 2 suffered from menorrhagia. In 2 cases the girls were obliged to lose time, but in only 1 case had the symptoms appeared since the work was commenced. The medical officer came to the conclusion that there was no special cause for alarm and that the conditions were fairly typical of the factory as a whole.

At factory No. 2 (Midlands) 30 out of 264 suffered from dysmenorrhea and 9 from frequency. An inquiry among 34 women engaged on the rough turn-body process showed that considerable pelvic discomfort occurred in those women whose pelvic and abdominal muscles were weakened either through pregnancy, overfatigue, or lack of muscular power. In 6 of the cases women had observed irregularity of menstruation, in 8 there was some degree of menorrhagia, 3 cases of prolapsus uteri had occurred and 3 suffered from some weakness of the bladder. Dysmenorrhea had increased in 3 cases; 1 woman had undergone spontaneous extrusion of a fibroid while engaged on this process and was feeling considerably better in health.

At factory No. 3 (Yorkshire) 23 out of 116 women suffered from dysmenorrhea, and in about half the number of cases the pain was sufficiently severe to

necessitate absence from the factory. Eleven severe cases and five slighter ones were stated to have arisen from or to have been aggravated by factory work. Two women complained of menorrhagia and seven of increased frequency.

At factory No. 4 (London) 39 women out of 157 suffered from menstrual disorders, 12 losing time every month. In 1 case improvement had taken place since working at the factory, in 6 cases the reverse.

At factory No. 5 (Yorkshire) of 146 women engaged on 6-inch shells menstruation was unchanged in 88 cases, decreased in 12, and increased in 5 cases. In the last group the loss was so excessive as practically to amount to actual flooding. These latter cases were women who had borne children and were working on processes involving heavy lifting, such as tightening the chuck of machines. A few complained of backache and bearing down sensation, amounting to definite prolapse in 1 case. These were directly attributable to overstrain and gave a fairly typical picture of endometritis following hard work and want of rest. Of 53 women engaged on 9-inch shells menstruation was increased in 9 cases and diminished in 10. There was no history of severe flooding.

At factory No. 7 (near London) 20 out of 67 girls complained of dysmenorrhoea and 2 of menorrhagia; 7 lost time every month.

At factory No. 8 (near London) 31 out of 114 suffered from dysmenorrhoea, of whom 18 lost time every month; 2 stated that they were worse since coming to the factory.

Very few women who suffered from dysmenorrhoea had ever consulted a doctor. They appeared to consider it a necessary evil to be put up with and made the best of. Many women were surprised that it should be regarded as an abnormal condition for which medical advice and treatment should be sought. There seemed indeed a great disinclination to consult their doctors, and "he's no time for such things" was a common reply to the question as to whether advice had been obtained. At factory No. 3 (Yorkshire) "there was a tendency for mothers or elderly women relatives to prescribe gin as a specific remedy, and though the younger women disliked its taste at first its use might easily lead to alcoholism in later years. In some cases the medical treatment obtained appeared to be palliative rather than curative, powders and liniment being given."

Other gynecological conditions which were noted (in addition to backache and symptoms possibly due to chronic pelvic trouble) were prolapsus uteri and miscarriage. Both these conditions may be caused partly or entirely by the heavy work, but without detailed inquiry it is difficult to attribute the cause solely to factory work, when the woman may also be undertaking heavy or unsuitable work at home.

ADDENDA.

In the course of the inquiry the attention of the medical officers was directed to two processes which for different reasons presented features of special interest, namely, (a) copper band turning; (b) continuous work in artificial light; (c) following up workers who have left the factory.

(a) COPPER BAND TURNING.

During this process workers are apt to inhale metallic dust or fumes, and symptoms suggesting irritant poisoning were noted in a number of cases.

At factory No. 1 (Northeast coast) there was an unusual amount of digestive disturbance among the workers in copper and brass. The girls themselves have a fixed idea that the copper "gets on their stomach" or "on their chest." They complained of dust in the mouth like verdigris, and purgatives are taken regularly to counteract this. In 11 cases inflammation of the gums and nausea and vomiting were noted, while diarrhea and vomiting occurred in 4.

At factory No. 2 (Midlands) 28 women on copper band turning were examined, and, generally speaking, the work was popular, but a fairly large number appear to have had symptoms suggestive of mild poisoning, possibly due to the inhalation of impurities in copper dust. About 18 were aware of a metallic taste in their mouths, 10 had noticed dryness of the throat, and about 7 suffered at intervals from nausea, indigestion, and diarrhea. Actual vomiting occurred in 4 cases. Other who did not complain of nausea suffered from nose bleeding with occasional loss of voice, especially after night duty. A certain amount of eye strain was noticed from the dazzling reflection of the rotating copper band.

It was observed that about 10 of the workers who complained of a metallic taste with digestive disturbance or nose bleeding had extremely bad teeth with marked oral sepsis. Conversely 10 women with clean and well-kept teeth had remained healthy at this work. Only two employees were examined who had good teeth but yet showed some symptoms on this process; and one of these stated that her sister had been away for some weeks with "copper poisoning" so that allowance may be made for personal susceptibility.

At factory No. 3 (Yorkshire) an examination of 26 women showed that at least 20 of the workers were conscious of a metallic taste with dryness and pricking of the throat, especially after night duty. Nausea was present in 16 and 4 had occasional attacks of vomiting and diarrhea. Nose bleeding occurred in two workers.

Fatigue of the eyes and headache were observed in a large number of cases from the glare of artificial light on the rotating copper band. These symptoms suggest that women are occasionally suffering from mild attacks of irritant poisoning due to impurity in the copper dust, and it seems possible that arsenic may be the exciting cause. This is supported by a conversation with the manager, who stated that arsenic is frequently found as an impurity in the copper and that the amount varies at different times; occasionally the copper bands are unduly soft and more dust is produced in rotation.

In favor of arsenic is the apparent connection between the condition of the teeth and the susceptibility of the worker, thus pointing to the existence of a volatile irritant. Forty per cent of the workers who showed symptoms had several carious teeth, often with marked oral sepsis. Conversely, five workers with good, well-kept teeth had remained quite healthy, and three women with excellent teeth who had attacks of vomiting or colic admitted that they never used a toothbrush. The known variation in susceptibility of persons to the influence of irritants such as arsenic should also be taken into account.

At factory No. 5 (Yorkshire) the work of the copper-band turners is highly paid and not so exacting physically as in the case of some other operations. It involves deftness and close visual attention and the girls employed are picked at the outset. In the summer of 1917 it was recognized by the medical officer

of the factory that the girls working in brass and copper were suffering to a certain extent from copper absorption as shown by a taste of copper in the mouth, sore dry throat and nose, pain after food, colic, constipation, and in some cases a green line of the gums corresponding to the lead line produced in cases of plumbism. At that time the worst cases were recommended for transfer to other work, washing before meals encouraged, saline drinks supplied in the ambulance room, and a half pint of milk per shift given to each worker. After this line of treatment the conditions improved greatly, so that the girls examined for the purpose of this inquiry showed no very marked evidence of injurious results. In 10 girls examined there were 6 cases of irritation, as shown by a copper taste in the mouth, and sore nose and throat, 3 cases of mild absorption; 1 girl had no evidence of injurious effects.

These findings point to the desirability of special attention being devoted to workers in this process. All possible means should be taken for preventing the inhalation of irritant dust, and the women so employed should be under the observation of the welfare staff, who should at once report symptoms suggestive of poisoning to the medical officer. Attention should be paid to dental hygiene and personal cleanliness should be encouraged.

(b) CONTINUOUS WORK IN ARTIFICIAL LIGHT.

Ball viewing is a most trying type of work as it has to be done in strong electric light, except in the case of lapping viewing where diffused light is used. For this process the women and young persons have to work in a room whence daylight is excluded by shutters; strong arc lamps, hanging low over octagonal tables and shaded by cartridge paper, throw a diffused light on to trays containing a certain number of balls (varying according to size). Each worker keeps her tray continually rotating while she watches intently for any flaw, removing any defective ball she may find. In order to detect any flattened surfaces the balls are examined again in the "twilight" room, similarly shuttered, but with the ordinary electric light so dimmed that the room is in a state of semiobscurity, in which the irregularities are said to be more quickly seen.

The work is very light and requires no physical strength. It therefore attracts girls who are perhaps unfit for ordinary factory employment. The workers say that their eyes ache and they have headaches for the first week, but after that they become accustomed to the light. At factory No. 8 some women had been working for several years in diffused light and appeared well. The pauses in this work are frequent. There are two additional breaks at 10.45 and 2.15 and the work is not continuous for more than 2½ hours. During these breaks the girls are sent out on to a roof playground for exercise and recreation.

At factory No. 8 (near London) there were seven girls in the "twilight" room and five were examined. All five suffered from

enlarged cervical glands which were presumably tubercular, two had scars of old abscesses, and one had had four operations for the removal of glands. In the latter case the last operation had been done three weeks previously, and the worker, who suffers from indigestion and is subject to fainting, had already been back at the factory for a week.

Nineteen girls were examined who work in diffused artificial light. Of these 6 had enlarged cervical glands, 7 were anemic, and 7 had eye affections.

Of the 24 workers 7 were classified as A, 13 as B, and 4 as C.

The presence of so many enlarged and possibly tuberculous glands, not a common complaint among munition workers, associated with continued work in the absence of sunlight is worthy of notice. It suggests that continued employment in artificial light is undesirable and that there should be some arrangement by which alternation of employment could be provided for workers in this process.

(c) FOLLOWING UP OF WORKERS WHO HAVE LEFT THE FACTORY.

It is clear that the examination of women actually employed at any given moment in the factories will not reveal a complete picture of the effect the work is having upon health and physique. Those who have been able to remain for a year or more in continuous employment without a breakdown are to some extent the results of a physiological selection and represent the most physically fit among the women workers. An examination of this kind takes no account of the women who have dropped out of employment because they were unable to support the strain of long hours, night shifts, or heavy work. It is not an easy task to trace workers who have left the factory, especially when the workers are drawn from a wide area. Lack of time and opportunity have prevented any extensive inquiries being made in this direction. At the same time it was thought that even limited investigations might be worth making and the following results are therefore given.

Factory No. 2 (Midlands): Home visits paid to 56 workers who had recently left showed that women liked the factory and were usually sorry to leave. The cause of absence as entered in the records of the welfare superintendent agreed closely with the results of private inquiry in the homes of workers. The following table shows causes of leaving:

	Cases.		Cases.
Ill health.....	18	Long distance from work.....	2
Left for other work.....	11	Not traced.....	2
Care of children or home duties..._	8		
Long hours.....	8	Total.....	56
Left district.....	7		

Cases of ill health included four women who left for approaching confinements and one woman who gave up factory work owing to severe hemorrhage during the menopause. One single woman who worked until three weeks before the birth of her child had a difficult confinement and the child was said to be very delicate. This was attributed by the doctor in charge to the prolonged work during pregnancy. The mother was at a nursing home for four weeks, but has now recovered and is working on munitions elsewhere. Another married woman was a machine operator and worked at her lathe until the day of her confinement when she had a 7-months stillborn child. Among the women who left for other work are included certain cases who gave in notice to secure employment elsewhere fearing dismissal owing to shortage of work. The eight cases who found hours long were unable to stand the fatigue of the 12-hour shift.

Factory No. 6 (Midlands): Visits were paid to 37 workers who had been examined at the previous inquiry but who were not available for inspection by the medical officer on this occasion. The results showed that only two workers left actually on account of illness.

Factory No. 4 (London): Visits were paid by the medical officer to 14 cases who were said to have left the factory on the grounds of ill health. The results were as follows:

1. Aged 18. Normal pregnancy; no complications.
2. Aged 20. Normal pregnancy, together with a mastoid abscess not attributable to factory conditions.
3. Aged 22. Left on account of slackness of work; in good health.
4. Aged 26. On base-facing process. Miscarriage at four months attributed to pulling levers. Work probably too heavy. Normal health at present.
5. Aged 33. Engaged in sweeping floors. Left on account of hemorrhage from piles. Found work too heavy. At present thin, worn; subject to bronchitis.
6. Aged 22. Worked on base plates. Constantly got steel splinters in her eyes—wore no goggles. Left on this account. Is in normal health now.
7. Aged 19. Left on account of slackness of work. Is in good health. Working at a tailor shop.
8. Worked as a checker. Sight was poor and could not do work properly. Left on this account. Thin, delicate girl.
9. Aged 33. Found standing tiring and got varicose veins. Left on this account.
10. Aged 25. Found work too hard—refused to be medically examined.
11. Aged 18. Left because she could not stand the night work. Is anemic, but now works at a tailor's.
12. Aged 28. Worked on base plates at first and then on boring. The latter operation caused menorrhagia. She became very tired and worn out, especially as she did her own housework, including washing. Is at present strong and well, and menstruation is normal.
13. Left on account of night work. Is now a guard on a tram; strong, healthy, and well.
14. Left on account of pregnancy; normal confinement. Quite well now.

Factory No. 8 (near London): The total number (according to the firm's records) of workers who have left since August 1, 1917, i. e., during four months, was 134. The following reasons for leaving were given:

1. Ill health.....	34	5. Own accord.....	18
2. Unknown.....	7	6. Home duties.....	11
3. Bad timekeeping.....	13	7. Not suitable.....	15
4. Other disciplinary reasons.....	20	8. Leaving town or to be married.....	16

An endeavor was made to visit the whole of these workers to ascertain whether the reasons given to the firm corresponded generally with the reasons given on inquiry. The results of 102 visits were as follows:

Visited at addresses recorded (reasons for leaving)—

(a) Effective:		(b) Ineffective:	
1. Ill health.....	34	1. No information.....	3
2. Maternity cases.....	3	2. Left addresses—forms sent in, 12; no forms, 17.....	29
3. To be married.....	7	3. Not traced or out— forms sent in, 8; no forms, 5.....	13
4. Home duties.....	7		
5. Still working at same factory.....	1		
6. Dismissed.....	5		
Total.....	57	Total.....	45

It is of interest to note the present occupations of 17 of the women visited—

Laundry.....	2	Work at same factory.....	1
Shop.....	2	Munition work.....	4
Flour mills.....	1	Work in recruiting office.....	1
Gas works.....	1	Domestic service.....	5

Factory No. 7 (near London): The total number (according to the firm's records) of workers who have left since August 1, 1917, i. e., during four months, was 42. The following reasons for leaving were given:

1. Ill health.....	9	6. Not required (probably owing to slackness).....	6
2. Prolonged absence.....	3	7. Not suitable.....	1
3. Bad timekeeping.....	4	8. Left town.....	2
4. Other disciplinary reasons.....	4		
5. Own accord.....	13		

Visits were paid to the homes of the workers with the following results in 14 cases:

Visited at addresses recorded (reasons for leaving)—

Effective:		Effective—Continued.	
1. Ill health.....	9	5. Still at same factory.....	1
2. Maternity cases.....	2	Total.....	14
3. To better position.....	1		
4. Dismissed.....	1		

Eight of the women visited are now employed as follows:

Shop	1	W. A. A. C. baker	1
Ticket collecting	1	Domestic service	1
Waiting at aeroplane canteen	1		
Work at same factory	1	Total	8
Work at munition factory	2		

In only a few cases was it practicable for the women to be examined by a doctor, so, unfortunately, few details are available as to the precise ailments of those who left work because of ill health. As far as they go, these findings do not suggest that an unduly large proportion of women is leaving the factories on account of physical breakdown. The numbers are highest at factory No. 8, where 34 out of 57 interviewed had left for reasons of health. The physique of the women at this factory, however, was decidedly below the average of workers examined, and a large number of women appeared to be undernourished. Such workers might be expected to be unable to stand the strain of munition work and all that it entails, even when the work is light in character.

JANET M. CAMPBELL, M. D.

FEBRUARY, 1918.

APPENDIX B (II).—GENERAL FINDINGS OF INQUIRIES INTO THE HEALTH OF WOMEN MUNITION WORKERS.

BY MISS JANET M. CAMPBELL, M. D., M. S.

The rapid multiplication and growth of munition factories since the commencement of the war have been associated with correspondingly wide and urgent demands upon women to enter industrial life. There has been ample response not only from women already accustomed to factory work but from large numbers of others who entered upon such employment for the first time. Latterly many places have been filled by married women, some of whom offered themselves because of the urgent national need, but most perhaps because they were unable otherwise to support themselves and their children. The existing conditions of employment are in many respects abnormal, but it is important to consider their effects on the health of the women with a view to present and future guidance. It was for the purpose of obtaining some reliable data and first-hand evidence of the effect of employment upon the individual woman that the health of munition workers committee made arrangements for two medical inquiries which were carried out in various factories in 1915, 1916, and in 1917.

In the first inquiry 1,326 women were examined in 11 typical engineering factories. In most cases the work was fairly light in character, nothing heavier than 4.5-inch shells being handled. The hours of work were often excessive. In one case women were employed 77 hours weekly, and here 15.5 per cent showed evidence of severe fatigue. In other cases the hours, excluding meals, were 63½, 63, 67, and 69 a week. Sunday work was general. On the whole the women realized the need for an adequate dietary and usually had substantial meals, but the canteen and mess-room accommodation at the factories was wholly insufficient and sometimes nonexistent, welfare supervision was little developed, and the arrangements for the personal hygiene and convenience of the workers often left much to be desired.¹

In the second inquiry 1,183 women were examined in eight typical factories. Practically all the women had been engaged in munition work for at least nine months, and most of them for longer. Those examined included a large proportion of married women with do-

¹ A report on this inquiry was published in the Interim Report of the Health of Munition Workers Committee on Industrial Efficiency and Fatigue, 1917.

mestic responsibilities, and the difficulties of shopping and providing food were beginning to be severely felt in some districts. Many women were employed on heavy work (5, 6, and 9.2 inch shells). The general conditions of employment had considerably improved. The hours had been shortened, there was no overtime or Sunday labor (except Sunday night in some cases); good canteens were available for meals, and the "welfare" of the workers was carefully organized. The conditions of work deserve a brief recapitulation.

CHARACTER OF THE WORK.

In the earlier days of the war women were only employed on the lighter processes of munition work and in the making of smaller shells up to 3-inch shells. Then after some hesitation they were allowed to begin work on 4.5-inch shells, which weigh 48 pounds in the rough and about 27½ pounds in the complete state. For these and heavier shells they now carry out all the different processes, which include working on lathes, milling and drilling machines, examining, cleaning, checking, and also loading and unloading wagons. They are employed as crane drivers and slingers. No lifting tackle is provided for the 4.5-inch shells, and the total weight of shell handled daily is considerable. For 5 and 6 inch shells lifting tackle is usually available, but is not always used by the women, who sometimes find it quicker to lift the shell than to adjust the tackle. The 6-inch shells weigh about 130 pounds in the rough and 90 pounds when finished, so that the women are just able to lift them. For this reason this type of shell is perhaps the most likely to cause overstrain and fatigue, although much has been done in many factories to reduce the strain of manipulation by arranging rolling ways, trolleys of the right height, etc., and giving the machine operators the assistance of laborers to lift the shells into the machines. The 9-inch and all heavier shells can not be handled except by tackle, and the risk of strain from lifting is much reduced, though the machines themselves are often heavy to work.¹

Women engaged in loading and unloading shells are usually organized in gangs and given due rest between each spell of work. Much can be done to minimize energy by preventing unnecessary lifting, as from the ground or a low trolley to a high bench or wagon above. Forge work, for example, lifting shells out of the furnace or carrying them out of the forge press, is done by a few women. At

¹The number of shells and consequently the weight handled by individual women varies greatly on the different operations. In order to give some indication the average individual output per 12-hour shift at one factory engaged in 6-inch shells may be cited for the different processes: Ripping, 79; rough turning, 35; rough and base boring, 37; finish and counter boring, 25; face base, 82; counter boring and chase, 50; rough profile, 120; finish turn, 48; grooving, 110; waving, 218; rough recess, 114; finish recess, 58; copper band turning, 130.

one factory the larger shells so handled weighed 96 pounds and the smaller ones 45 pounds. Women took turns in lifting and changed after every 20-30 shells. It is astonishing how deft women become in dealing with heavy weights, and they often take great pride in their muscular strength and dexterity. But clearly it is most important first to select the workers properly and next to watch that they do not attempt too much in their eagerness to do well.

THE LONG HOURS OF WORK.

Even though the excessive hours worked at the beginning of the War have now been reduced, it is still permissible for women to work 60 hours a week, irrespective of pauses and mealtimes. This usually means in practice two 12-hour shifts with no Sunday daywork. In many factories working the two-shift system the hours are somewhat less than this (55 or 57½) and a half holiday is given on Saturday. A 12-hour shift means in practice 13-14 hours away from home. The whole of the remaining time ought to be occupied with meals and sleep if the women are to have sufficient rest to overcome fatigue. But though many of the younger women are fairly free from domestic responsibilities most of the older ones are burdened with the care of house or children after working hours. Their "leisure" is occupied with shopping, mending, cleaning, and other duties. The time for sleep is perilously reduced and recreation is impossible. Even Sunday, which should bring relief, must often be spent in doing the weekly washing, baking, or cleaning, and if such a day is followed by a night shift it is small wonder if the output of work is not as good as it might be.

Even girls who have few or no home duties only obtain the time they desire, and indeed require, for exercise in the fresh air, recreation, and amusement at the expense of much-needed sleep. It may have been necessary and even desirable at the beginning of the War to impose these long working hours. For a time it was possible, by giving up many things that make life worth while, for women to stand the physical strain reasonably well, but after more than three years of war domestic conditions have become more arduous, staleness and fatigue are being experienced by many women who have worked cheerfully until now, and the question whether, having regard to the present and future health of the women, these long hours can rightly be continued becomes ever more urgent. To put the case at its lowest it is not economically sound to exhaust and cast aside women who have become experienced and capable workers. Even if there were no disadvantages in constantly training new relays of workers, it should be remembered that the best of the available women have probably already been attracted to the munition fac-

tories, and if they become physically unfit they can only be replaced by the less efficient.

Some factories, recognizing the need of their workers for proper rest and recreation and for at least a minimum of time to devote to their own affairs, are working a three-shift system of about 8 hours each. This involves a weekly total of 35-44 hours. In some respects the hours of work are not altogether convenient, but the main objection on the part of the workers to the shorter shift is the reduction in their possible earnings. From the factory's point of view there is the difficulty of providing women for three shifts instead of two and of suiting the hours worked by the women to those worked by the men.

If it is considered impossible to effect a general reduction of working hours for women, it might at least be practicable to arrange for shorter hours for certain groups, for example:

(a) All women engaged in heavy work should not work longer than eight-hour shifts. A sufficient minimum wage would be necessary, as many of the operations are lengthy and can not be much accelerated by the skill of the worker.

(b) The hours for light work, the output of which can be increased by skill and industry, might be reduced either by working two shifts of, say, 9 or 10 hours in length (e. g., beginning after breakfast instead of before) or three shifts of 8 hours each. It might even be possible in some cases to work two 8-hour shifts and abandon the night shift without materially affecting output.

Proposals have been made at times for reducing the hours of work for married women, allowing them to come later, leave earlier, or work half shifts. Such arrangements would not seem to be practicable, at any rate, on a general scale from the point of view of the factory, and the only true remedy lies in a general shortening of hours, so, that as long as women having other duties must be employed, they may have reasonable time in which to perform them.

It has been shown so repeatedly that unduly long hours do not yield a correspondingly large output, that it seems not unreasonable, for the sake of the health of the women, to ask urgently for a further reconsideration of this matter, even though a reduction in hours of work would involve difficult questions of factory reorganization, wages, and adjustment with the hours of men workers.

NUTRITION.

Women are now beginning to realize that a heavy day's work in a factory under discipline and in touch with the rhythm of machinery, requires a better and more substantial dietary than miscellaneous work at home. Most working women have never acquired the habit

of taking solid and regular meals, partly because when food is not abundant the woman goes short rather than the man, partly because women, as a whole, have never commanded sufficiently good wages to enable them to purchase adequate food, as well as the various other articles, necessities, or luxuries which they also desire. The bread and butter and tea dietary is practically a thing of the past as far as munition workers are concerned, though the evidence from one factory visited indicates clearly the disadvantages to health of unsuitable food. This is due to the higher wages, which allow better food to be bought, to the increased appetite and desire for solid food following upon regular work under fairly good conditions of hygiene, and to the growing taste for the substantial middle-day meal in place of sandwiches brought from home and supplemented by sweets, pastry, tinned pineapple, etc., from the canteen. The increase in the number of well-equipped and managed canteens, and the daily object lesson of cheap, appetizing meals, nicely served, are gradually promoting a habit of eating well, which has, undoubtedly, saved many women from unnecessary fatigue and physical disability, or breakdown. Sweets, pastry, etc., are popular, as they always will be. Taken in excess by themselves and instead of proper food, they are unwholesome in many ways. It is quite another matter when they are eaten as part of a full, well-proportioned dietary. The custom of drinking tea frequently is widespread, but as the tea is almost always freshly made, it probably does little, if any, harm, and it forms the best and most acceptable stimulant for the tired worker.

TRANSIT AND HOUSING DIFFICULTIES.

Transit and housing difficulties have pressed hardly upon women, and much of their fatigue is certainly due to conditions incidental to the factory life rather than to the nature of the work itself. The waiting in all weathers for the often crowded tram or train, the struggle for a place, the frequent obligation to stand for part or the whole of the journey, is fatiguing to men, but usually far more so to women. Most men have few, if any, duties once they are free of the factory. Practically all women return home to some work, which varies from their personal washing and mending to the care of a house and family. It is this combination of home and factory duties which bears so hardly on the women.

THE IMPORTANCE OF WELFARE WORK.

All available evidence goes to show the value of welfare supervision when suitably organized, at any rate, as far as girls and women are

concerned. It is valuable, not so much from the point of view of increasing output, though this usually follows when workers are healthy and contented and the factory environment satisfactory, but primarily in order to raise the standard of health, contentment, and happiness as a whole. Women have become so accustomed to work for low wages and under bad conditions that they are only beginning to learn what is needful for their mental and physical health. Some one, therefore, is required to supervise on their behalf conditions which do not belong to the actual technical work, for example, to make sure that the lavatory and sanitary accommodation is convenient for the women and is properly used and supervised; to see that there are opportunities for drying wet clothing; to watch that minor accidents and injuries receive prompt and continued treatment; to insure full and suitable use being made of the rest room for temporary illness; to encourage wholesome outside interests and recreation, such as games, gymnastics, dancing, classes, clubs, etc.; in short, to make the well-being of the women her chief care and to establish such friendly relations with them that they will not hesitate to seek from her help, advice, or guidance. Whether the welfare supervisor should remain an *ad hoc* officer, as is common at present, is relatively unimportant, provided her chief function is not in any way overshadowed or lost sight of.

MEDICAL FINDINGS.

The medical examination could not be made as complete and exhaustive as might have been wished, partly because suitable accommodation was not always available, partly because the time was limited (women were summoned from their work), but chiefly because presumably healthy women are naturally shy of searching medical examinations. In estimating the physical condition and the amount of fatigue, reliance had to be placed to a large extent on statements and descriptions of symptoms volunteered by the women. The heart, lungs, and abdomen could not be fully examined as a routine. As in the previous inquiry, the workers were classified into three groups—A, B, and C—and it will be interesting to observe the results of the two inquiries, which, in spite of the different conditions of the examination, are surprisingly similar.

	Number of workers examined.	Class A (healthy).	Class B (some fatigue or ill health).	Class C (marked fatigue or ill health).
Inquiry No. 1.....	1,326	Per cent. 763=57.5	Per cent. 451=34.0	Per cent. 112=8.5
Inquiry No. 2.....	1,183	692=58.5	425=35.8	66=5.7

FATIGUE.

These tables indicate generally the amount and degree of fatigue observed among typical workers chosen at random. The following points clearly emerge:

(1) The proportion of serious fatigue amounting to marked ill health and incapacity for work is relatively small, approximately 5 to 6 per cent of the cases examined.

(2) There is a considerable amount of slight fatigue, which varies from 20 to 57 per cent.

(3) The total proportion of women exhibiting definite signs of fatigue is about 40 per cent of all cases.

This proportion, namely, 40 per cent, does not, however, represent the full burden of fatigue, for the following reasons:

(a) Much early fatigue is latent and objectively unrecognizable.

(b) The women most seriously affected tend to drop out of factory life before they have served for any long period.

(c) Women knowing themselves to be fatigued did not volunteer for examination.

(d) The examination was necessarily superficial and only such as could detect definite and relatively well-marked fatigue.

(a) *Latent or undetected fatigue.*—Fatigue, apart from reduced capacity and diminished output, is always difficult to measure, and particularly so when the investigator is dependent upon the statements of workers who may be interested in exaggerating or minimizing the effects on their work. A tired woman who fears in any way to prejudice her position at the factory may make a point of appearing bright and cheerful to the medical officer and give an excellent account of her health. Although from her nutrition, complexion, and general appearance the doctor may be disinclined to accept her statements as accurate, it is almost impossible in a short interview to elicit the whole truth. Again, the beginnings of fatigue may show themselves in ways unrecognized by the workers. A greater number of accidents, more spoiled work, diminished output often pass unnoticed because unrecorded, and even when fatigue becomes objective and pathological many of the physical symptoms, such as headache, indigestion, sleeplessness, irritability, etc., are disregarded or made light of because they have often been experienced before, and are taken as a matter of course. Working women are so accustomed to being weary and overtired that they frequently accept patiently a condition of physical malaise which would be the subject of definite complaint by women in better circumstances.

(b) *Disappearance of women most affected.*—The fact that a woman is able to work regularly for many months is in itself evidence of good physique. The less robust women, who are unable to stand

the strain, tend either to leave voluntarily or to be dismissed for bad timekeeping. No accurate estimate of the fatigue caused by the conditions of work can be made unless the women who drop out on physical grounds are examined as well as those who remain.

(c) *Women knowing themselves to be fatigued* are likely to have refused to present themselves for examination, especially in factories where dismissals were taking place or known to be pending, for fear that the detection of physical disability might, if reported to the management, result in their discharge. The examination was, in point of fact, wholly confidential, but no compulsion was exercised, and any woman approached was free to decline to see the doctor.

(d) The necessarily *superficial character of the examination* made it impossible to detect anything but fairly well marked fatigue. No special tests were employed, and there was no opportunity of examining the records of individual workers as regards lost time, accidents, etc., even had such records always been available. Fatigue in its earliest stages is therefore not recorded.

Thus it is clear that the amount of fatigue revealed by the inquiry is less, and possibly much less, in amount and degree than the actual fatigue experienced by the workers as a whole. On the other hand, there are various reasons why the fatigue should not be so great as might be anticipated from a mere recital of hours and processes. For example:

(a) *The interest of the work.*—Interesting work is less fatiguing than dull and monotonous work. Women have taken extremely kindly to machine work. The former tailoresses, mill hands, domestic servants, charwomen, etc., find engineering work unexpectedly congenial and they enjoy it for its intrinsic interest apart from added incentives such as high wages, responsibility, etc.

(b) *Patriotism* and a desire to “do their bit” have also had considerable effect in maintaining interest and keenness. The women are glad to feel that they are releasing men for other service and are anxious to play an effective part in the defense of their country.

(c) *The higher wages* obtained are in themselves an incentive to good and regular work, but they have important secondary results in that they lead to a higher standard of living, better food and clothing, and so to improved nutrition and a greater power of resistance to fatigue and disease.

(d) *Previous harder work* had been carried out by many of the women under less good conditions. Such women are accustomed to long hours; they derive benefit from an improved environment, and their health is likely to become better rather than worse.

(e) *The immense advance of welfare supervision.*—The attention now given by the management to the health and welfare of the

workers was almost unknown in ordinary factories before the war. The development of welfare supervision in the broadest sense has led to astonishing improvements in the circumstances of the work and has prevented the establishment or continuance in many factories of conditions likely to be harmful to the workers. For instance, hours of work have been shortened, there is practically no Sunday day work, and overtime has been largely abolished. It is realized with increasing clearness that women can not profitably work for five hours without a break, and the spells of work have therefore been shortened in many cases, and unofficial "breaks" of 10 minutes or so for tea have been found to assist the workers without reducing output. The greatly extended provision of canteens and mess rooms on a scale never before contemplated has not only made cheap, well-cooked food easily accessible to the workers, but has enabled those who remained at the factory to spend their mealtimes under conditions of reasonable comfort and restfulness. The improvement in canteen accommodation is still going forward, and in view of the difficulties of shopping, etc., it is likely to become even more welcome and needful. Rest rooms for women workers are now provided in most factories, though their proper use is not always fully appreciated by the factory staff. Malingering must, of course, be guarded against mainly by effective supervision, but an hour or two's rest in a comfortable room may enable many women temporarily unfit for work to return to the shop and continue to work satisfactorily instead of experiencing physical discomfort or malaise during the whole period and doing bad work in consequence. Well-equipped surgeries for the treatment of minor accidents and ailments have replaced the Red Cross boxes kept in the workshop. Prompt and continued treatment has prevented many slight wounds from becoming serious and has saved much physical distress to the workers. Great attention has been given to the provision of suitable and comfortable protective clothing, including goggles, caps, footwear, etc., with good results on the health of the workers. This is particularly important where ordinary clothing is apt to catch in machinery or become wet or soiled during the work, where the liability to burns, etc., is great or where workers are exposed to the weather. The protective clothing in filling factories in particular is of the highest value. Welfare supervision by trained, experienced women acting in the interests of the workers, coordinates the various means by which comfort and well-being are promoted and physical disabilities, likely to cause more serious ill health if neglected, removed.¹

¹ In addition to the general supervision special arrangements have been made for the supervision of all filling factories and especially those where TNT is handled. These are not dealt with in the present report.

In the second inquiry the greatest amount of fatigue was observed at factories No. 5, 3, 7, and 8. At factory No. 5 (Yorkshire) the women were engaged in making 6-inch shells (which it is just possible for them to lift without tackle), and they were working 12-hour shifts in an unsatisfactory environment. Many were married women with heavy domestic responsibilities. Transit was reasonably good and the food taken satisfactory in quality and quantity. The women themselves were the pick of the available workers, independent, sturdy, and keen. The number of women classified as B was high (57 per cent), and in many in this group the evidence of fatigue was decidedly greater than in the same group in other factories. The reports on individual women give the impression that if the conditions of work continue a considerable number will either drop out or pass into the C group. It is interesting to compare the proportion of B cases with those in other factories doing similar work. At factory No. 2 (Midlands) 22 per cent of cases were classified as B. Here eight-hour shifts are worked on 6-inch shells and the general conditions are reasonably good. At factory No. 4 (London) (mainly 6-inch shells) the proportion of B cases was 27 per cent. Twelve-hour shifts are worked and the factory conditions and environment are good. At factory No. 3 (Yorkshire), where the proportion of B cases is 40 per cent, 4.5-inch and 60-pounder shells are made and the factory conditions are satisfactory. The physique of the women is less robust than, for example, at factory No. 4, and this may explain the greater amount of ill health revealed.

Factories Nos. 7 and 8 (near London) fall into another category. Here the work is not heavy, but the hours are somewhat long and the physique of the workers poor. At factory No. 7 the B cases were 44.5 per cent of the total. The hours worked are 57½ a week. The factory is crowded and ill ventilated and heated. There is as yet no canteen and no properly equipped surgery and rest room. At factory No. 8 the B cases amounted to 45.5 per cent. The factory conditions are good on the whole. The hours are 52½ a week. The workers, on the other hand, were markedly ill nourished and of poor physique. In both these cases the workers are drawn from a small town and rural district where low wages have always been the rule, and the people are habituated to an inadequate dietary. Generally speaking, the workers were younger than those engaged in the heavier processes, and in the circumstances it is not surprising that even though occupied in light work many are unable to withstand the strain of continuous employment on 12-hour shifts.

The results of the inquiry indicate, therefore, that although the amount of existing fatigue probably considerably exceeds that discovered by the investigators, the women at work in the factories are, as a whole, bearing the fatigues of munition work surprisingly well. At the

same time there are evident signs that where heavy work is combined with long hours and possible domestic duties the strain is beginning to produce a serious degree of weariness, ill health, and fatigue, which is likely not only to prevent the workers from continuing to give efficient service in the factories, but may cause more or less permanent physical incapacity. The longer the war continues the greater the evidence of staleness and fatigue is likely to become unless conditions of work can be further improved. It should not be forgotten that any physical unfitness which exists at the time of demobilization will probably be considerably accentuated by the reaction which will then take place and the financial anxiety which will have to be faced by many of the women now employed in munition factories.

PHYSICAL DISABILITIES.

The ailments most frequently observed include digestive disturbances (indigestion and constipation), headache, anemia, muscular pains, and various "nervous" symptoms. Disorders of menstruation also occurred with some frequency.

Digestive disturbances.—Common causes of indigestion among women are dietetic, e. g., insufficient, unsuitable, or improperly prepared food, the persistent use of certain unwholesome articles of diet, such as strong tea, unduly rich substances, or food containing excess of carbohydrates. Alcohol may be a cause especially in older women, but this was not observed in the present examination. It had been expected that complaints of indigestion, etc., would be far more frequent than proved to be the case. Long hours and the alternation of night and day shifts lead to hurried meals, eating when tired, meals at unusual times, and a consequent disturbance of regular habits of bodily function. Although many women stated that they were not hungry on night shift, and some did, in fact, take inadequate and unsuitable meals at night, while many others said that they had occasional attacks of pain after indigestible food, the abnormal arrangement of the work appeared to have resulted in much less indigestion or chronic dyspepsia and constipation than might have been supposed. Constipation was usually avoided by the regular taking of aperients, but few who complained of indigestion were receiving medical treatment. History pointing to severe gastritis or gastric ulcer was very seldom obtained. The improved nutrition resulting from better food is likely to diminish digestive disorders unless counterbalanced by increased fatigue.

Defective teeth and oral sepsis were only too common. In some factories complete upper or lower dentures were frequently observed. The dentistry had apparently been fairly rough and ready, all upper or lower teeth having been extracted, regardless of the possibilities

of conservative treatment, in order to make a complete job. The women were not alive to the advantages of stopping the teeth, but even if they had been few facilities were available for such treatment, and the provision of efficient dental treatment at moderate charges seems to be one of the most pressing needs for working women. Bad teeth were not often directly associated with complaints of indigestion, but many ill-defined symptoms of malaise were doubtless due to the effects of absorption of toxins from unhealthy teeth, and these effects are likely to become more pronounced as the woman becomes older and the teeth decay still further.

Headache was fairly common. It could often be attributed to one or more causes, such as fatigue in transit, noise in the factory, eye strain, general tiredness, and was often associated with anemia, indigestion or carious teeth. Neuralgia was complained of by a number of workers evidently suffering from nervous fatigue. Sleeplessness, especially among women on night shift, was frequently accompanied by headache.

Anemia is most common among ill-fed, overworked girls in industrial districts who have to work in badly ventilated and badly lighted rooms under conditions which prevent proper exercise, especially in the open air and sunshine. Associated menstrual disturbances are not uncommon. Indigestion and constipation are frequently observed. Breathlessness on exertion, palpitation, or a tendency to fainting may be noted. The proportion of anemia observed was unexpectedly small. A large number of the workers classed C showed signs of more or less severe anemia frequently accompanied by hemic murmurs. A higher percentage was noted in one or two factories where it was mainly due to prewar rather than postwar conditions, such as chronic malnutrition or work in artificial light. The improved diet and the usually healthy factory environment have no doubt acted as preventative of anemia, and as far as can be judged on general grounds, munition workers compare favorably in this respect with young women workers in other trades and industries.

Indigestion, constipation, anemia, and headache are so closely associated that it is often difficult to say which is primary and which secondary. They all depend in considerable degree upon environments and habits of life, and they are remedied less by drugs or direct medical treatment than by improved hygiene and nutrition. Sunshine, fresh air, exercise, good food, and sufficient sleep are the most potent factors in the restoration to health.

Muscular pains, including aching or stiffness of the neck or limbs, are naturally common during the early weeks at the factory until the workers become habituated to unaccustomed muscular exercise. Among more experienced workers muscular pains may be complained of toward the end of a shift or attributed to a particular operation.

They may indicate the commencement of fatigue in the worker or that the work is unduly heavy or otherwise unsuitable.

Aching or swollen feet were not complained of to any considerable extent, except where the floor surface was unsatisfactory or damp. Most women, except a few who suffered from varicose veins, soon became accustomed to standing, especially when allowed to sit down during prolonged operations. The pain was often stated to be relieved by the provision of wooden boards to stand on and the wearing of suitable thick shoes or clogs.

Nervous symptoms, such as neuralgia, irritability, nervousness, sleeplessness, or an undue tendency to worry, were complained of by many women who were beginning to feel tired and worn. The symptoms were dependent on the general state of health rather than upon any organic defect.

Disorders of menstruation may be due to local organic causes, but they also depend to some extent on general derangement of health. Anemia, for example, is often associated with amenorrhea or dysmenorrhea. The most serious departures from the normal are dysmenorrhea and menorrhagia, which may be combined with metrorrhagia. Dysmenorrhea may vary from quite bearable pain to total physical disablement. Its degree is difficult to estimate from the workers' statements, some being inclined to regard severe pain as a natural and necessary burden, others, probably much fewer in number, being somewhat apt to exaggerate the discomfort. The severity can to some extent be estimated from the numbers who regularly lose time on this account. For example, at factory No. 8, 19 out of 34 who complained of symptoms lost one or more days' work each month. At factory No. 7, 7 out of 25 lost time each month. At factory No. 1, 19 out of 31 lost time regularly, and at factory No. 4, 12 out of 39. Many who suffered much pain, however, endeavored to continue their work in spite of it. There was some evidence of increase in pain since undertaking munition work, and this was most noticeable among women engaged in heavy work. On the whole, there is probably not a serious increase in dysmenorrhea, though the total number of women affected is considerable.

Menorrhagia was complained of by a much smaller number of women. It seemed more directly due to conditions of work (e. g., constant standing, strain), though sometimes attributed to a miscarriage. The disorders of menstruation averaged 26 per cent and, broadly speaking, they were most common in factories where the greatest amount of fatigue was observed.

Both dysmenorrhea and menorrhagia exercise a definitely harmful effect upon the general health whether through recurring pain, malaise, and disablement or through anemia consequent upon undue

hemorrhage. A disturbing element in the inquiry is the almost negligible amount of medical treatment being obtained for such conditions. This is partly because the girls take the discomfort as a matter of course and use only domestic remedies, which unfortunately sometimes include alcohol, partly because they hesitate to consult a doctor about a matter of this kind, but also because expert medical advice is not always obtainable. It is suggested that steps might be taken by welfare supervisors, at any rate in some cases, to arrange for women who suffer in this way to consult a medical practitioner, preferably a woman, who would be prepared fully to investigate and treat the condition. Much unnecessary suffering and injury to health might thus be saved.

MATERNITY AND CHILD WELFARE.

Although not strictly arising out of the findings of these inquiries, some reference to maternity in its special relation to munition workers seems not inappropriate. The problems which arise in connection with maternity cases among munition workers are the same as those which affect the community as a whole, but from causes associated directly with the making of munitions they are apt at times to become acute and urgent in an unusual degree. The exceptionally large numbers of married women engaged in factory work, the overcrowded condition of many munition areas, and the large influx of women into these areas naturally strain to the breaking point the always inadequate provision for maternity which exists locally. The impression gained from inquiries at numerous factories and among many of those responsible for the supervision and welfare of the workers is that the problem in an acute form is limited to a relatively small proportion of women workers, but that there is urgent need for some immediate action in regard to the care of those expectant mothers, married and single, who are unable to make suitable arrangements themselves.

The cases naturally fall into three groups—prenatal, natal, and postnatal.

(a) *Prenatal*.—The married woman with a home of her own usually leaves the factory in the early months of pregnancy, or at least as soon as her condition becomes obvious. No special provision is required for her apart from the provision for women as a whole. A certain number of women, however, are obliged to work almost until their confinements are due, as they have no other means of support. In filling factories it is usual, on account of the danger due to explosion or the handling of poisonous materials, to discharge a woman as soon as she is known to be pregnant. In engineering factories the practice varies. Where the work is heavy and it is not possible to transfer women to lighter processes they may be dis-

charged as soon as their condition is recognized. Where lighter work is available and the general environment suitable they may be retained until, say, the seventh or eighth month. There is often employment for a few as checkers or cloakroom attendants, and welfare supervisors usually do all they can to find suitable work for at least the most necessitous cases and to arrange for them to work day shifts only. As regards unmarried women, public opinion in a factory is usually kindly, but at times it is averse to their remaining after they are known to be pregnant.

The question of lodgings is another matter. Many landladies refuse to keep pregnant women, even when married, though they may be willing to do so if arrangements are made for the confinement to take place elsewhere. In most cases there is necessarily a period of one, two, or more months before leaving the factory and the birth of the child, during which time the woman may find herself with no home and little means of support. The fear of dismissal may thus lead the women to conceal their condition for as long as possible, and they are often successful in doing so for a considerable time. Such concealment may result in disaster to mother and child. The following example is typical:

A woman was engaged on heavy munition work (6-inch shells and working night and day shifts). Because of her need for money to keep her home together she concealed her condition and remained at the factory until she was five months' pregnant and could no longer stand because of the swollen condition of her legs. When she finally had to give up work she miscarried. Her general health suffered considerably from the prolonged physical strain, and she is now neither the mother of a healthy child nor a useful machine operator.

(b) *Natal*.—The number of lying-in homes and hospitals is notoriously inadequate to the needs of the country as a whole. In many munition areas the workhouse is the only institution to which women, unable to be in their own homes, can go for their confinements. This is naturally repugnant to most women.

(c) *Postnatal*.—The care of the mother's own health is now complicated by the need for suitable arrangements for her child. Where is she to live? How is she to support herself until fit to resume factory work? What is to become of the child while she is absent night or day? The only statutory provision which relates to the employment of pregnant women or nursing mothers is section 61 of the factory and workshop act, 1891, which states that a woman must not be employed within four weeks of giving birth to a child. It is obvious that the mother's first duty is to her young infant and that in the interests of its health she should not return to the factory for a much longer period than four weeks. But she may have to choose between remaining with her baby, without adequate means of support, or returning to well-paid work as soon as possible, even

though this entails virtual separation from the child. A breast-fed infant is more likely to thrive than one which is brought up by hand; but an ill-nourished mother is either unable to nurse her baby or continues to do so only at undue cost to herself. Until the State is prepared to recognize the claims of nursing mothers to assistance and financial aid the lesser of the two evils may be for the mother to go back to work as soon as she is physically fit to do so, provided that she can insure the care of the baby during her absence.

The practice in regard to the employment of mothers with young infants varies in different factories. In some, with a view to encouraging breast feeding, no woman is supposed to be employed who has a child under 9 to 12 months. In others no general rule exists and cases are judged on their merits. In others, again, no attention is paid to the age of the child. It is, of course, impossible to investigate all cases fully, and a woman who is badly in need of employment has often little difficulty in evading inquiries. Children are thus commonly left with relatives or "mindes," or sent to a day nursery when there is one.

A maternity scheme for the assistance of munition workers might properly include the following:

(a) *Skilled supervision of pregnant women* is necessary, both factory and domiciliary, by a qualified and competent officer, in order to insure that suitable arrangements are made for the confinement at home or in lodgings (engagement of the midwife or doctor, antenatal care, postnatal care, etc.), and for the care of the infant after birth. Such an officer would be able to bring the women into touch with local agencies for assistance. She would also encourage thrift and proper preparation for the confinement. This supervision might be arranged by the welfare staff of the factory, though in large factories an extra officer with midwifery qualifications might be desirable for home visitation, etc.

(b) *The provision of light employment* may be made available inside or outside the factory during the later months of pregnancy, say from the fourth or fifth to the eighth or ninth month, and also after the birth of the child. In some factories this might be arranged as part of the general organization; in other factories all the work is too heavy or the general conditions too unsatisfactory to admit of pregnant women being employed at least after the early months. In such cases separate workrooms would be necessary, which might serve more than one factory, where lighter work, such as sewing and mending, might be undertaken (e. g., the sewing of exploder bags, the making of light boxes, the manufacture of overalls, etc.). Such small separate departments might also be used by other women temporarily ailing from one cause or another.

(c) *Favorable welfare conditions* are essential for all pregnant women, including the abolition of night work and, where possible, reduction in the length of the day shift. Arrangements for an adequate supply of suitable food, including milk, through the canteen or otherwise, is also advisable.

(d) *Maternity homes should be established for women who can not be confined at home or in their lodgings.*—These institutions should also provide, where necessary, for preconfinement residence and lying-in accommodation. Maternity homes might be organized (i) as a branch of an existing lying-in hospital available for normal and abnormal cases; or (ii) as an ad hoc maternity home of six or a dozen beds in charge of a competent midwife.

In connection with these homes, but not necessarily under the same roof, there should be accommodation for women before and, if necessary, after confinement. Arrangements should be available for married or unmarried women, and, as far as possible, the schemes should be self-supporting.

Exchequer grants would be necessary for the establishment of such homes and also to make good deficits in the cost of working and maintenance, but the greater part of the maintenance expenses should be met by payments from the women themselves.

(e) Lastly, in many districts a crèche or day nursery is necessary for the children, where they may be cared for during the absence of the mother. The number of available "minders" to whom children would ordinarily have been sent has steadily diminished, largely because these women have themselves sought regular employment. Mothers working long shifts are physically unable to devote as much attention as they would wish to the care of their homes and children. There is thus a substantial case for an increased provision of nurseries which would take charge of children under school age by day and, if necessary, by night.

Sympathetic administration is essential to the success of such a scheme, the aim and intention of which is to encourage the women to report their condition at an early stage and to afford them such advice and assistance as are needed, without exercising a burdensome or inquisitorial supervision.

CONCLUSIONS.

To sum up, the general results of these inquiries indicate:

(1) That there is definite burden of fatigue, which though relatively small in amount as regards severe fatigue is considerable as regards that of a less severe character.

(2) That the fatigue and ill health are less than might have been anticipated having regard to the hours of work and the nature of

the employment, and that this is due, broadly speaking, to the greatly improved attention to the health and welfare of the workers.

(3) That fatigue and sickness are greatest where heavy work is combined with long hours at the factory and associated with onerous domestic duties after factory hours.

(4) That unless brought under control, the considerable amount of moderate weariness and ill-health now present is likely to reduce immediate efficiency and also exercise in many cases an injurious effect on subsequent health and on capacity for maternity.

(5) That although there has been substantial improvement in the conditions and circumstances of women's work in factories further action is necessary if the amount of fatigue is to be diminished rather than increased. In particular the findings of this inquiry seem to indicate the necessity—

(a) For further shortening of the hours of labor for women;

(b) For restricting women's work in the heavier branches of industry to those who are young, physically fit and capable and who have not arduous home duties to perform;

(c) For the continuation and development, wherever women are employed in factories, of hygienic conditions and especially "welfare" arrangements (including industrial canteens); and

(d) For making appropriate provision for effective medical supervision, both on entrance to the factory (in heavy and exceptional occupations) and subsequently, by means of the services of medical officers (women preferred) and nurses, and in the form of suitable accommodation as to rest rooms, first-aid appliances, and well-equipped surgeries.

JANET M. CAMPBELL, M. D.

FEBRUARY, 1918.

APPENDIX C.—A COMPARISON OF THE SYSTEMS EMPLOYED FOR DIVIDING UP WORKING HOURS INTO SPELLS AND BREAKS.

BY H. M. VERNON, M. D., FELLOW OF MAGDALEN COLLEGE, OXFORD, AND UNIVERSITY LECTURER IN CHEMICAL PHYSIOLOGY.

The systems employed in various factories for dividing up the weekly hours of work into spells and breaks differ greatly, and it is a matter of considerable importance to select the system which yields the most advantageous results in respect of output and of the comfort and convenience of the workers. Direct and exact evidence upon the merits of rival systems is very difficult to obtain, and so the information adduced below is necessarily incomplete. Nevertheless it is sufficient to indicate that the systems employed in the majority of factories are capable of considerable improvement, and to suggest the lines on which such improvements should be made.

First, if a night shift is being run as well as a day shift, what ought to be the distribution of working hours as between the two shifts? In my own experience the night-shift hours are usually longer than the day-shift hours. For instance, in the four factories (A to D) referred to in another memorandum,¹ the following hours were usually worked:

Factory.	Day-shift hours.	Night-shift hours.	Excess of night-shift hours over day-shift hours.
Factory A, from February to August, 1916.....	64.5	62.5	-2
Factory A, from August, 1916, to March, 1917.....	58.5	62.5	4
Factory A, from March, 1917, to October, 1917.....	54.5	62.5 (or 52.5)	8
Factory A, from October, 1917, onward.....	54.5	60 (or 50)	5.5
Factory B, from October, 1916, to March, 1917.....	63	63	-----
Factory B, from April, 1917, onward.....	59	63	4
Factory C, from July, 1918, till May, 1917 (for men).....	57	69.5	12.5
Factory C, from May, 1917, onward (for men and women).....	48	60	12
Factory D, from August, 1916, till March, 1917 (for men).....	63 or 62	63	1
Factory D, from April, 1917, onward.....	58	63	5
Factory E, before June, 1916.....	56.8	61.5	4.7
Factory E, after June, 1916.....	52.3	57	4.7
Factory F.....	53 (or 64)	57.5 (or 67)	4.5

Grouped with these factories are two others, viz, factory E, which was chiefly devoted to the manufacture of rifle ammunition, and factory F, where 3-inch shells and aeroplane engines were made. These data show that the night shift was generally several hours

¹ Committee's memorandum No. 21.

longer than the day shift, and in one instance was 12.5 hours longer. This system of division is undoubtedly erroneous, as night-shift work imposes a greater strain than day-shift work, and so the hours ought to be shorter rather than longer. The cause of the difference in the total hours worked is frequently due to the fact that only a half day is worked on Saturday by the day shift, whilst six full nights are worked by the night shift. In correspondence with the Saturday afternoon relaxation, the night shift might be allowed some reduction of hours on Sunday evening, but the workers object to this plan, as they lose the double-time pay which is usually granted on Sunday evenings up till midnight. It would be better, therefore, to recognize the greater strain of night work by reducing the time worked each night to an hour less than that worked each day, and regard 9 hours per night, or a 54-hour night-shift week, as the equivalent of 10 hours per day, or what is generally a 55 or 54 hour day-shift week. Similarly 8 hours per night would be equivalent to 9 hours per day.

If the number of working hours per week be fixed at, e. g., 54, the question arises as to the best system of dividing them up throughout the week. Theory might suggest that they should be divided up nearly equally over the seven days, or that, for instance, 8 hours should be worked each day from Monday till Friday and 7 hours on Saturday and Sunday. Though some such system was adopted in many factories in the early months of the war, it is now generally recognized that every worker is entitled to one day's rest per week, and that such a relaxation tends to the increase of the total output rather than to its diminution.¹

But ought the 54 hours to be divided up equally over the remaining six days, so as to give an evenly distributed 9-hour day, or ought there to be only a half day's work on Saturday, with the resultant necessity of 10 hours' work per day from Monday to Friday? An even 9-hour day is undoubtedly the best for such workers as are prepared to put every ounce of their available energies into the production of munitions. Such patriotic workers exert themselves to their limit each day, the said limit being such that it does not prevent complete or nearly complete recovery of vigor as the result of the night's rest. If the limit is surpassed, so as to induce a state of fatigue which is no longer properly recovered from, output is diminished and the worker is no longer capable of exerting his maximum powers of production. Unfortunately, not many workers have the strength of mind to exert themselves in this manner month after month and year after year. They crave for some relaxation from the monotonous grind of work, and this they can get best on Saturday afternoons. Hence the Saturday afternoon work, which was

¹ Cf. memorandum No. 18.

enforced in many factories in the earlier years of the war, is now usually remitted, and the 54-hour week is accomplished by working 10 hours per day from Monday to Friday and 4 hours on Saturday. In a few factories six full days of work are put in, but the day of rest from work is on Saturday, not Sunday. By this procedure the workers get plenty of opportunity to enjoy themselves, and, moreover, get a whole day of double-time pay. The system, though not morally defensible, permits of freedom from work (until the evening) on alternate Sundays, supposing that the workers are employed on alternate weeks of day and night shift.

TWO-BREAK AND ONE-BREAK SYSTEMS.

Supposing that a 10-hour day be considered necessary, what is the best way of dividing up the hours into spells and breaks? The method most frequently adopted is on the two-break system, though this is gradually being replaced by the one-break system in many industrial areas. In the two-break system the workers start at 6 a. m., or less frequently at 6.30 or 7 a. m., and work for about two hours, when they have a breakfast interval of half an hour. There is an hour's dinner interval from 12.30 to 1.30 or from 1 to 2, or the working day is usually cut up into spells of two, four, and four hours. On the one-break system the workers usually start at 7 and work two spells of five hours each, with an hour for dinner in between. Upon the disadvantages of the two-break system a large amount of valuable evidence has been collected by Prof. Loveday.¹ His main conclusion may be quoted: "Work before breakfast gives inferior output, lowers health, and leads to great loss of time, as the first short spell is so frequently missed. Experience shows that in certain descriptions of work the early quarter has been advantageously abolished both prior to and even during the course of the war, and under similar conditions it ought not to be instituted in new factories opened during the further course of the war." Though Prof. Loveday adduces plenty of evidence in proof of his contention that work before breakfast increases lost time, he does not quote any direct observations to support his statement that it gives inferior output. Hence, it is worth while for me to record such information as I have been able to collect upon the subject.

Output observations were made at factories A to D by the method described in memorandum No. 21. It consisted in determining the power consumption, either by the reading of wattmeters or from automatic-power records, deducting the power required to drive the machinery apart from that required in the actual machining operations, and verifying the results by direct enumeration of the articles

¹ Cf. Interim Report, pp. 41 to 67, 1917.

produced. A number of these output determinations are quoted for every hour of the day and night shifts, but for my immediate purpose it is necessary only to consider and compare the output during the first few hours of the corresponding day and night shifts. The night-shift workers have invariably had a good meal before they come on to work, or start work in full vigor. How does their output compare with that of the day shift, who are presumed to have had an adequate breakfast before work when employed on the one-break system but to have had little or no breakfast when employed on the

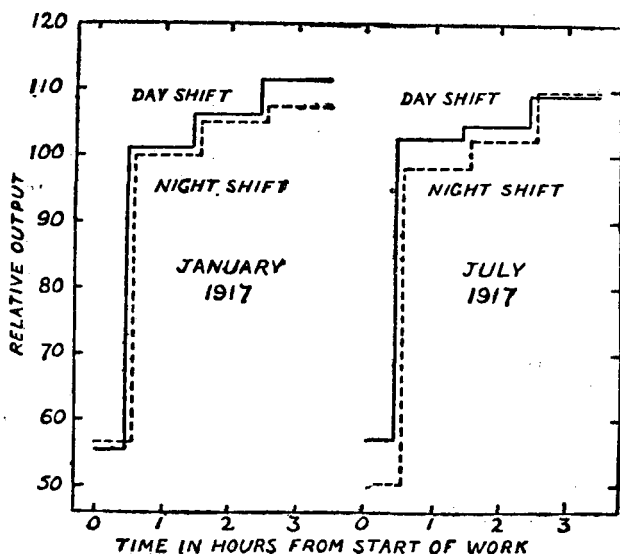


FIG. 1.—OUTPUT AT FACTORY WORKING ON ONE-BREAK SYSTEM.

two-break system? In figure 1 we see the output curves for the first three and one-half hours of the day and night shift at factory A, where the day shift worked a five-hour spell from 7 to 12. This output relates to seven sections of lathe workers (some 1,000 to 1,800 individuals), who were for the most part engaged in machining fuze parts. The output was determined for three consecutive days and for three consecutive nights in January and July, 1917, and the mean relative hourly output taken as 100 in each case. We see that the output variations of the day and night shift workers corresponded closely both in winter and summer, and increased from about 55 per cent of the average during the first half-hour of work to 100 per cent of the average in the next hour and 110 per cent of the average in the next hour but one. If anything, the day shift worked up their output more rapidly than the night shift.

Very different is the comparison of day and night shift output shown by workers on the two-break system. At factory B, where 6-inch shells were made, the day shift started at 6 a. m. and had breakfast from 9 to 9.30 a. m., whilst the night shift started at 6 p. m., and in corresponding fashion had their first break at 9 p. m. Power records for the whole factory were obtained for five consecutive days and nights in August, 1916, and for three consecutive days and nights in August, 1917. From figure 2 it will be seen that in 1916 the day-shift output during the first half hour was only 58 per cent of the

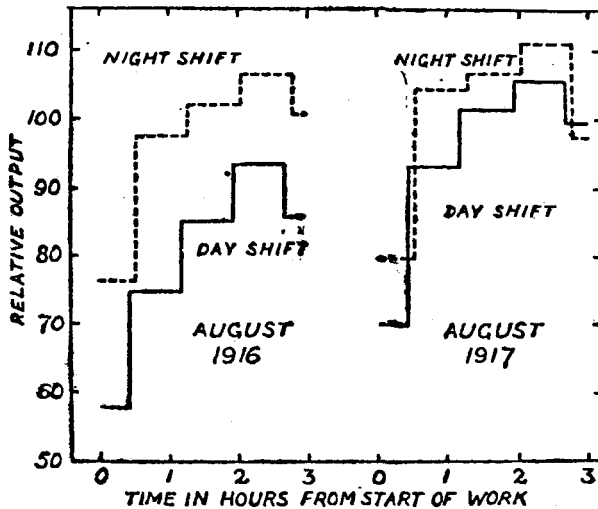


FIG. 2.—OUTPUT AT FACTORY WORKING ON TWO-BREAK SYSTEM.

average, whilst that of the night shift was 76 per cent of the average. Even in the next three-quarters of an hour period it was only 75 per cent of the average in the day shift, whilst it was 97 per cent of the average in the night shift, and, in fact, the day-shift output lagged behind the night-shift output so much throughout the spell that the mean hourly output during the spell was only 80 per cent of the average for the whole day, while that of the night shift during the corresponding spell was 97.5 per cent of the average for the whole night. In August, 1917, the difference was not so great, the mean hourly output during the first spell of the day and night shifts being, respectively, 95 per cent and 102 per cent of the average.

In factory C, where 9.2-inch projectiles were exclusively manufactured, the day shift started work at 6 a. m. until May, 1917, when their weekly hours of labor were reduced from 57 to 48, and they started work at 7.15 a. m. They had a breakfast interval from 9 to 9.30, or 9.30 till 10, and so were under the two-break system, but

owing to their late start it is probable that most of the workers got more breakfast before coming to the factory than the workers at factory B. Power records for the whole factory (from four automatic recorders) were obtained for 48 consecutive hours in August, 1917, and January, 1918, and the relative output during the first 1½ hours of the day shift and first 2 hours of the night shift, is shown in figure 3. It will be seen that in August, 1917, the day-shift output was considerably behind that of the night shift, but in January, 1918, there was very little difference between them. This may be due to the workers having by that time acquired the one-break-system habit of taking a good breakfast before work, whereas in August, 1917, they still retained the custom followed when they started work at 6 a. m. However, the power records did not extend over sufficiently long an interval to warrant a definite conclusion.

It should be stated that the conditions of supply of material to the day and night shifts were just the same in all three factories. There was never a shortage at any time in factories A and C, and though there was at times a shortage in factory B, it came toward the end of the day and night—i. e., the shifts always started with plenty of material. Hence, the smaller initial output shown by the day shift in factories B and C is a genuine phenomenon, dependent on smaller capacity for work.

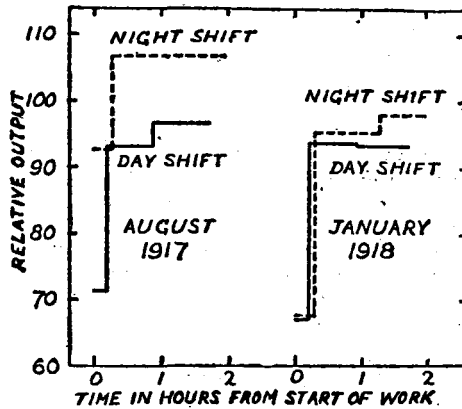


FIG. 3.—OUTPUT AT FACTORY WORKING ON MODIFIED TWO-BREAK SYSTEM.

PROOF THAT FIVE-HOUR SPELLS OF WORK ARE TOO LONG.

If it be admitted that the two-break system, with work before breakfast, is a mistake, must the 10-hour day be worked on the one-break system of two 5-hour spells? As the result of conversations with workers, and of my own experience, I am convinced that five hours of continuous work are too long for a man, and considerably too long for a woman. With the possible exception of passive work such as the watching of automatic machines, no type of labor ought

to be run continuously for more than four hours if it can be avoided, or it is important to split up the 10-hour day by at least two breaks, only the first break must not occur so early in the morning that it can function as a breakfast interval. Methods of overcoming this difficulty are suggested later on, but I wish first of all to adduce a numerical proof that the five-hour spell is too long. It is an indirect proof which has been briefly referred to previously,¹ but it is none the less convincing. It was obtained at factory A, where the day shift worked for two five-hour spells, viz, from 7 to 12 and 1 to 6, while the night shift worked for three spells, viz, from 6.30 to 10.30, 11.30 to 3, and 3.30 to 6.30, or for intervals of four, three and one-half, and three hours respectively, separated by breaks lasting one hour and half an hour. That is to say, they put in 10½ hours of labor instead of 10 hours, but they worked their longest spell of four hours when they were fresh and vigorous, and worked for shorter and shorter spells as they became more fatigued. Hence a comparison of the output of the day and night shifts, if made under valid conditions, will demonstrate the relative efficiency of the two systems of breaks.

In the Interim Report (pp. 26-40) are quoted very large numbers of data, collected by Capt. Greenwood, Mr. P. S. Florence, and myself, to show the relative output of day-shift and night-shift workers. Eight sets of data concerning women were obtained at different factories where the shifts changed over every week, and these data, which relate to the manufacture of cartridges, fuze parts, and 9.2-inch projectiles, show that, on an average, the hourly output of the night shift was 3 per cent less than that of the day shift, while in no individual factory was it more than 1.3 per cent greater than that of the day shift. Data relating to men were obtained at three factories, and they showed a night-shift output which averaged 2 per cent more than that of the day shift. If the women's and men's data be grouped together, the average night-shift output for the whole of the workers comes to 1 per cent less than that of the day-shift workers. Factory A forms a striking exception to this general average, for the hourly output of its night shift was most distinctly greater than that of its day shift, in spite of the longer hours worked. By no means all of the workers went onto night shift, but such as did do so worked for alternate fortnights of day and night shift, and in order to compare output it is convenient to group these workers in four-weekly periods, during a fortnight of which they were on day shift, and a fortnight on night shift.

The women turning aluminum fuze bodies generally remained on continuous day shift, but a group of 21 workers were put on the

¹ Interim Report, p. 29.

day-and-night shift system for two months in February and March, 1916, and a group of 26 workers were put on it for three months in April-July, 1916. In March, 1917, most of the women were put on this system, and a block of 70 workers was obtained for a three-month period. In Table I is shown the relative hourly output of each of these groups during the first and second weeks of the day-shift fortnight, and the first and second weeks of the night-shift fortnight. The general mean shows that during the night-shift fortnight the hourly output was 9 per cent greater than during the day-shift fortnight, the mean excess of output for the separate blocks of women amounting to 10, 6, and 10 per cent, respectively. Taking each fortnight of the general mean separately, we find that the output was 3 per cent less in the second week of the night-shift fortnight than in the first week, whilst it was 3 per cent greater in the second week of the day-shift fortnight than in the first week. Undoubtedly, therefore, night-shift work exerted a depressant effect upon output (this is well shown in the Interim Report, when permanent night shifts were found to have 5 per cent to 10 per cent less output than permanent day shifts), but the effect did not show itself for the first few nights, and it continued to exert its influence for the first few days of the subsequent day-shift fortnight. In order to eliminate this depressant effect of night-shift work, and obtain a more genuine comparison of output under the two systems of work spells, it is better to compare the output of only the first week of the night shift and the day-shift fortnights, and we then find that the output under the three-spell system was 12 per cent greater than that under the two-spell system.

TABLE I.—TWENTY-ONE TO SEVENTY WOMEN TURNING ALUMINUM FUZE BODIES.

Four-week period extending from—	Number of workers.	Relative hourly output.				Weekly hours of actual work.			
		Day shift.		Night shift.		Day shift.		Night shift.	
		First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.
Jan. 31 to Feb. 27, 1916.....	21	101	111	111	118	56.6	59.4	56.6	59.3
Feb. 28 to Mar. 21.....		111	117	130	126	62.2	57.1	56.8	55.0
Apr. 17 to May 14, 1916.....	26	124	117	134	121	56.6	49.8	49.8	42.7
May 15 to June 11.....		133	133	145	136	61.1	61.9	60.2	53.7
June 12 to July 9.....		135	142	157	140	55.9	55.4	54.7	59.9
Feb. 25 to Mar. 24, 1917.....	70	179	172	191	193	53.4	52.1	57.4	54.9
Mar. 25 to Apr. 21.....		163	172	186	185	40.1	49.0	40.9	50.0
Apr. 22 to May 19.....		167	170	184	183	49.2	49.2	55.6	57.4
Mean.....		138	142	154	150	54.4	54.2	54.0	53.4
		140		152		54.3		53.7	

The rapid increase of output observed during the three statistical periods examined—for it averaged 116, 135, and 177, respectively—was dependent on the reduction in the hours of labor. These averaged 57.1, 55.1, and 50.8 hours per week in the respective periods.¹

In Table II is shown the output of a group of 90 men engaged over a seven-month period (Mar. 11 to Sept. 22, 1917) in the very active and somewhat heavy labor of sizing aluminum fuze bodies. In spite of the average hours of work during the night shift fortnight being 5.8 more per week than during the day-shift fortnight, the hourly output was 3 per cent greater. Taking each fortnight by itself, we find that the output during the second week of the night shift was 2 per cent less than in the first week, whilst that in the second week of the day shift was 4 per cent more than in the first week, or the same sort of relationship held as in the fuze-turning women. The output during the first week of the night-shift fortnight was 5 per cent greater than that observed during the first week of the day-shift fortnight, or this is the genuine improvement dependent on the substitution of three spells for two.

Both the fuze-turning women and the sizing men were actively employed throughout working hours, so a suitable system of work spells was much more important to them than to workers who stood passively watching automatic machines for most of the time. Two classes of such workers were examined, and in accordance with expectation, it was found that their night-shift output corresponded more closely with their day-shift output than in the active workers. The first class consisted of women who were milling a screw thread on the fuze bodies, and in this operation they stood passively watching their machines for four-fifths of the total time taken. The output of 26 women over a three-month period, and of 42 women over a two-month period was obtained, and average values for these periods are quoted in Table III. Taking the results as a whole, the night shift output came to 1 per cent less than the day-shift output. The other class of workers consisted of youths of 16 to 18 who were boring top caps, an operation in which they stood passively watching their machines for seven-eighths of the total time taken. A group of 15 workers was examined for a six-month period, and another group of 24 workers for a five-month period. As can be seen from Table IV, the night-shift output was 1 per cent less than the day-shift output, just as in the mill-thread women.

¹ Cf. memorandum No. 18.

TABLE II.—90 MEN SIZING FUZE BODIES.

Four-week period extending from—	Relative hourly output.				Weekly hours of actual work.			
	Day shift.		Night shift.		Day shift.		Night shift.	
	First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.
Mar. 11 to Apr. 7.....	138	137	150	135	50.9	48.1	61.1	55.0
Apr. 8 to May 5.....	130	138	136	141	31.2	46.4	41.2	50.2
May 6 to June 2.....	142	143	146	140	37.5	36.6	51.6	38.0
June 3 to June 30.....	135	139	143	144	42.5	47.3	49.6	48.7
July 1 to July 29.....	135	137	148	142	38.4	51.3	36.7	50.7
July 29 to Aug. 25.....	141	158	143	148	44.5	52.7	46.3	61.1
Aug. 26 to Sept. 22.....	144	148	152	149	48.2	47.9	57.9	56.8
Mean.....	138	143	145	143	41.9	47.2	49.2	51.5
	140		144		44.5		50.3	

TABLE III.—WOMEN MILLING A SCREW THREAD.

Period extending from—	Number of workers.	Relative hourly output.				Weekly hours of actual work.			
		Day shift.		Night shift.		Day shift.		Night shift.	
		First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.
Nov. 19 to Feb. 10.....	26	133	132	131	135	43.7	45.6	46.2	45.1
Mar. 25 to May 19.....	42	135	135	133	135	39.9	46.5	46.0	49.4
Mean.....		134	133	132	134	41.8	46.0	46.1	47.2
		134		133		43.9		46.6	

TABLE IV.—YOUTHS BORING TOP CAPS.

Period extending from—	Number of workers.	Relative hourly output.				Weekly hours of actual work.			
		Day shift.		Night shift.		Day shift.		Night shift.	
		First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.
July 3 to Dec. 16.....	15	129	128	129	126	54.1	55.1	57.9	58.5
Dec. 31 to May 19.....	24	128	127	133	119	54.4	53.4	56.7	56.5
Mean.....		128	127	131	123	54.3	54.2	57.3	57.5
		128		127		54.2		57.4	

The conclusion to be derived from the whole of the observations may be summarized by saying that when men and women are engaged in active work, their output is 5 to 12 per cent greater if working hours are divided up into three spells of suitable duration (e. g., 4, 3½, and 3 hours) than if they are divided up into two 5-hour spells.

HOW CAN FIVE-HOUR SPELLS BE AVOIDED?

The 5-hour spells can be avoided in two ways. The first way is to split up the day-shift hours in the same way as the night-shift hours at factory A, viz, by a long first spell of work followed by two shorter spells. As workers are not usually accustomed to having their dinner before midday, the simplest arrangement of spells would be: 8 to 12, 4 hours; 1 to 4, 3 hours; 4.30 to 7.30, 3 hours. This system has the disadvantage that work ends too late to give the workers a chance of doing their shopping, so the following system might be adopted: 7.30 to 11.30, 4 hours; 12.30 to 3.45, 3½ hours; 4 to 6.45, 2¾ hours. On this system only one-fourth hour is allowed for tea, and this is too short an interval to enable the workers to leave the workshops and go to the canteen, so it would be necessary to supply them with refreshment by means of traveling canteens. This plan is now adopted with success in many factories, and is often run by volunteer helpers.

The second and probably the better method of dividing up working hours is that adopted at a large cartridge factory (factory E), where each of the two 5-hour spells was cut in half by means of one-fourth hour breaks. During these breaks the machinery was stopped, and the workers were supplied with tea and food by traveling canteens. The hours of work were the following: 7.30 to 10, 2½ hours; 10.15 to 12.30, 2¼ hours; 1.30 to 4.15, 2¾ hours; 4.30 to 6.30, 2 hours. These hours include no spell of longer than 2¾ hours duration, whereas they had previously been: 7 to 8.30, 1½ hours; 9 to 1, 4 hours; 2 to 4.15, 2¼ hours; 4.30 to 6 or 7, 1½ or 2½ hours; i. e., they were on the two-break system, or they had a breakfast interval which was followed by a 4-hour spell. The night-shift hours during the two periods were the same as the day-shift hours with p. m. substituted for a. m., and vice versa, except that on Sunday night the full hours were worked whereas no work was done on Saturday afternoon. Hence, the total weekly hours of work during the two periods were generally 61½ and 57 hours, respectively, for night shift, and 56¾ and 52¼ hours, respectively, for day shift.

The output of five groups of experienced workers in the factory was investigated for 38 consecutive weeks, during 23 of which (January 2 to June 10) they were under the two-break system, and during 15 under the one-break system. As the workers changed over from day shift to night shift in alternate weeks, they were grouped in fortnightly periods, and the output of the whole group was calculated for a week of day shift and a week of night shift. The groups relate to four cartridge-case operations, viz, 29 women on the "second draw," 39 on "head trimming," 26 on the "second cut-off," and 20 girls on "mouth reamering," and one bullet operation, viz, 36 women engaged in cutting off bullet sheaths. The average hourly output for both day

and night shift on each operation during the two-break period was taken as 100, and we see from Table V that the average output of all the workers on day and night shift improved very slowly during the two-break period, being approximately 99, 100, and 101 during the three consecutive seven or eight week intervals into which the total period was arbitrarily divided. When the one-break system was adopted, however, the average output jumped to 105 during the seven-week period immediately following, and to 108 in the subsequent eight-week period. Assuming that if the system of hours had not been changed, the gradual rise of output previously observed would have continued at the same steady rate, we may say that the change from the two-break to the one-break system improved the hourly output by 5 per cent. The average hours of actual work are given on the right side of the table, and they amounted to 51.7 hours per week for the day shift, and 56 hours for the night shift during the two-break period, and to 50.3 and 54.5 hours for the respective shifts during the one-break period, i. e., they averaged 1.4 hours per week less. The total output of the workers may be reckoned thus:

For the two-break system.....	108 × 53.8=5,541
For the one-break system.....	108 × 52.4=5,659

or the total output would have been 2 per cent greater under the one-break system than under the two-break system. Hence, the introduction of the one-fourth hour break during the middle of the morning of the first 5-hour spell, though it was still reckoned as work time and paid accordingly, more than justified itself.

The total lost time of the workers could not be determined from the data available, as there was uncertainty about absent workers, but the average "broken time" is given in the last two columns of the table. This "broken time" included only the time lost when the workers put in at least 45 hours a week out of a nominal 57 hours or more, or 40 hours out of a nominal 52 hours, and so on. It averaged 5.3 per cent and 4.6 per cent for day shift and night shift during the two-break period, and 6 per cent and 4.7 per cent for the respective shifts during the one-break period, or was practically the same. The "actual hours of work" quoted in the table relate only to workers who put in more than 45 hours per week of work out of 57 hours, or 40 hours out of 52 hours, and they are in consequence about three hours per week longer than if all lost time had been taken account of.

THE NEED FOR REST PAUSES.

Repeated observation showed that the nominal one-fourth-hour breaks just mentioned meant an average stoppage from work of 20 to 25 minutes, and yet we saw that this considerable loss of working time more than justified itself. The reason is that no worker will, or can, work continuously for several hours without taking occasional rests. Especially is this so in all kinds of work requiring continuous activity and attention, as was proved by direct observations upon various groups of workers. In observations made upon four men engaged in hand-tapping fuze sockets, an operation requiring continuous and very considerable muscular activity, it was found that on an average the men took seven to nine minutes of voluntary rest pauses in all except the first full hour of work, and as they had all of them been engaged for many months on the operation and were paid at piece rates, there can be no doubt that they found by experience that such pauses improved their total output. It was curious to note, however, that they worked on no sort of system, but often took rests in a most irregular manner. In figure 4 are shown the actual times when rests were taken, no pause of 2 minutes or less being registered. We see that the best workman, whose output was 34 per cent more than that of the worst workman, took frequent rests at fairly regular intervals in the morning or both days he was under observation, but was not so regular in the afternoon. The next best workman, however, though he took regular rests in the morning of one day, worked continuously for four hours in the afternoon, whilst workman C on one day worked continuously for 2½ hours in the morning and 3½ hours in the afternoon. Workman D took an unnecessary number of rests on both days, and accordingly had a low output. Hence these few data indicate that a greater regulation of rest pauses would have conduced to a better output, and that the best

system of all would have been to take about 7 minutes off regularly in each hour.

In the less severe operation of sizing fuze bodies observations were made upon 16 men, i. e., four on each day of four days,¹ and the data recorded in Table VI show that they took on an average about eight

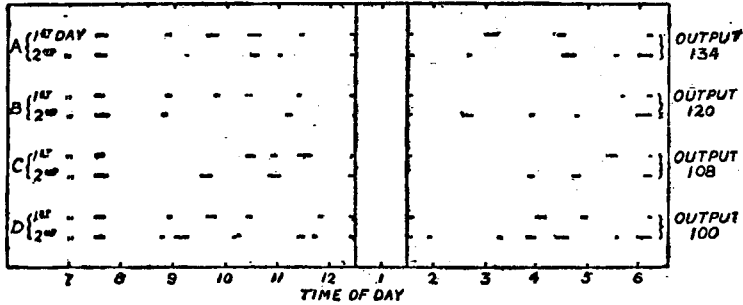


FIG. 4.—REST PAUSES OF MEN HAND-TAPPING FUZE SOCKETS.

minutes of rest per hour, though the rest pauses were not so evenly distributed over the hours as those of the hand tappers. The very long rest pauses taken in the initial and final hours of the morning and afternoon spells were due to the men beginning work some considerable time after nominal starting time, and knocking off before the nominal stopping time.

TABLE VI.—AVERAGE DURATION OF REST PAUSES, CALCULATED PER HOUR.

Time.	Men hand-tapping fuze sockets. ¹	Men sizing fuze bodies.	Women turning fuze bodies.		
			Available pauses.	Unavoidable pauses.	Total pauses.
	<i>Minutes.</i>	<i>Minutes.</i>	<i>Minutes.</i>	<i>Minutes.</i>	<i>Minutes.</i>
7 to 7.30.....	25.7	28.8	30.6	4.0	34.6
7.30 to 8.30.....	2.6	12.0	3.9	12.0	15.9
8.30 to 9.30.....	9.4	10.5	4.4	12.6	17.0
9.30 to 10.30.....	9.4	6.2	.4	9.2	9.6
10.30 to 11.30.....	7.1	6.0	3.5	2.4	5.9
11.30 to 12.....	11.3	9.9	3.6	2.7	6.3
1 to 1.30.....	13.2	15.9	20.4	4.9	25.3
1.30 to 2.30.....	2.4	4.9	2.0	6.3	8.3
2.30 to 3.30.....	7.4	9.0	4.5	4.9	9.4
3.30 to 4.30.....	8.2	7.8	11.4	4.8	7.7
4.30 to 5.30.....	7.8	7.4	2.2	4.7	6.9
5.30 to 6.....	20.3	34.6	20.2	2.6	22.8

¹ The hours of work in this operation were half an hour later than those recorded.

In lathe operations the lathes generally need a good deal of attention at the hands of the tool setters, or the workers take "unavoidable" rest pauses; but such rests fulfill their object as well as "avoidable" pauses, and so the observations upon women turning alumi-

¹ These observations and those on women turning fuse bodies were made by Mr. W. Neilson Jones.

num fuze bodies (made for five days on 27 women in all) showed that the average avoidable plus unavoidable rest pauses in the last two full hours of work in the morning spell, and the four full hours of work in the afternoon spell, averaged a fairly steady eight minutes per hour, or the same time as was observed in the men engaged in sizing and hand tapping. As can be seen from the data in Table VI, this eight minutes might be made up almost entirely of unavoidable pauses (e. g., between 9.30 and 10.30), or chiefly of avoidable pauses (e. g., between 3.30 and 4.30).

In operations involving the passive watching of machinery for most of the working hours the avoidable rest pauses are naturally reduced very greatly. For instance, five women engaged in boring 9.2-inch shells were found, in the $3\frac{1}{2}$ -hour spell for which they were watched, to lose only 3.7 minutes per hour in rest pauses (avoidable plus unavoidable), the reason being that they were doing active work on the machines for only 19 minutes per hour, and were passively watching them, either in a sitting or standing position, for 38 minutes per hour.

The principle of rest pauses being admitted, it is evidently better to control these pauses to some extent for the workers, rather than to leave them to their uncontrolled and haphazard initiative. For this reason the one-fourth hour break in the middle of the five-hour morning and afternoon spells is valuable, as the workers are thereby precluded from working very long continuous spells, such as the hand-tapping men did sometimes. The probability is that they would get into the habit of spontaneously taking a further short rest pause in the middle of each $2\frac{1}{2}$ -hour spell, or would thereby secure a pause in every $1\frac{1}{2}$ hours of the working day.

If a shorter working day than the 10-hour day be adopted, somewhat similar plans of dividing up the hours could be employed. If a 9-hour day be worked, the hours might be divided up into a $3\frac{1}{2}$ -hour spell from 8 to 11.30, a 3-hour spell from 12.30 to 3.30, and a $2\frac{1}{2}$ -hour spell from 3.45 to 6.15; or what would probably be better, two $4\frac{1}{2}$ -hour spells might be worked, but with one-fourth-hour breaks in the middle of each. If an eight-hour day be decided on, the simplest plan would be to work two four-hour spells, and this might likewise prove the best for many types of labor, but for very vigorous and active work it might still be best to split up the eight hours by two breaks into spells of, e. g., $2\frac{3}{4}$ and $2\frac{1}{4}$ hours, or by one-fourth hour breaks in the middle of each four-hour spell.

TABLE VII.—5 WOMEN BORING 9.2-INCH PROJECTILES.

Time intervals.	Active work, reckoned per hour.	Passive work, reckoned per hour.	Rest pauses, avoidable and unavoidable.
	<i>Minutes.</i>	<i>Minutes.</i>	<i>Minutes.</i>
10 to 10.15.....	23.2	19.2	17.6
10.15 to 11.15.....	14.8	45.2	0.0
11.15 to 12.15.....	20.6	38.2	1.2
12.15 to 1.15.....	19.0	34.2	6.8
1.15 to 1.30.....	19.2	39.2	1.6
Weighted mean.....	18.6	37.8	3.7

SUMMARY.

The total weekly hours of night shifts ought to be shorter than those of days shifts, instead of longer, as is the usual custom. If 10 hours be worked each day (or a 54 to 55 hour week) only 9 hours should be worked each night.

Day-shift workers on the one break system were found to work up to their maximum output each morning rather more quickly than the night shift worked up to their maximum; but day-shift workers on the two-break system, in which work was begun at 6 a. m. and was followed by a breakfast interval at 9 a. m., had 7 per cent to 18 per cent less output in these three prebreakfast hours than the night shift workers had in their first three working hours. This was presumably due to the night shift having had a good meal before starting work.

Five-hour spells of work are too long, for it appeared that by cutting up the 10-hour day into three spells of, e. g., four, three, and three hours, separated by two breaks (the first of which is too late to function as a breakfast break), the output might be increased 5 per cent to 12 per cent above that experienced when two five-hour spells were worked. What is probably a better system still of avoiding five-hour spells is to stop work for one-fourth hour in the middle of each spell and provide the workers with refreshment by means of traveling canteens. The introduction of one such extra one-fourth hour break in a cartridge factory, together with the abolition of the breakfast interval, increased the hourly output 5 per cent.

Rest pauses are essential in active work, for both men and women engaged on it were found to stop work spontaneously for about eight minutes per hour, on an average.

H. M. VERNON, M. D.

APPENDIX D.—SUMMARY OF CAPT. GREENWOOD'S MEMORANDUM ON "LOST WORKERS."

At the request of the committee, Capt. Greenwood undertook to collect information¹ in regard to the admission, discharge, or disappearance of women workers in munition factories, and as to the principal causes.

In the course of his inquiries he made investigations in 16 factories or sections of factories, employing together 40,000 women workers.

Although the majority of operations carried out in munition factories do not require a high degree of manipulative dexterity hardly any are such that practice does not lead to increased precision of work and therefore of rapidity of output. Thus in the manufacture of cartridge cases—perhaps the simplest type of operation—it is generally agreed that a woman worker can not obtain her maximum degree of efficiency until she has been engaged some weeks on her task. It follows that a factory at which the operators are constantly leaving and being replaced can not attain the same level of output as one in which the working population is stationary.

The problems at issue differ in certain respects in war time and peace time. Under war conditions there has been a constant and urgent demand for labor. As a result discontinuity and intermittency due to seasonal or other causes are practically nonexistent. On the other hand, this urgent demand for labor has probably tended to encourage workers who were for any reason discontented with their present surroundings promptly to seek other forms of employment. They have not been deterred by the fear that when a job is lost no other may be found. Further, the demand of the Military authorities for recruits and the schemes of dilution have not only directly affected the wastage amongst men but indirectly the wastage amongst women.

No similar inquiries have hitherto been attempted in this country. In America the results of certain recent investigations by Mr. Joseph H. Willits carried out in Philadelphia have been published under the title "Steadying Employment," in the annals of the American Academy of Political and Social Science for May, 1916. One example may be quoted:

A particular shop in a carpet mill was selected for intensive study. The dates of engagement and discharge of the employees were tabulated for the period 1907-1915. As a result it appeared that 48 per cent of the men and 38 per cent of the women remained in the service of the firm less than 10 weeks.

A wider and less detailed study was made by Mr. Alexander, of the General Electric Co., of a large number of factories of all sizes in the United States and Europe. From the figures collected it appeared that on 1st of January, 1912, 38,668 persons were employed in the factories and on 31st of December 46,796, or an increase of 8,128. The records also showed that during the period 44,365 persons had been engaged, so that 36,237 had dropped out

¹ Capt. Greenwood's memorandum on The Causes of Wastage of Labor in Munition Factories Employing Women is being published, as a special report, by the medical research committee.

of employment during the year; that is to say, five and a half times as many people had to be engaged as constituted the increase in the number employed at the end of the period.

From a large munition factory Capt. Greenwood collected the following figures:

Month.	Number employed.	Number star.ed.	Number left for various reasons.	Number left without reason.	Number employed at end of month.
June.....	4,340	622	138	58	4,571
July.....	4,571	695	48	87	5,131
August.....	5,131	494	67	229	5,308
September.....	5,308	578	174	45	5,697
October.....	5,697	1,064	236	248	6,237

It will be seen that during the four months from the end of October 2,791 women were engaged and 1,125 left; the number of engagements was thus 167.5 per cent of the net increase in four months. Further, during these four months, together with the previous month, the firm lost 1,516 women workers. In only 663 of these cases—or 43.7 per cent—was the cause of leaving known to the firm; the balance had simply vanished.

The facts are next given in regard to the cordite department of a large munition factory. From these it appears that during the 12 months ending August 28, 1916, an increase of 624 workers resulted from 1,031 new engagements amongst men, while an increase of 914 was obtained from 1,527 new engagements amongst women—percentages of 165 and 167, respectively, figures which compare favorably with those previously quoted.

More detailed investigation was found to be practicable at a factory at present organized in two main departments, one producing cases and bullets, the other carrying out cartridge and grenade filling operations. The two sections are denoted by the figures L 1 and L 2, respectively. Records have been kept by the firm of the name, age, previous occupation, character, and reason for leaving, which permitted of data being collected for the period January 1, 1911–August 4, 1914, and for the period August 4, 1914, to December 1, 1916.

Causes of leaving were classified by Dr. Greenwood into three categories:

- (i) Those who left on account of ill health.
- (ii) Those who left for some sufficient reason other than that of health, including—
 - (a) Girls who left to be married;
 - (b) Girls moving from the district;
 - (c) Girls required at home on account of illness there, or, in the case of married women, to keep house;
 - (d) Girls who found the wage earned insufficient;
 - (e) Girls discharged from the firm, not for misconduct, but because they were unsuitable or because the factory was slack;
 - (f) Girls considered by the factory surgeon to be physically unfit though not complaining of illness.
- (iii) Those who left for no reason or for an insufficient one, including—
 - (a) Girls discharged for misconduct;
 - (b) Girls leaving for other employment without a signed reason; and

(c) Girls wanting a change, or dissatisfied, or stating the work to be unsuitable.

The great majority in this category gave no reason at all.

Analysis shows that of 1,000 girls entering the factory during the war period 132 did not outstay the second month. Even if there had been no loss from sickness or other reasonable cause, 1,000 would still have been reduced by 10 per cent for no sufficient reason. Moreover, these figures are an underestimate, since the records take no account of the large number of girls who have worked in the factory only for a few minutes or days. Further, the workers were not generally removed from the register until after they had left for some time. Even disregarding these considerations the figures show that at a factory of high standing, thoroughly familiar with the industry, which they have not entered upon for the first time since the war, the absolute loss of workers occurring was serious. Workers leaving with less than two months' service can on the average have made but a very small contribution to the output of munitions, while on the debit side of the account is the trouble to which they have put the officials of labor bureaus and the administrative staff of the factory, as well as in some cases the demands made upon the transport facilities of the country. A comparison of the figures shows that the war-time experience is somewhat more favorable than that of peace time, but this advantage is decidedly less when only losses without reasonable cause are considered. The loss of effectives, amounting to at least 10 per cent of the original strength, in a period of employment so short that little useful service has been rendered must be attributed to some or all of the following causes:

(i) The default of the employee herself, such as caprice, unwillingness to submit to discipline, love of the excitement of change.

(ii) The fault of the employer as displayed in want of judgment in the selection of a candidate for employment, the conditions of which are unknown to the applicant but known to the employer.

(iii) Similar lack of judgment on the part of the officials of the labor bureaus.

No national system of organization can eliminate these causes of wastage, but it may be possible to diminish them.

The next factory considered (L 7) is in the open country, 6 miles by rail from the nearest town, and still farther from any large city. It is very isolated. There is no village in the immediate neighborhood, and no sleeping accommodation. The vast majority travel at least 6 miles to and from their work. The work is divided into that of the cordite and the gun-cotton departments, and is therefore roughly similar to that of L 2. Ample provision is made for the care of workers' health and comfort. In these respects the factory is probably unsurpassed by any other in the country. Any woman absent for more than two days without communicating with the management is automatically discharged, but in practice all these cases are followed up and the sick visited.

Comparison of figures shows that the loss in L 7 was little more than a third of that in L 2. Two possible causes for this difference may be suggested:

(i) A smaller proportion of the women were previously engaged in industrial employment, and it is possible that those who have had no previous experience of factory life are really more likely to remain steadily at work than old factory hands; or it may be that country people are less prone to change than those drawn from urban districts.

(ii) The more favorable conditions of employment have more than counterbalanced any initial instability of the population.

One point must at least be regarded as definitely established, viz, that existing rates of loss in many factories are unnecessarily high, and that so long as they continue the effective mobilization of labor for national service has not been even approximately realized. When expressed in terms of the whole munition-making female population the avoidable losses must amount to many thousands.

The third factory examined was situated in a midland industrial city. It is organized in two branches, one manufacturing fuzes (L 4), the other loading them (L 5). The general conditions of employment were good, being intermediate between those of the two factories previously considered. The general result of the investigation is that the factory as a whole is better off than L 1 and L 2, and worse off than factory L 7 in the matter of wastage, while it occupied a similarly intermediate position between the two factories in welfare efficiency.

Three factories employed on manufacturing projectiles of 6 inch or larger caliber were next examined. Taking the figures of these three factories together it appears that the rates of loss at ages above 22 are significantly greater than for girls between 18-22. It appears that the unusually heavy losses are seriously contributed to by ill health and other sufficient causes—causes of leaving for which the employees themselves are not responsible. No doubt the accuracy of statements purporting to describe reasons for leaving are not likely to be of a high order; however, there is no reason to suggest that the proportion of inaccurate replies in one factory is likely to differ sensibly from the percentage in another. The information as to the nature of previous employment was incomplete, but it would appear that the percentage of industrially employed women is greater than in L 1, L 2, or L 7, and it is possible that this contributes to frequent changes of employment, there being good opportunities to obtain another place.

While women at these factories undergo no specific medical examination their work is appreciatively heavier than the work of the fuze and cartridge factories. The large percentage of women—especially older women—who leave on alleged medical grounds is clearly consistent with the view that the occupation is on the whole unsuitable for such women.

Inquiry was next directed to 10 further factories doing heavy work and to an explosive-supply factory and a national cartridge shop doing light work. The figures in regard to these factories hardly admit of the same degree of detailed consideration. It was not possible to the same extent to eliminate variations of production or program, though all reasonable endeavors were made to do so. Such variations, while they should affect only losses due to reasonable causes, indirectly affect also losses due to insufficient reasons.

Looking, however, at the figures as a whole, certain general considerations are suggested. In the first place, while the survival rates diminish with age almost invariably among heavy factories, this is not so in the light group. The age group 18-22 is in a more favorable position than the later groups amongst the "heavy" employees, while the differences observable in the "light" group are almost negligible. The older women differ from the younger not only in age but also in that a higher proportion of them are married. It appears that the double handicap of age and home duties is insufficient to diminish perceptibly the resisting powers of the older women so far as light physical labor in factories is concerned. For the heavier type of work this ceases to be true. It would appear to follow that the recruitment of women over 22 for heavier factories is relatively disadvantageous.

A comparison is made between an H 3 factory and an L 6 factory, both of which are situated in the same part of the country and conform to high standards of general management. The conditions, in fact, are closely similar except as regards the type of work. The figures for three months' wastage are not significantly different at the ages of 18-22 nor at the ages of 23-27. At ages over 28 the light factory loses appreciably fewer women than the heavy factory, and it seems legitimate to infer that labor in the heavy factories is really less suitable for older women.

Much importance can not be attached to the recorded insistence of sickness. The data are not attested by medical evidence and may be no measure of the true incidence of sickness upon munition workers. Still it is worth noting that out of nearly 37,000 women under observation for at least a month illness or medical unfitness is given as the cause of leaving 1,651 times. The losses from ill health are practically the same at all ages in light factories, while they increase after the age of 22 in the heavy factories. Under 23 girls have fewer sickness losses in the heavy than in the light factories.

The data at present available are insufficient to enable any conclusions to be drawn as to possible relationships between wastage and hours of labor.

Capt. Greenwood thus summarizes his general conclusions:

(i) It has been proved that the magnitude of the wastage amongst women workers in munition factories is considerable and that there is much discontinuity of employment even in the best-organized factories which must prejudicially affect output.

(ii) It has been shown that much of this wastage is inexplicable, or at least unexplained. The greatest proportion of the losses is unaccounted for. Of a total number of about 11,000 women who left, about 6,700 gave no reason for doing so, or an insufficient one. This is not a satisfactory state of affairs. There is no panacea for the disease, but there is one promising remedy. This is organized welfare work. It has already been suggested that in factories where there are organized welfare departments the wastage unaccounted for is below the average. While no absolute connection can be proved, the importance of welfare work is certainly suggested. Intelligent and sympathetic following up of absentees is likely to produce good results. It is suggested that wherever any factory loses more than 20 per cent of its entrants within three months a special inquiry into the reasons should be instituted. In some cases, of course, sufficient reasons—such as housing difficulties—may exist.

(iii) It appears that the general strain of factory life in itself was not worse borne by older than by younger women, even in factories engaged on chemical work which has often been associated with specific danger to the health of certain individuals. On the other hand, when the general strain of factory conditions is combined with more than a very moderate degree of actual physical work, women over 23 come less well through the ordeal. The difference is sufficiently distinct to make an attempt at systematic recruiting of the older women for the physically lighter labor and the younger women for the more strenuous tasks worthy of practical attention, the reason being that the older women—of whom a larger proportion are married and have young children than of the girls under 23—have not sufficient reserves of energy to meet the double demand made upon them.

APPENDIX E.—CATERING EQUIPMENT.

The following is a list of articles required. The number to be ordered will depend on the size of the canteen and the accommodation for which it is to provide, but the undermentioned basis of calculation may be of assistance to determine the original equipment of a canteen: Knives, forks, spoons (dessert and tea), cups and saucers, one for each person seated, allowing for a few dozens over; plates, double and seating accommodation. The same size of plates should be used for meat and pudding. Tumblers, egg cups, soup bowls, and small plates, half the seating capacity; jugs, sugar basins, mustard pots, and salt cellars, tablespoons, about one-tenth of the seating capacity.

The cost of equipment, etc., is steadily increasing, and it is, therefore, manifestly impossible to give any fixed figures. Speaking generally, however, the complete equipment should cost approximately:

- 47a. [\$11.44] per head for 100 persons seated.
- 32a. [\$7.79] per head for 500 persons seated.
- 30s. [\$7.30] per head for 1,000 persons seated.

CATERING OFFICE EQUIPMENT.

Chairs.	Desk.	Safe for money.
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DINING ROOM.

Cash till.	Chairs or benches. ²	Scraper mat at door.
Covering for tables and counter. ³	Curtains or blinds for windows (dark).	Tables. ⁴
		Waste-paper baskets. ⁴

CUTLERY.

Carving knives and forks.	Spoons (mustard).	Spoons (tea), 5 inches in length.
Forks, 7 inches in length. ⁵	Spoons (salt).	
Knives, 9 inches in length. ⁵	Spoons (table), 8 inches in length.	Steels.
Spoons (dessert), 7 inches in length.		

¹ In some canteens there is no covering for the tables and counters, and if these are made of good quality wood and kept scrubbed no covering is required. On the other hand some kind of covering imparts a better furnished appearance. The covering generally used is linoleum or American cloth. A new form of rubber covering has also lately been placed on the market.

² Chairs are recommended in preference to forms, as they are more comfortable for the customers.

³ The arrangement of the tables should provide for easy access to the service counter.

⁴ Waste-paper baskets, preferably wire ones, should be placed about the dining room; they have a considerable effect on the general tidiness of the room. Trolleys can be used for the collection of dirty crockery, etc.

⁵ Only one size of knife and fork is necessary, preferably with solid metal handles. Rustless steel knife blades, although more expensive save a considerable amount of labor in cleaning.

GLASS AND CROCKERY.

Basin (sugar).	Meat dishes (assorted sizes).	Salt pourers.
Bowls (soup), liquid capacity 1 pint.	Mustards.	Teapots. ²
Cups and saucers, liquid capacity, 8 ounces.	Peppers.	Tumblers, liquid capacity, $\frac{1}{2}$ pint.
Egg cups.	Plates (meats and puddings), $9\frac{1}{2}$ inches, one size only. ¹	Vinegars.
Jugs (milk).	Plates (small), 7 inches.	
Jugs (water).		

LINEN.

Dusters.	Kitchen rubbers.	Roller towels and roller.
Glass cloths.	Muslin strainers.	Swabs.
Hand towels (small).		

COOKING APPARATUS.³

For 100 persons:	For 250 persons:	For 500 persons:
One double-oven range for roasting and baking, with hot plate for boiling, frying, etc.	One 3-oven range for roasting and baking, with hot plate for boiling, frying, etc.	One large roasting oven.
One hot closet and warming cupboard, about 48 inches long by 30 inches high by 24 inches deep.	One hot closet and warming cupboard, about 72 inches long by 30 inches high by 30 inches deep.	One 3-oven range.
One 15-gallon boiler for vegetables, etc.	One potato and pudding steamer.	Hot closets and warming cupboards to form part of each serving counter.
One 15-gallon boiler for tea water, etc.	One 20-gallon boiler for vegetables.	Carving table with hot closet under for warming plates.
Apparatus for supplying hot water through the sink taps.	One 25-gallon boiler for tea water.	One potato steamer.
	One 10-gallon boiler for soup.	One pudding steamer.
	Apparatus for supplying hot water through the sink taps.	One 25-gallon boiler for vegetables.
		Two 25-gallon boilers for tea water.
		One 20-gallon boiler for soup.
		Apparatus for supplying hot water through the sink taps.

KITCHEN, SCULLERY, AND LARDEE REQUISITES, ETC.

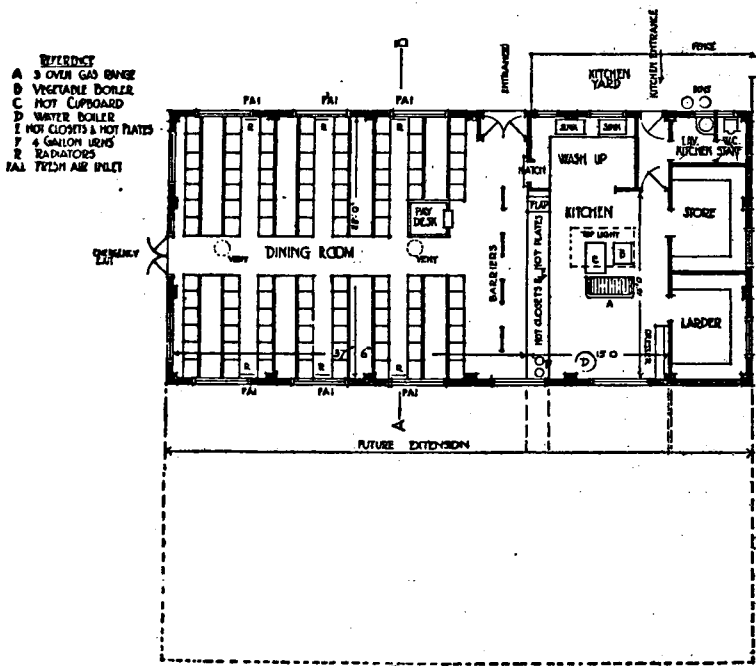
Basins (puddings).	Bread-cutting machine.	Meat safe.
Basins (pudding, one person).	Broom (bass).	Milk measurer.
Bins (flour).	Brushes (scrubbing).	Mincing machine.
Bins (sanitary).	Brushes (sweeping).	Oval pots with covers.
Bowls (enameled).	Bucket.	Pastry board and rolling pin.
Bread knife.	Canister (tea).	Pie dishes (enameled).
	Meat hooks.	

¹ The provision of flat topped covers for the plates of food is suggested, as these keep the food hot and render them more easily stored in the hot closets.

² Individual pots of tea for each customer are not altogether desirable, as it has the effect of slowing down the service. In some canteens an increased charge for a teapot service is made.

³ Cooking by gas, coal, or steam is most in favor, and to an increasing extent electricity. A good plan is to furnish the different cooking apparatus manufacturers with particulars of the number to be catered for, leaving them to submit a scheme for the apparatus. Some provision has generally to be made for those of the workers who require warming up facilities for food brought by themselves.

DESIGN FOR CANTEN ACCOMMODATION FOR 100 DINERS



PLAN

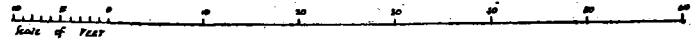
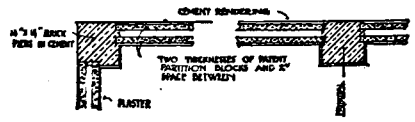
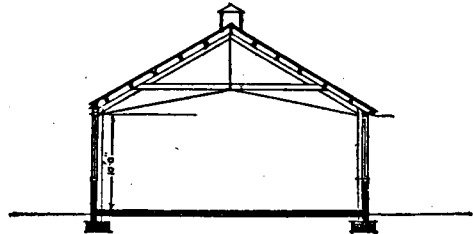


Plate covers (tin). ¹	Graters.	Scoop.
Potato-peeling machine. ²	Gravy strainer and ladle.	Sieves (wire).
Saucepans.	Jugs (enameled).	Spoons (iron).
Saucepans (milk).	Kettles.	Spoons (wooden).
Saw (butchers').	Knife boxes.	Step ladder.
Chairs (kitchen).	Knife-cleaning machine. ³	Table (rigid).
Chopper (meat).	Knives (cooks').	Teapots (enameled).
Chopping board.	Lemon squeezers.	Tins (baking).
Corkscrews.	Scales and weights. ⁴	Tin opener.
Colanders.	Sinks (not less than 3 feet by 2 feet by 1 foot). ⁵	Tools (mixed).
Dish covers (wire).	Sink baskets.	Towel rack.
Dustpan and brushes.	Sink brushes.	Trays (japanned or wood).
Fish kettle.		Urns. ⁶
Flour dredger.		
Frying pan.		

¹ The provision of flat topped covers for the plates of food is suggested, as these keep the food hot and render them more easily stored in the hot closets.

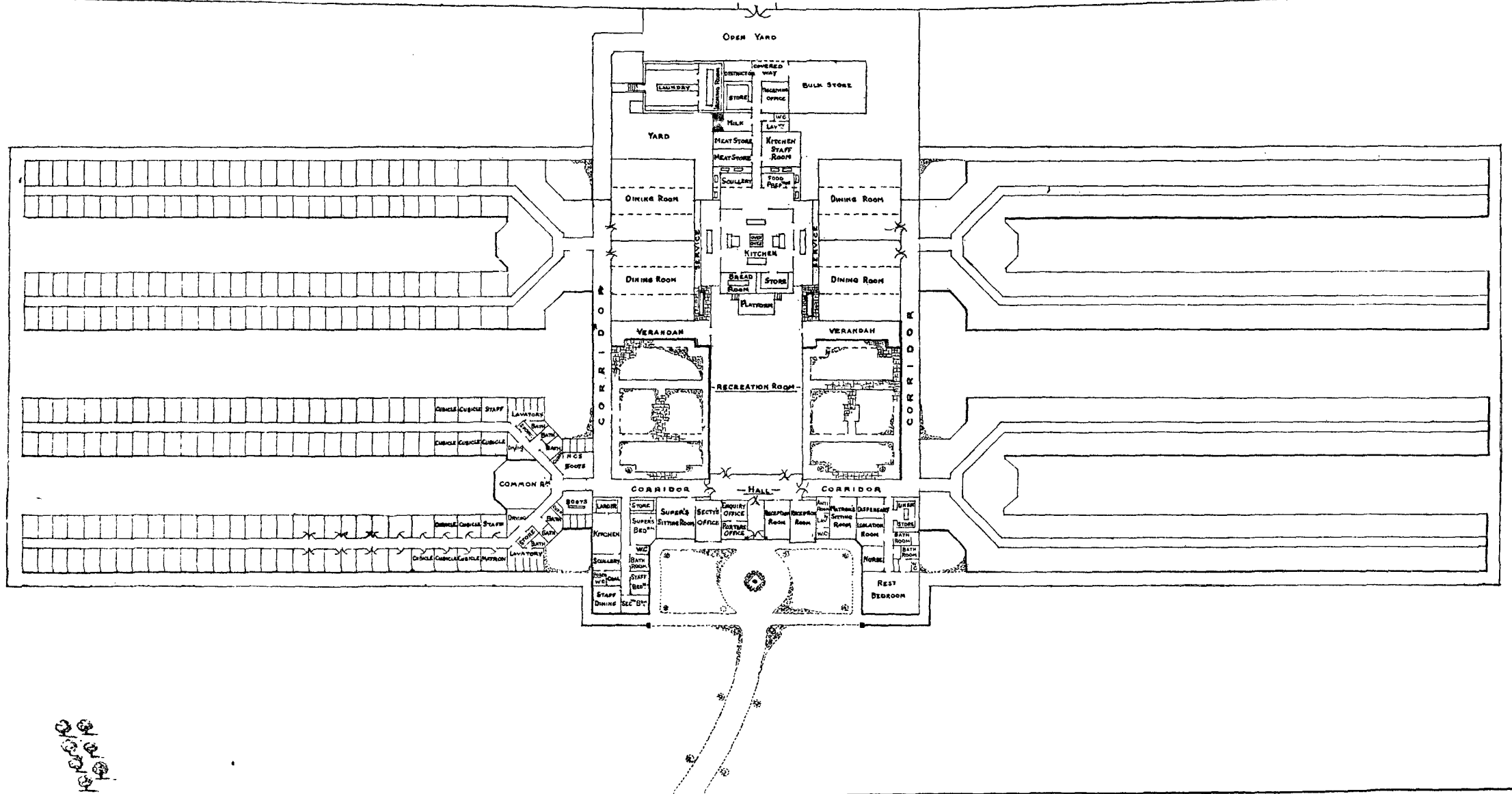
² In a large canteen, say one seating over 500 persons, it may be advisable to have these articles power driven.

³ Where large quantities of food have to be purchased, a platform scales is required, as well as a small cook's scales.

⁴ Teak sinks are recommended for washing up crockery, and glazed fire clay sinks for vegetable preparation, etc. There should always be a separate sink for the cook's own use. Power driven washing up machines are suggested where a large trade is done.

⁵ It is essential that the tea served in a canteen should be as excellent as possible, and great care should be taken to insure absolute cleanliness in the urn or other article in which it is contained. Urns with earthenware linings are strongly recommended.

TYPICAL HOSTEL FOR 500 GIRLS



APPENDIX F.—HOSTEL PLANNING AND EQUIPMENT.

PLANNING.

Where a hostel is housed in an existing building little scope for planning exists. The following suggestions are accordingly concerned only with temporary hostels built especially for the purpose. Such hostels are generally built of materials such as wood, cemented coke breeze blocks, or concrete slabs.

Size.—For efficient management the numbers to be accommodated should not exceed 500. If provision is required for larger numbers, two or more separate hostels should preferably be provided.

Plan.—The attached plan (facing this page), which has been prepared by the building construction department of the Ministry of Munitions, suggests how a hostel for 400 girls may be arranged. The administrative block should be centrally situated. The sleeping blocks should be entered from the central block and consist of corridors with cubicles opening out of them on either side.

Single-story buildings are usual, but an upper story in the sleeping blocks has been found satisfactory and economical.

Administrative block.—The entrance to the hostel should be through this block; the gate matron's lodge should be situated close to the entrance. The block should include the canteen, recreation rooms, staff dining recreation rooms, waiting room for tenants' friends, private rooms for the superintendent and her assistant and their business offices. Care should be taken to separate the superintendent's quarters, offices, etc., from the main common rooms in such a manner as to secure a reasonable measure of quiet.

Hospital block.—Every large hostel should have a small ward, isolation room, surgery, and two private rooms for the hospital matron.

Recreation rooms.—The recreation rooms should be ample in space for the number of tenants. For the dimensions in proportion to the number of tenants see details in Table I. In a large hostel the recreation rooms should consist of—

(1) A large hall for dancing, concerts, social evenings, etc., with a stage and dressing room.

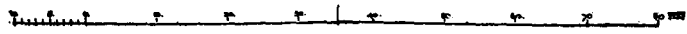
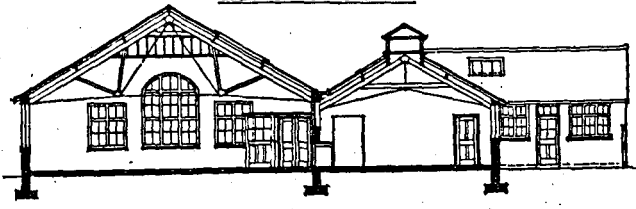
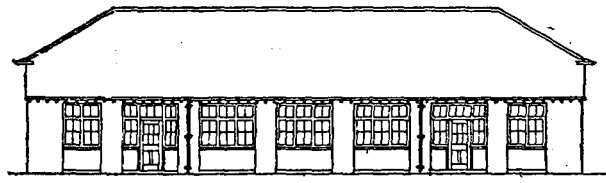
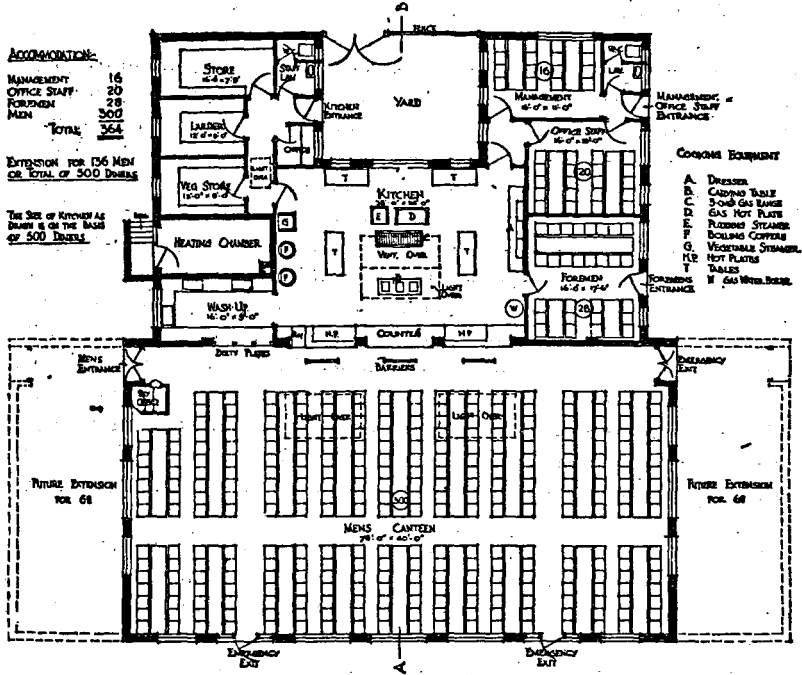
(2) A quiet room where tenants can read and write and see friends undisturbed.

(3) A small common room attached to each sleeping block.

(4) A staff common room (servants' hall) where the staff can rest apart from the other tenants of the hostel.

(5) A matrons' common room, not attached to the sleeping blocks, where they can be undisturbed by the tenants.

DESIGN FOR CANTEN
 ACCOMMODATION FOR 364 DINERS
 WITH EXTENSION TO 500 DINERS



Dining room and kitchen.—The kitchen and sculleries should be adjacent to the dining room and divided from the dining room by a counter which, in the case of the scullery, should be fitted with hatchways through which the dirty plates are passed.

It is desirable in large hostels that two or more dining rooms should be provided rather than that one dining room should accommodate all the tenants, the unit for a dining room being preferably 100. The dining rooms should be divided by folding doors, which can be thrown open for entertainments.

Sleeping accommodation.—Single cubicles are preferred by the tenants, though a certain number of double cubicles are useful. The cubic area of a cubicle should not be less than 400 cubic feet; 6 feet by 9 feet by 8 feet forms a satisfactory cubicle. Cubicles should be partitioned¹ from each other right up to the roof. The windows may be either sliding or casement. A space of 6 inches should be left between the bottom of the door and the floor to allow for ventilation.

Drying room and laundry.—There should be a drying room attached to each sleeping corridor for airing clothes and for drying wet outdoor clothes. This room should be fitted with hot pipes and hooks. A laundry where tenants can do their own washing is also essential.

Heating.—Central heating should be installed in all temporary hostels, radiators should be fitted for the living rooms, and a hot-water pipe of 3-inch bore should be passed through each cubicle about a foot from the floor.

Lighting.—Electricity is the best form of lighting for a temporary hostel.

TABLE I.—APPROXIMATE SUPERFICIAL AREA OF FLOOR SPACE PER PERSON FOR THE VARIOUS ROOMS IN CONNECTION WITH THE ERECTION OF HOSTELS FOR GIRLS.

Number of girls.	Dining hall ² (superficial feet).	Kitchen (superficial feet).	Scullery and food preparation (superficial feet).	Stores, larder, vegetable, milk, and meat stores (superficial feet).	Recreation room.
30.....	10	8	4	4	Up to 50 girls allow 8 feet superficial for each; 50 to 100 girls allow 5 feet superficial for each; 100 and above 4 feet superficial for each; stage, seats and class rooms to be added extra.
50.....	8	6	3	3	
100.....	8	4	2	2	
250.....	8	2½	1½	1½	
400.....	8	2	1-1	1½	
800.....	8	1½	1	1½	
1,000.....	8	1	1	1-1	

¹ Cement slabs have been found preferable to matchboarding owing to (1) the liability of wood to harbor vermin, (2) the scarcity of wood in war time, (3) the security from fire.

² The figures in this column allow 20 inches space for each girl at table, tables 21 inches wide, about 4 feet space between tables, gangways 4 feet wide, and ample space in front of counter.

N. B.—The above figures do not include provision for the staff dining room, sitting room, office, and lavatory, or for the boiler house.

TABLE II.

[The preceding table would permit of the following space in a hostel for 400.]

Room.	Superficial feet per person.	Total area or room.	Dimensions of rooms.
Dining hall.....	<i>Feet.</i> 8	<i>Feet.</i> 3,200	100 by 32 feet.
Kitchen.....	2	800	40 by 20 feet.
Scutlery and food preparation.....	2-1	350-400	Say 2 rooms each 20 by 10 feet, or 1 room 15 by 15 feet, and 1 room 15 by 10 feet.
Stores, larder, vegetable, milk and meat stores.	1½	450	These would be divided up as best suit plan.
Recreation room.....	4	1,600	Say 50 by 32 feet or 55 by 30 feet. Anteroom; extra.

EQUIPMENT.

Furniture for recreation rooms.—The recreation rooms should be furnished with strong easy chairs, sofas, or settees, writing tables in the quiet rooms, and in the large recreation room there should be a piano and a stage with a small dressing room attached. It is difficult to give the number of sofas and chairs which should be supplied in relation to the number of tenants housed, as all the tenants seldom use the common room at one time owing to the different shifts worked. It will, however, probably be sufficient if the easy chairs are provided at a ratio of about 1 to 12 of the tenants housed.

Cubicle furniture.—Iron bed, size 6 foot 6 inches by 2 feet 6 inches, spring mattress, cleaned wool overlays, two sheets, and four blankets. One small chest of drawers or large locker, one looking-glass.

Washing and sanitary accommodation.—Basin in iron frame in cubicle or separate washing cubicles in the lavatories. The former are preferable from the point of view of the tenant, but they entail a large amount of extra work upon the staff. One lavatory basin should be provided for every 10 tenants, if separated; one for every 15 should suffice if for common use. One bath should be provided for every 20 tenants. There should be one water-closet for every 12 tenants.

A schedule of equipment is given at the end of this appendix.

FOOD IN HOSTELS.

Amount.—The primary consideration in catering for munition hostels is that the food supplied should be sufficient to provide the energy necessary for the work which the residents have to do.

Memorandum No. 19 gives 3,500 to 4,000 calories¹ per day to a man employed on medium work, an average adult woman worker requires rather less (0.8 or 0.9) than a man. Sample diets are given showing how the desired amount of calories can be obtained and the

¹The energy expended in mechanical work (1 calorie) is equivalent to the energy expended in lifting 1 kilogram through 425.4 meters. For the calorie values of individual foodstuffs, see a report drawn up by a committee of the Royal Society and published by H. M. Stationery Office under the title of *The Food Supply of the United Kingdom*, Cd. 8421. Price, 4d.

proportion of the three different classes of foodstuffs (protein, fat, carbohydrates) can best be distributed.

The following amounts of the three main foods given in hostels (before the regulations of the ministry of food were in force) have been tested and found satisfactory:

Women:

Meat.....	3½ ounces to 8 ounces per head per day.
Bread.....	3 pounds to 6½ pounds per head per week.
Margarine.....	4 ounces to 8½ ounces per head per week.

Men:

Meat.....	6½ ounces to 12 ounces per head per day.
Bread.....	6 pounds to 7 pounds per head per week.
Margarine.....	4½ ounces to 8½ ounces per head per week.

Variety.—Variety affects efficiency both physically and psychologically. One of the secrets of successful hostel management lies in preserving the tenants' interest in their meals. It is a common experience in hostels that the nerve strain of heavy munition work on operatives produces a disposition to be difficult about food, and in hostels where there is little discontent it is generally found that variety of food is studied.

Meals provided.—The number of meals given in the hostels varies from two to four. Four are given when the works are near enough for the residents to return home during the intervals. The types of meals provided are as follows:

Breakfast: Porridge (in some parts of the country); a meat dish, e. g., fish, bacon, sausages; tea, bread and margarine, jam.

Dinner: Meat, two vegetables, pudding, or stewed fruit. A cup of tea is sometimes given. In some hostels, mostly in poorer ones, meatless days are observed.

Tea: Bread and margarine, jam, cake, tea.

Supper: Cold meat or a made-up dish, or a milk pudding, bread and cheese, tea, coffee, or cocoa. In men's hostels a hot meat supper is often provided.

Food provided.—It is important to provide the staple dishes of the district, because the digestive organs find it easier to digest food to which they are accustomed. Among such dishes the following have been noted. In the southern Midlands and the south the kind of food which is popular is heavier than that which is customary in the north. More meat is eaten on the whole, and suet puddings, jam rolls, etc., are included more frequently. In the north of England and Scotland more porridge is eaten. In many Scottish hostels no meat dish is provided at breakfast in addition to porridge. Fried fish and chips are favored by many Yorkshire and Scottish workers in preference to meat. Meat turnovers and shepherd's pie, broth, and boiled beef are popular Scottish dishes also. In general, meat is not considered so indispensable by Scottish working people as it is in England. This applies especially to women.

For tea and breakfast, oatcake and barley-meal scones are eaten in the north. Potato dishes have been tried with considerable success. Maize has been found to be unpopular and indigestible. Suet puddings and rolls are thought by the workers to be sustaining. Meat pasties are also popular.

Provision of lunches to be taken to the factory is a difficult matter. Carried food is found to be unsatisfactory for two reasons—

- (1) It becomes dry and unpalatable if in the form of sandwiches.
- (2) If it is in a made-up form its digestibility is certain to suffer in the process of reheating.

It is not, however, possible to abolish the system entirely. It is much cheaper for girls to pay an inclusive fee and take lunch from the hostel. There is a strong prejudice, especially in the north, in favor of bringing food to work rather than buying it at the canteen. In many small works there is no canteen, only a mess room. The following lunch, provided at a women's hostel where catering is satisfactory, gives an idea of what is necessary: One slice of meat roll (made with very little meat and strongly flavored with onion), one square of jam tart, two rounds of bread and cheese, one-half round of bread and butter, dry tea or cocoa.

In one women's lodging house the lodgers feed themselves on 1s. 3d. (30 cents) per day. For this they are only able to have meat twice a week. Typical meals are as follows:

Breakfast: Bacon or kipper, tea, bread, and margarine.

Dinner: Fried fish, tea, bread, and margarine.

Tea: Bread and margarine, and tea.

On the days when meat is bought the women have only a cup of tea in the morning, and combine breakfast and dinner in the meat meal.

The feeding of men in navy huts is receiving much attention now. One managing contractor who had had experience of housing navvies in various parts of Scotland has decided to abolish the mess room altogether and to have the canteen only, so that he may have the feeding of the men under his own control. In this connection comfort in the canteen is of importance. Navvies are notoriously restless, but men who are comfortably fed are more likely to stay on the work, and managers are beginning to try the effect of more attractive surroundings.

Methods of buying.—Skillful buying combined with the most economical use of foodstuffs is the secret of successful catering.

Those hostels which are attached to a large factory have a great advantage in this respect in that the buying is done centrally and the hostel reaps the benefit of wholesale prices, and in some cases will avoid competition with other hostels. Large hostels have a similar advantage over small ones. There is, however, great scope for a matron's ability in retail buying, because prices often vary in differ-

ent parts of the same town, although seeking out the best and cheapest shops is a severe tax on her time and strength. The difficulty and cost of transport has to be reckoned with if supplies are brought from a distance. Good storage accommodation is essential if buying is done on a large scale. Methods of buying are, of course, materially affected by rationing or other war-time emergency conditions.

The prevention of waste.—Waste on the part of the tenant can be prevented in two ways—

(1) By making dishes so palatable that very little is left on the plates at meals.

(2) By using up all scraps.

Variety and attractiveness are the most difficult qualities to insure in catering. Monotony in menus leads to food being left. Twice-cooked food soon becomes unpopular if served too often, and the traditional British method of cooking vegetables is unattractive in the extreme.

The second method, viz, using all scraps of food left, is carried out by most matrons according to their ability. In some places, if the tenants know what is being done in this way, they are apt to object on hygienic grounds. It was found in the case of two hostels under the same management that in one the tenants thought it unwholesome to use bones taken from the plates for the stock pot, while in the other hostel the tenants quite approved of it.

As to the ways in which saving is effected, it is found that educated cooks are the most enlightened and expert. All bones and scraps from plates, except starchy scraps and green vegetables, can be used in the stock pot. Waste bread can be used without danger if it is baked and grated. It can be mixed with flour for puddings, etc. In connection with methods of cooking it has been established by experiments made in King's College that slow cooking of meat in a gas oven effects a saving of 9 pounds in every hundredweight. Experiments in the methods of cooking dried pulses have shown the economy of using the water in which these are cooked as a basis for stock of soup.

A la carte catering, though in other respects more difficult, may be a method of avoiding waste in so far as workers can choose what they wish to eat. This can not be carried out in small hostels. It is also open to objection on the ground that many girls can not be relied on to select a suitable and nourishing diet.

MANAGEMENT.

The superintendent is the most important factor in hostel management. A hostel superintendent should possess a tactful, sympathetic, and understanding personality.

In *women's hostels* she should be an educated woman, and to be really successful she must, as far as possible, know her tenants personally and take an interest in the social side of their life. To manage a colony composed of people differing widely as to age and social standing is not easy. Nor are the tenants the only persons to be considered, for the management of the staff often requires considerable skill, especially in large hostels.

The value of having educated women as canteen workers is well known. Where they have been employed it has been observed that not only has the waiting been more efficient and the food better served but there has been a marked improvement in the tone and general behavior of the girls.

Voluntary workers to organize recreations and amusements in the hostels have been found to be a great asset. They bring an outside element into the hostel which is much needed. In some instances the hostel staff has been drawn entirely from voluntary workers, but this has not proved to be altogether satisfactory.

Tenants' committees.—The committee is elected by the tenants from among themselves and, in cooperation with the superintendent, makes and enforces all rules, hears complaints, and is generally responsible for the behavior of the tenants. It is noticeable that in hostels where these committees are working there is a feeling of esprit de corps among the girls to an extent unknown in other hostels.

Rules in hostels.—It has been found in hostels that the minimum amount of rules produces the best results in behavior. Where there are few restrictions the girls feel that they are being trusted, and this is a fact which they appreciate. In no instance has it been found that the girls have taken advantage of the greater amount of freedom.

Recreation in hostels is an important factor in making for happiness and good feeling among the tenants. Hostels are often situated in isolated areas where outside recreations and entertainments are beyond the reach of the tenants. At many hostels, therefore, regular schemes for outdoor and indoor recreation have been organized.

Women patrols are doing a valuable work at some of the large hostels, but their employment must be considered as an emergency precaution rather than a part of an ideal form of management.

Men's hostels.—Good male warders are necessary for all men's hostels, and there should be one on duty all night as well as in the daytime. In every possible case tenants committees should be formed and the hostels run as residential clubs. The household work of the general run of the men's hostels is best done by a staff of maids under a competent matron, if suitable quarters can be arranged. A good standard as regards cleanliness and minor comforts has been secured

in some hostels for skilled men by the appointment of an educated woman to supervise the household work.

Staff.—The following are suggested as the average proportions of staff to tenants required in munition hostels: Housing 100 and over, proportion of staff to tenants, 1 to 10; housing between 50 and 100, proportion of staff to tenants, 1 to 8; housing under 50, proportion of staff to tenants, 1 to 6.

The following are the usual rates of pay at women's hostels:

Superintendents, £200 to £250 [\$973.30 to \$1,216.63] per annum all found.
 Assistant superintendents, 20s. to £3 1s. 6d. [\$4.87 to \$14.96] per week all found.
 Secretaries, 25s. to 30s. [\$6.08 to \$7.30] per week all found.
 Head matrons, £2 10s. to £4 4s. [\$12.17 to \$20.44] per week all found.
 Nurse matrons, 35s. to 40s. [\$8.52 to \$9.73] per week all found.
 Matrons, 12s. 6d. to 30s. [\$3.04 to \$7.30] per week all found.
 Games mistress, 25s. to £2 5s. 2d. [\$6.08 to \$10.99] per week all found.
 Canteen superintendent, £3 17s. [\$15.33] all found.
 Canteen supervisors, 20s. to £2 10s. [\$4.87 to \$12.17] per week all found.
 Storekeepers, 25s. to 35s. [\$6.08 to \$8.52] per week all found.
 Cooks, 15s. to 35s. [\$3.65 to \$8.52] per week all found.
 Maids, 12s. to 16s. [\$2.92 to \$3.65] per week all found.

The following are the usual rates of pay in men's hostels, which are generally less well staffed than women's hostels:

Superintendents¹ and head matrons, £100 to £200 [\$486.65 to \$973.30] per annum all found.
 Assistant matrons, 21s. to 25s. [\$5.11 to \$6.08] per week all found.
 Cooks, 20s. [\$4.87] per week.
 Waitresses and maids, 12s. to 15s. [\$2.92 to \$3.65], except in one group of hostels where the head maid gets 19s. [\$4.62] per week.

RECREATION FOR HOSTELS.

Classes.—Educational schemes are being much discussed at present in connection with hostels, chiefly because hostels seem to be good centers for developing classes. The following considerations show, however, that great caution must be used in starting schemes in hostels:

(1) The hostels are, or should be, homes for the time being. Residence is entirely voluntary and therefore rules and restrictions should be the minimum necessary. Educational schemes imposed from outside may tend to destroy this home feeling.

(2) Most munition work is heavy, and the shifts are long. Tenants have not much energy at the end of the day to devote to serious study.

Classes, however, are becoming more and more popular in hostels. The best way to develop them is as a rule to ascertain from a committee of tenants what is wanted, and then to propose a scheme. The

¹ At our large hostels the superintendent's salary averages £327 10s.

large hostels are obviously the most interesting fields for development. The Y. M. C. A. have set on foot a scheme for giving courses of lectures at hostels and canteens. Eight of the large hostels have taken advantage of this scheme. The tenants have chosen the subjects of the lectures from a syllabus issued by the Y. M. C. A., the most popular being descriptions of the various fronts illustrated with lantern slides. The object of lectures should be not so much to increase knowledge of particular subjects as to increase breadth of view, and to provide distraction from the strain of long and monotonous work.

In the case of hostels which belong to societies such as the Y. M. C. A. and the G. F. S., there is often an institute out of which the hostel originally grew, and non-resident members attend lectures and classes there. In the past, sewing, dressmaking, singing, and Bible classes were chiefly carried on. Since the war, lectures on hygiene, sick nursing, and first-aid, dancing classes, and literature have become more popular. In one hostel, housing girls from 16 years of age, the old-fashioned Scottish plan is followed of having the schoolmaster twice a week at the hostel to teach arithmetic, literature, and singing. In some of the small North Country hostels, the matrons have domestic circles for sewing, reading, etc.

Libraries.—There is great demand for libraries of modern books in hostels. There are libraries which have existed for many years in the institutes of various societies, but some of them would be improved by the addition of new books. A certain sum has just been set aside by the welfare and health section of the Ministry of Munitions out of which small grants will be made for books and pictures in hostels. These books should be chosen by the residents themselves and made the nucleus of a library to be formed gradually by subscription. Newspapers and magazines should be taken in. In one Government hostel the public library sends books and changes them periodically from lists selected by the girls. This is a good plan, but a library which is subscribed for is more valued.

Games.—Games are much easier to provide in large than in small hostels. In one or two hostels there is a trained games mistress, and hockey and football are played in winter, lawn tennis in summer. In small hostels there is rarely any ground available. Where there is sufficient space a tennis court or Badminton court to which men friends can be invited may be provided.

Organized games are not always popular, chiefly because the girls have not played them at school. Where quite young girls are housed hockey, football, etc., are more likely to succeed. Organized games are being tried in factories and hostels, but in many cases the hours of work prevent workers from taking advantage of them. In one hostel drills are held by the woman police inspector and are well

attended. In the case of small hostels matrons may be able to encourage outdoor recreation by advising girls to join their factory athletic clubs, local clubs, etc.

Gardening.—Grants have been made for gardening tools and seeds from the fund which the Maharajah Scindia has given to the Ministry of Munitions. The results have been very satisfactory. The girls have taken up gardening with great zest, and the waste ground between the blocks of cubicles has yielded good crops of vegetables.

HOSTEL FINANCE.

Cost of building a temporary hostel of wood, concrete blocks, or other temporary material necessarily varies with the size, local conditions, and changes in cost of labor and materials. It may, however, be roughly estimated at 7d. [14.2 cents] per cubic foot for structure only, or at from £40 [\$194.66] per head for a small hostel to £20 [\$97.33] per head for a large one. This figure should cover the requisite dining and recreation rooms but is exclusive of drainage, fencing, paving, and road making.

Cost of furniture and equipment may be put at from £17 10s. to £20 [\$5.16 to \$97.33] a head in adapted hostels, including kitchen equipment. In large temporary hostels the cost is only about £3 to £10 [\$38.93 to \$48.67], exclusive of kitchen equipment.

Cost of maintenance.—The cost of catering to the management may be estimated on the basis of the prices prevailing in November, 1917, at:

Number of men provided for:	Cost.		Number of women provided for:	Cost.	
	s.	d.		s.	d.
50	15	10 (\$3.85)	50	13	9 (\$3.35)
100	14	6 (\$3.53)	100	13	2 (\$3.20)
300	13	6 (\$3.28)	300	12	7 (\$3.06)
500	12	6 (\$3.04)	500	11	3 (\$2.74)
1,000	12	0 (\$2.92)	1,000	10	8 (\$2.60)

Other expenses of maintenance (e. g., salaries, rent, rates, lighting, heating, etc.) may be estimated at from 5s. to 7s. [\$1.22 to \$1.70] per head per week.

Hostel charges.—The above figures suggest that in order that a hostel may be self-supporting it is necessary that a charge of from 21s. to 17s. [\$5.11 to \$4.14] a week should be made to men, and from 19s. to 17s. [\$4.62 to \$4.14] to women. Admittedly in theory hostels should be self-supporting, but in practice there are grave difficulties in the way of doing so. It would involve in general hostel charges being higher than those for lodgings. Many workers live in hostels because there is no other decent accommodation available, and it is in their own and the national interest that they should do so; on the other hand, it is

unjust that circumstances beyond their own control should place them at a financial disadvantage, especially as they have often showed considerable patriotism in volunteering for employment in places remote from their own homes. This particular difficulty might be met by paying them higher wages, but to do so would involve fresh difficulties through their being paid at a higher rate than their fellow workers, who are able to live in lodgings or at home. Moreover, hostels vary in cost, the smaller and more popular being the more expensive. In consequence of these difficulties it has been usual for charges to be determined according rather to the circumstances of the locality than to the cost of working, and recent inquiries suggest that they tend to be fixed somewhat below rather than above the local charges. Hostels are, in fact, normally run at a loss.

Grants from the State.—Since it is in the interest of all parties to encourage the provision of hostels by voluntary bodies, grants are payable in aid of initial charges in cases where it can be shown that if these charges are paid off the hostel would be self-supporting. Under certain conditions private firms have been allowed to charge initial cost against excess profits; loans for a similar purpose can also be granted within certain limitations. In view of their special importance and their difficulties of working, clearing hostels may under certain conditions receive a maintenance grant of 6d. [12.1 cents] per person per day.

SUGGESTED SCHEDULE OF EQUIPMENT AND FURNITURE FOR A HOSTEL TO ACCOMMODATE 400 GIRLS.

[This schedule may also be taken as applicable to a skilled workmen's hostel, though not to one for navvies.]

(a) ADMINISTRATION BLOCK.

Office:	Superintendent's bedroom:
1 knee-hole writing table, 5 feet by 2 feet 9 inches	1 3-foot iron combination bedstead
1 armchair.	1 mattress.
1 writing table, 4 feet by 2 feet 3 inches.	1 canvas platform.
2 small chairs.	1 wool bolster.
1 scuttle and shovel.	1 feather pillow.
1 safe.	4 sheets.
2 cupboards, 3 feet.	3 pillow slips.
	3 blankets.
	2 counterpanes.
Staff room:	1 down quilt.
1 rug, 7 feet by 5 feet.	1 dressing chest.
1 dining table.	1 washstand.
1 sideboard.	1 toilet set.
6 small chairs.	1 chair.
2 elbow chairs.	1 water bottle and tumbler.
2 cupboards, 3 feet.	

- Superintendent's bedroom—Concluded.**
 1 bedside rug, 4 feet 6 inches by 2 feet 3 inches.
 1 large rug.
 1 coal scuttle and fire irons.
- Superintendent's bathroom:**
 1 chair.
 1 toilet fixture.
 1 hanging mirror.
- Superintendent's sitting room:**
 1 carpet.
 1 table with drawer, 4 feet 6 inches by 2 feet 6 inches.
 1 circular table, 3 feet.
 1 table cover.
 4 small chairs.
 1 armchair.
 1 easy chair.
 1 curb fender.
 1 coal caldron.
 1 fire set.
- Staff kitchen:**
 1 kitchen table, 5 feet by 3 feet, and 1 drawer.
 3 Windsor chairs.
 1 hearth rug.
 1 pair house steps.
 1 clothes horse.
- Kitchen utensils, hardware, cutlery, crockery, table linen, towels, etc., for staff:**
 1 dinner service for six persons.
 1 tea service for six persons.
 12 meat plates.
 12 soup plates.
 12 tea plates.
 2 meat dishes.
 12 large cups and saucers.
 12 small cups and saucers.
 12 egg cups.
 12 tumblers.
 3 China cruets.
 6 milk jugs (assorted).
 1 1-quart milk jug.
 1 1-pint milk jug.
 3 sugar basins.
 2 slop basins.
 2 jam dishes and spoons.
 2 glass water jugs.
 2 enameled pails.
 2 12-inch enameled pie dishes.
 1 9-inch enameled colander.
 2 4-pint milk cans.
- Kitchen utensils, etc.—Continued**
 1 1/2-quart graded milk measure.
 3 trays (assorted).
 1 6-inch enameled ladle.
 2 12-inch enameled basins.
 6 7-pound canisters.
 1 2-pound tea canister.
 1 bread pan.
 1 2-quart teapot.
 1 1-quart teapot.
 1 1-quart coffee pot.
 2 12-inch fry pans.
 3 saucepans.
 1 4-gallon saucepan.
 3 galvanized pails.
 1 slop pail.
 15 large knives and forks.
 15 small knives and forks.
 15 dessert spoons.
 15 tablespoons.
 15 teaspoons.
 15 egg spoons.
 3 salt spoons.
 3 mustard spoons.
 2 carving knives and forks.
 1 steel.
 2 bread knives.
 1 egg whisk.
 1 egg slice.
 1 tin opener.
 1 wooden mixing spoon.
 1 iron mixing spoon.
 1 potato masher.
 1 cook's fork.
 1 flour dredger.
 1 sink basin.
 2 wire dish covers.
 1 apple cover.
 1 coal scuttle.
 1 shovel.
 1 poker.
 1 kitchen fender.
 1 flue brush.
 2 flatirons.
 1 iron stand.
 1 ironing blanket.
 1 ironing cloth.
 1 clothes basket.
 36 clothes pegs.
 1 2-foot 6-inch pot stick.
 1 hand wringer (18-inch roller).
 2 soft brooms.
 1 hard broom.

Kitchen utensils, etc.—Concluded.

- 2 scrub brushes.
- 1 mop.
- 2 black-lead brush sets.
- 2 dustpans.
- 2 soft brushes.
- 2 Turk's-head brushes.
- 6 tablecloths.
- 12 table napkins.
- 12 drying cloths.
- 6 glass cloths.
- 12 dusters.
- 12 sweat cloths.
- 12 house flannels.
- 4 18-inch calico pudding cloths.
- 12 bath towels.
- 24 hand towels (Huckaback).
- 24 hand towels (Turkish).
- 6 roller towels.
- roller fittings.
- 1 knife box.
- 1 knife board.
- 1 toasting fork.
- 1 mincing machine.
- 1 9-inch wire sieve.
- 1 bread board, 24 inches by 10 inches.
- 1 meat board, 24 inches by 10 inches.
- 1 bread platter.
- 1 rolling-pin.
- 1 pair spring scales (to 14 pounds).
- 1 electric torch.
- 1 lemon squeezer.
- 1 hammer.
- 2 small axes.
- 2 toilet holders.
- 1 alarm clock.
- 1 clock (without alarm).
- 4 soap holders.
- 1 screw driver.
- 1 box opener.
- 12 baths.

Maid's bedroom:

- 1 2-foot 6-inch combination iron bedstead.
- 1 wool mattress.
- 1 wool bolster.
- 1 mattress slip.
- 1 pillow.
- 4 pillow slips.
- 3 sheets.
- 3 blankets.

Maid's bedroom—Concluded.

- 1 counterpane.
- 1 combination dressing chest and washstand.
- 1 toilet set.
- 1 chair.
- 1 bedside rug.

Scullyery:

- 1 table, 4 feet by 2 feet 3 inches.
- 1 mat.

Porter:

- 1 chair.
- 1 coal scuttle.
- 1 shovel.
- 1 small table.

Linen store:

- 1 chair.
- 1 coal scuttle.
- 1 shovel.
- 2 cupboards, 3 feet.

Dispensary:

- 3 chairs.

Bath room and lavatory:

- 2 toilet fixtures.
- 1 hanging mirror.

Nurse's sitting room:

- 1 large rug.
- 2 small chairs.
- 1 easy chair.
- 1 small table (with drawer).
- 1 table.

Nurses' room:

- 1 3-foot combination iron bedstead, with bedding as before.
- 1 combination dressing chest and washstand.
- 1 toilet set.
- 1 chair.
- 1 bedside rug.
- 1 water bottle and tumbler.

Isolation room:

- 1 2-foot 6-inch iron combination bedstead.
- 1 mattress.
- 1 mattress cover.
- 1 bolster.
- 1 pillow.
- 4 pillow slips.
- 3 sheets.
- 2 blankets.
- 1 counterpane.
- 1 combination dressing chest and washstand.

Isolation room—Concluded.

- 1 toilet set.
- 1 bedpan.
- 1 chair.
- 1 bedside rug.

Sick ward:

- 5 2-foot 6-inch bedsteads, with bedding as before.
- 5 chairs.

Sick ward—Concluded.

- 5 lockers.
- 5 chambers.
- 1 bedpan.
- 1 table.
- 1 chair.
- 5 bedside rugs.
- 5 hanging mirrors.
- 1 carrying chair.

(b) SUGGESTED EQUIPMENT FOR FIVE BLOCKS OF CUBICLES, EACH BLOCK CONTAINING 60 GIRLS, 2 MAIDS, AND 1 MATRON.**Cubicles (each cubicle has a cupboard fixture:**

- 410 2-foot 6-inch iron combination bedsteads (bedding as for isolation room).
- 410 chambers.
- 410 lockers.
- 410 bedside rugs.
- 410 hanging mirrors.
- 410 enameled mugs.

5 matrons' rooms:

- 5 iron bedsteads, with bedding as before.
- 5 combination dressing chests.
- 5 toilet sets.

5 matrons' rooms—Concluded.

- 5 large rugs.
- 5 easy chairs.
- 5 water bottles and tumblers.
- 5 small tables.
- 5 common rooms:
- 30 easy chairs.
- 60 small chairs.
- 10 rugs.
- 20 circular tables (3-foot).
- 10 cupboards (3-foot).

Towels:

- 830 Turkey towels.
- 830 Huckaback towels.
- 60 roller towels.

(c) CANTEEN AND DINING HALL.

[To seat 384 persons.]

Dining hall:

- 64 trestle tables (5 feet 3 inches by 1 foot 10 inches).
- 84 chairs.

Crockery:

- 504 dinner plates.
- 504 soup plates.
- 504 pudding plates.
- 504 tea plates.
- 504 cups and saucers (breakfast).
- 200 egg cups.
- 72 sugar basins.
- 72 slop basins.
- 72 water jugs (1 quart).
- 500 tumblers.
- 72 salt dredgers.
- 72 pepper pots.
- 72 mustard pots.
- 36 vinegar bottles.

Crockery—Concluded.

- 36 teapots (two persons).
- 36 cream jugs.
- 24 meat dishes (assorted sizes).

Cutlery:

- 6 pairs carving knives and forks.
- 504 table knives.
- 504 cheese knives.
- 504 table forks.
- 504 dessert forks.
- 504 teaspoons.
- 504 dessert spoons.
- 144 tablespoons.
- 72 salt spoons.
- 72 mustard spoons.
- 4 steels.

Linens:

- 48 dusters.
- 48 glass cloths.
- 144 small towels.

Linen—Concluded.

- 36 roller towels.
- 48 kitchen rubbers.
- 20 muslin strainers.
- 36 swabs.
- 200 tablecloths (2½ yards by 1½ yards) (or American cloth to fit table tops).

Kitchen utensils:

- 20 enameled bowls.
- 30 large pudding basins.
- 12 baking tins for meat.
- 12 cake tins.
- 12 large pie dishes.
- 1 potato masher.
- 3 milk pails.
- 6 milk cans.
- 24 enameled jugs.
- 4 ladles.
- 1 bread pan.
- 6 bins for flour, etc.
- 4 strainers.
- 4 graters.
- 1 knife machine.
- 1 mincing machine.
- 1 potato-peeling machine.
- 1 bread cutter.
- 1 meat chopper.
- 1 axe.
- 6 cook's knives.
- 6 cook's forks.
- 3 tea urns.
- 3 fish kettles.
- 3 large fry pans.
- 3 small round fry pans.
- 6 oval pots and covers (3 to 6 gallons).
- 12 iron saucepans (four 4-pint, four 8-pint, two 12-pint, two 16-pint).
- 12 enameled saucepans (various sizes).
- 6 coffeepots.
- 12 enameled teapots (2 pints).
- 24 teapots (one person).
- 6 colanders.
- 3 large kettles.
- 3 hard brooms.
- 6 soft brooms.
- 6 bannister brushes.
- 6 dustpans.

Kitchen utensils—Concluded.

- 6 scrubbing brushes.
 - 6 Turk's head brushes.
 - 3 black lead brush sets.
 - 12 Jap trays.
 - 6 egg whisks.
 - 6 egg slices.
 - 2 meat-chopping boards.
 - 3 pastry boards.
 - 3 rolling-pins.
 - 12 knife boxes.
 - 4 flour dredgers.
 - 6 wire dish covers.
 - 1 weighing machine.
 - 1 set of scales and weights (to 28 pounds).
 - 6 wire sieves.
 - 200 plate covers.
 - 6 iron spoons.
 - 12 wooden spoons.
 - 1 stepladder.
 - 3 tin openers.
 - 3 corkscrews.
 - 1 hammer.
 - 2 screw drivers.
 - 1 box opener.
 - 12 slop pails and covers.
 - 6 galvanized pails.
 - 3 clothes baskets.
 - 1 clock.
 - 6 water cans.
- Staff dining room:
- 4 tables (5 feet by 2 feet 6 inches.)
 - 24 small chairs.
 - 1 cupboard (3 feet).
 - 6 easy-chairs.
 - Scuttle and fire irons.
- Canteen superintendent's room:
- 1 writing table.
 - 1 armchair.
 - 1 table with drawer.
 - 2 chairs.
- Recreation room (with annexes):
- 12 easy-chairs.
 - 75 chairs.
 - 12 tables (2 feet by 2 feet).
 - 4 cupboards (3 feet).
- For anterooms—
- 3 writing tables (5 feet by 2 feet 9 inches).

Recreation room, etc.—Concluded.**For anterooms—Concluded.**

1 table (4 feet by 2 feet 3
inches).

1 blackboard and easel.

Laundry:

1 wringer.

2 buckets (3 gallons).

20 yards ironing felt.

1 skirt board.

1 sleeve arm.

10 iron stands.

18 irons.

6 washing boards.

Laundry—Concluded.

2 laundry brushes.

2 clothes baskets.

1 large clothes horse.

4 dozen clothes pegs.

6 pot sticks.

General:

Door mats.

Scraper mats.

Dust bins.

Linoleum to floors.

Blinds to windows.

Fire extinguishers.

APPENDIX G.—MEDICAL CERTIFICATES OF INCAPACITY FOR WORK.

[Booklets of medical certificates on the lines set out below can be obtained on application to the health and welfare section of the ministry. They are intended to be used for persons employed on munitions of war who are found to be unfit to follow their present occupation. They are for factory purposes only.]

MINISTRY OF MUNITIONS FACTORY CERTIFICATE.

I hereby certify that on ----- 20th March, 1917, I examined (Name) John Smith (Sex) M (Age) 44 (Address) 21 High Street, London, who states his or her present occupation to be fitter and who, in my opinion, is rendered¹ unfit to follow that occupation through disease of:²

- (1) Respiratory tract, viz. Broncho-pneumonia
- (2) Digestive tract, viz. _____
- (3) Circulatory system, viz. _____
- (4) Central nervous system, viz. _____
- (5) Special sense organs, viz. _____
- (6) Locomotive system, viz. _____
- (7) Skin, viz. _____
- (8) Other conditions, viz. _____

Is immediate rest from work necessary Yes

Absence from work³ is likely to be necessary for longer than a week.
is not

(Signed) _____ W. Robinson

(Registered Medical Practitioner.)

(Date) 20th March, 1917

(Address) High Street, London

To be filled up by the firm:

- (1) Period of absence _____ Days
- (2) Name and address of firm _____

IMPORTANT.—This certificate must be sent to the factory the same day that it is obtained completed from the doctor.

As suggestions for filling in a diagnosis in the appropriate category, the following examples are given:

1. Respiratory tract, e. g., bronchitis, pulmonary tuberculosis, pneumonia, adenoids.
2. Digestive tract, e. g., tonsillitis, indigestion, appendicitis, diarrhea, colitis, gastric ulcer, gastric carcinoma.
3. Circulatory system, e. g., anemia, morbus cordis, angina pectoris, varicose veins.
4. Central nervous system, e. g., debility, tabes, neurasthenia.
5. Special sense organs, e. g., astigmatism, cataract, otorrhea.
6. Locomotive system, e. g., rheumatism, sciatica, lumbago, chronic arthritis.
7. Skin, e. g., scabies, industrial dermatitis.
8. Other, e. g., nephritis, measles, salpingitis, lead poisoning.

¹ The words "unfit to follow that occupation" are to be understood to include not only cases in which the patient's illness (or injury) renders him physically incapable of performing his work, but also cases in which the illness (or injury) is of such a nature that the patient's health would be seriously endangered by continuing to perform it.

² The exact diagnosis should be entered under the appropriate heading. If an exact diagnosis can not be recorded, the system of the body principally affected should be indicated by initials. See sample forms at end of the book and back of cover.

³ The words "is not" or "is" (as the case may require) to be struck out where it is possible to make this prognosis.

APPENDIX H.—POLICE, FACTORIES, ETC. (MISCELLANEOUS PROVISIONS), ACT, 1916, SECTION 7.

FACTORIES AND WORKSHOPS.

7. (1) Where it appears to the secretary of state that the conditions and circumstances of employment or the nature of the processes carried on in any factory or workshop are such as to require special provision to be made at the factory or workshop for securing the welfare of the workers or any class of workers employed therein in relation to the matters to which this section applies, he may by order require the occupier to make such reasonable provision therefor as may be specified in the order, and if the occupier fails to comply with the requirements of the order or any of them, the factory or workshop shall be deemed not to be kept in conformity with the factory and workshop act, 1901.

(2) The following shall be the matters to which this section applies:

Arrangements for preparing or heating and taking meals, the supply of drinking water, the supply of protective clothing, ambulance and first-aid arrangements, the supply and use of seats in workrooms, facilities for washing, accommodation for clothing, and arrangements for supervision of workers.

(3) Orders may—

(a) Be made for a particular factory or workshop, or for factories or workshops of any class or group or description;

(b) Be made contingent in respect of particular requirements upon application being made by a specified number or proportion of the workers concerned, and may prescribe the manner in which the views of the workers are to be ascertained;

(c) Provide for the workers concerned being associated in the management of the arrangements, accommodation, or other facilities for which provision is made, in any case where a portion of the cost is contributed by the workers; but no contribution shall be required from the workers in any factory or workshop, except for the purpose of providing additional or special benefits which, in the opinion of the secretary of state, could not reasonably be required to be provided by the employer alone, and unless two-thirds at least of the workers affected in that factory or workshop, on their views being ascertained in the prescribed manner, assent.

(4) If, in the case of any order proposed to be made for a particular factory or workshop, the occupier, or, in the case of an order for factories or workshops of a particular class or group or description, the majority of the occupiers of factories or workshops of that class or group or description, dispute the reasonableness of the requirements in the proposed order or any of them, the objection shall be referred for settlement to a referee selected in accordance with rules made under this section, but the secretary of state may so refer any objection though not made by a majority of the occupiers if he thinks desirable.

(5) Save as otherwise expressly provided in the order, the occupier of a factory or workshop shall not make any deduction from the sum contracted to be paid by him to any workman or receive any payment from any workman in respect of any provision made in pursuance of an order under this section, and, if he makes any such deduction or receives any such payment, he shall be guilty of an offense against the truck act, 1831, and shall be liable to the penalties

imposed by section 9 of that act as if the offense were an offense mentioned in that section.

(6) The secretary of state may make rules as to the time within which, and the manner in which, notice of objection to any order may be made, and as to the selection of, and the procedure before, a referee and the cost of the proceedings before a referee (including the remuneration of the referee).

(7) Any order made under this section may be revoked at any time in whole or in part by the secretary of state, without prejudice to the making of a further order.

(8) This section shall not apply to domestic factories or workshops.

(9) The secretary of state may by a special order made in accordance with the provisions of section 126 of the factory and workshop act, 1901, extend the matters to which this section applies to matters other than those mentioned in this section.

Orders under this section have been made by the Home Office in regard to—

(a) Drinking water, dated October 9, 1917 (see p. 98, on which the substance of this order is given).

(b) First aid, dated October 12, 1917. (The terms of this order are given in Appendix I, p. 133.)

(c) Manufacture of tin plates, dated October 5, 1917, dealing with the provisions of protective clothing, cloakrooms, mess rooms, and facilities for washing.

(d) Use of bichromate of potassium or sodium in tanning, dated March 22, 1918, dealing with the provision of protective clothing, first-aid appliances, cloakrooms, mess rooms, and washing facilities.

(e) Use of bichromate of potassium or sodium in dyeing, other than job dyeing, dated March 22, 1918, dealing with the provision of protective clothing, first-aid appliances, cloakrooms, mess rooms, and washing facilities.

APPENDIX I.—FIRST AID.

ORDER DATED OCTOBER 12, 1917, MADE BY THE SECRETARY OF STATE UNDER SECTION 7 (1) OF THE POLICE, FACTORIES, ETC. (MISCELLANEOUS PROVISIONS), ACT, 1916, IN REGARD TO AMBULANCE AND FIRST-AID ARRANGEMENTS AT BLAST FURNACES, COPPER MILLS, IRON MILLS, FOUNDRIES, AND METAL WORKS.

In pursuance of section 7 of the police, factories, etc. (miscellaneous provisions), act, 1916, I hereby make the following order, and direct that it shall apply to all factories in the following classes: Blast furnaces, copper mills, iron mills, foundries, metal works.

First aid.

1. In every factory to which this order applies and in which the total number of persons employed is 25 or more the occupier shall provide, in readily accessible positions, "first-aid" boxes or cupboards in the proportion of at least one to every 150 persons.

The number of "first-aid" boxes or cupboards required under this provision shall be calculated on the largest number of persons employed at any one time, and any odd number of persons less than 150 shall be reckoned as 150; provided—

(i) That an ambulance room maintained in conformity with paragraphs 6, 7, and 8 of this order may be counted as one of the "first-aid" boxes or cupboards required by this order.

(ii) That the requirement of "first-aid" boxes or cupboards shall not apply to a blast furnace if an ambulance room is provided and maintained as aforesaid.

2. Each "first-aid" box or cupboard shall contain at least—

(i) A copy of the first-aid leaflet issued by the factory department of the Home Office;

(ii) Three dozen small size sterilized dressings for injured fingers.

(iii) One dozen medium size sterilized dressings for injured hands or feet.

(iv) One dozen large size sterilized dressings for other injured parts.

(v) One bottle of eye drops.

(vi) Sterilized cotton wool.

Each "first-aid" box or cupboard shall be distinctively marked, and if newly provided after the date of this order shall be marked plainly with a white cross on a red ground.

3. Nothing except appliances or requisites for first aid shall be kept in a "first-aid" box or cupboard.

4. Each "first-aid" box or cupboard shall be kept stocked and in good order, and shall be placed under the charge of a responsible person, who shall always be readily available during working hours.

A notice or notices shall be affixed in every workroom stating the name of the person in charge of the box or cupboard provided in respect of that room.

Ambulance room.

5. In every factory to which this order applies and in which the total number of persons employed is 500 or more the occupier shall provide and maintain in good order an ambulance room.

6. The ambulance room shall be a separate room used only for the purpose of treatment and rest. It shall have a floor space of not less than 100 square feet and smooth, hard, and impervious walls and floor, and shall be provided with ample means of natural and artificial lighting. It shall contain at least—

- (i) A glazed sink with hot and cold water always available.
- (ii) A table with a smooth top.
- (iii) Means for sterilizing instruments.
- (iv) A supply of suitable dressings, bandages, and splints.
- (v) A couch.
- (vi) A stretcher.

7. Where persons of both sexes are employed arrangements shall be made at the ambulance room for their separate treatment.

8. The ambulance room shall be placed under the charge of a qualified nurse, or other person, trained in first aid, who shall always be readily available during working hours, and shall keep a record of all cases of accidents and sickness treated at the room.

Ambulance carriage.

9. At every factory to which this order applies and in which the total number of persons employed is 500 or more the occupier shall, for the purpose of the removal of serious cases of accident or sickness, provide on the premises and maintain in good condition a suitably constructed ambulance carriage, unless he has made arrangements for obtaining such a carriage when required from a hospital or other place in telephonic communication with the factory.

10. This order shall come into force on December 1, 1917.¹

GEO. CAVE,

One of His Majesty's Principal Secretaries of State.

HOME OFFICE,

Whitehall, October 12, 1917.

¹An explanatory leaflet has been issued by the Home Office and may be had on application.

**APPENDIX J.—MINISTRY OF MUNITIONS MEMORANDUM ON THE
DUTIES OF WELFARE SUPERVISORS FOR WOMEN (SOME-
TIMES CALLED EMPLOYMENT SUPERINTENDENTS).**

NOTE.—It is not suggested that all these duties should be imposed upon the employment superintendent directly she is appointed. The size of the factory will to a certain extent determine the scope of her work, and in assigning her duties regard will of course be had to her professional ability to cope with them.

These officers are responsible solely to the firms that employ them, and in no sense to the Ministry of Munitions.

The experience which has now been obtained in national and other factories making munitions of war has demonstrated that the post of welfare supervisor is a valuable asset to factory management wherever women are employed. Through this channel attention has been drawn to conditions of work, previously unnoted, which were inimical to the well-being of those employed. The following notes have, therefore, been prepared for the information of employers who have not hitherto engaged such officers, but who desire to know the position a welfare supervisor should take and the duties and authority which, it is suggested, might be delegated to her.

POSITION.

It has generally been found convenient that the welfare supervisor should be directly responsible to the general manager and should be given a definite position on the managerial staff in connection with the labor employment department of the factory. She is thus able to refer all matters calling for attention direct to the general manager, and may be regarded by him as a liaison between him and the various departments dealing with the women employees.

DUTIES.

The duty of a welfare supervisor is to obtain and to maintain a healthy staff of workers and to help in maintaining satisfactory conditions for the work.

In order to obtain a staff satisfactory both from the point of view of health and technical efficiency it has been found to be an advantage to bring the welfare supervisor into the business of selecting women and girls for employment.

I. *The obtaining of a healthy staff.*—Her function is to consider the general health, physical capacity, and character of each applicant. As regards those under 16 years of age, she could obtain useful advice as to health from the certifying surgeon when he grants certificates of fitness. The management can, if they think fit, empower her to refer for medical advice to their panel doctor other applicants concerning whose general fitness she is in doubt. This selection of employees furnishes the welfare supervisor with a valuable opportunity for establishing a personal link with the workers.

Her function is thus concerned with selection on general grounds, while the actual engaging of those selected may be carried out by the overlooker or other person responsible for the technical side of the work. In this way both aspects of appointment receive full consideration.

The management may find, further, that it is useful to consult the welfare supervisor as to promotions of women in the factory, thus continuing the principle of regarding not only technical efficiency but also general considerations in the control of the women in the factory.

II. *The maintaining of a healthy staff.*—The welfare supervisor should ascertain what are the particular needs of the workers. These needs will then be found to group themselves under two headings:

- (a) Needs within the factory—Intramural welfare.
- (b) Needs outside the factory—Extramural welfare.

INTRAMURAL WELFARE.

I. *Supervision of working conditions.*—The welfare supervisor may be made responsible for the following matters:

(a) *General behavior of women and girls inside the factory.*—While responsibility for the technical side of the work must rest with the technical staff, the welfare supervisor should be responsible for all questions of general behavior.

(b) *Transfer.*—The welfare supervisor would, if the health of a woman was affected by the particular process on which she is engaged, be allowed, after having consulted the foreman concerned, to suggest to the management the possibility of transfer of the woman to work more suited to her state of health.

(c) *Night supervision.*—The welfare supervisor should have a deputy for night work and should herself occasionally visit the factory at night to see that satisfactory conditions are maintained.

(d) *Dismissal.*—It will be in keeping with the general suggestions as to the functions of the welfare supervisor if she is consulted on general grounds with regard to the dismissal of women and girls.

(e) *The maintenance of healthy conditions.*—This implies that she should, from the point of view of the health of the female employees,

see to the general cleanliness, ventilation, and warmth of the factory and keep the management informed of the results of her observations.

(f) *The provision of seats.*—She should study working conditions, so as to be able to bring to the notice of the management the necessity for the provision of seats where these are possible.

II. *Canteen.*—Unless the factory is a small one, it would hardly be possible for the welfare supervisor to manage the canteen. The management will probably prefer to intrust the matter to an expert, who should satisfy the management in consultation with the welfare supervisor on the following matters:

(1) That the canteen provides all the necessary facilities for the women workers; that is to say, suitable food, rapidly and punctually served.

(2) That canteen facilities are provided when necessary for the women before they begin work, so that no one need start work without having taken food.

(3) That the canteen is as restful and as comfortable as possible, so that it serves a double purpose of providing rest as well as food.

III. *Supervision of ambulance rest room and first aid.*—While not responsible for actually attending to accidents, except in small factories, the welfare supervisor should work in close touch with the factory doctor and nurses. She should, however, be responsible for the following matters:

(1) She should help in the selection of the nurses, who should be recognized as belonging to the welfare staff.

(2) While not interfering with the nurses in the professional discharge of their duties, she should see that their work is carried out promptly and that the workers are not kept waiting long before they receive attention.

(3) She should supervise the keeping of all records of accident and illness in the ambulance room.

(4) She should keep in touch with all cases of serious accident or illness.

It would further be useful if she were allowed to be kept in touch with the compensation department inside the factory, with a view to advising on any cases of hardship that may arise.

IV. *Supervision of cloakrooms and sanitary conveniences.*—The welfare supervisor should be held responsible for the following matters:

(1) General cleanliness.

(2) Prevention of loitering.

(3) Prevention of pilfering.

The management will decide what staff is necessary to assist her, and it should be her duty to report to the management on these matters.

V. *Provision of overalls.*—The welfare supervisor should have the duty of supervising the protective clothing supplied to the women for their work.

EXTRAMURAL WELFARE.

The welfare supervisor should keep in touch with all outside agencies responsible for—

- (1) Housing.
- (2) Transit facilities.
- (3) Sickness and maternity cases.
- (4) Recreation.
- (5) Day nurseries.

In communicating with any of these agencies it will no doubt be preferable that she should do so through the management.

III. *Records.*—(a) The welfare supervisor should, for the purpose of her work, have some personal records of every woman employee. If a card-index system is adopted, a sample card suggesting the necessary particulars which it is desirable should be kept by welfare supervisors is supplied to employers on request.

(b) The welfare supervisor should have some way of observing the health in relation to the efficiency of the workers, and if the management approved this could be done—

(1) By allowing her to keep in touch with the wages department. She could then watch the rise and fall of wages earned by individual employees from the point of view that a steady fall in earnings may be the first indication of an impending breakdown in health.

(2) By allowing her to keep in touch with the time office she should be able to obtain records of all reasons for lost time. From such records information can be obtained of sickness, inadequate transit, and urgent domestic duties, which might otherwise not be discovered. Here, again, if a card-index system is adopted a sample card for this purpose can be obtained from the welfare and health section on request.

(3) By keeping records of all cases of accident and sickness occurring in the factory. Sample ambulance books and accident record cards can also be obtained from the welfare and health section.

APPENDIX K.—CONDITIONS UNDER WHICH EXPENDITURE ON THE PROVISION OF WELFARE SUPERVISION, CANTEENS, CLOAK-ROOMS, RECREATION, ETC., IN CONTROLLED ESTABLISHMENTS CAN BE REGARDED AS AN EXPENSE FOR PURPOSES OF EXCESS-PROFITS DUTY.

EXPENDITURE ON WELFARE CONDITIONS WITHIN THE FACTORY.

The provision most frequently required includes—

(1) Salaries of welfare supervisors, overalls and protective clothing.

(2) Canteens, mess rooms, rest and ambulance rooms, cloakrooms and changing rooms, lavatories, baths, sanitary accommodation, and similar structures.

(1) Expenditure on the salaries of welfare supervisors and the provision of overalls, protective clothing, etc., may be allowed in full as a working expense if approved by the ministry.

(2) In order to encourage firms to make better provision for the welfare of their workers it has been decided to allow them to charge in their accounts as a working expense a proportion (varying according to circumstances) of any outlay of this nature when making up their accounts for the purposes of the excess-profits duty.

Expenditure on ambulance rooms and first-aid equipment will generally also be allowed in full as a working expense, but where the ministry consider that the expenditure is excessive or that the rooms are permanent structures, which will have a substantial value after the war, the expenditure will be treated as capital expenditure, and a suitable amount will be written off as an allowance against excess profits, having regard to the probable postwar value of the rooms.

In the case of canteens and mess rooms the canteen committee of the central control board were empowered to recommend that the cost of the building and equipment may be written off, if it is considered by the committee to be reasonable and economical; where this cost, or any part of it, was treated as a trade expense under this concession, the canteens or mess rooms must be maintained permanently in use for the purpose for which they were provided.

In the case of other accommodation some allowance in respect of the cost is given in certain cases in assessing the excess-profits duty, but schemes must be submitted to the ministry beforehand, and they will only be approved if the ministry are satisfied not only that the improved accommodation is necessary, but also that the scheme is reasonable and economical in construction and cost. It is a condition of the acceptance of this concession that the firm undertakes to bear the cost of maintaining the accommodation, not only while it remains "controlled," but afterwards.

CONTRIBUTIONS TO RECREATION SCHEMES OUTSIDE THE FACTORY.

Where a recreation scheme has been approved by the welfare and health section of the Ministry of Munitions, the board of inland revenue are prepared to allow contributions on a capitation basis to be made by "controlled" establishments subject to the following conditions:

(a) The board of inland revenue desire that applications shall be based on a capitation estimate, i. e., a rough estimate of the number of workers for whom it is proposed to cater must be drawn up, and a grant of so much a head asked for.

(b) Managers of the factories concerned must be consulted from the first with regard to such schemes, as the money, in the case of controlled firms, does not come as a direct grant from the treasury, but when the scheme is approved by the welfare and health section any sum contributed by such firms is allowed as an expense for excess-profits duty. This means that while the firm has full discretion in making a contribution, any contribution is in fact largely from money which would otherwise pass to the State.

(c) Schemes should allow for expansion and should cater for a reasonable proportion of those employed. They may include both men and women and provide for indoor and outdoor recreation.

(d) The chief expenditure contemplated should be concerned with initial establishment or extension of premises, as ordinary running expenses should be covered mainly by the workers' own subscriptions.

(e) In the case of schemes started on a comparatively modest scale a small capitation grant should be asked for, a proviso being made that an additional grant may be necessary later should the scheme prove a success. A grant of 6d. or 7d. [12.2 or 14.2 cents] a head may be sufficient at first, which may later require to be increased to 2s. 6d. or 3s. [60.8 or 73 cents], but if only a small number of workers is catered for out of possibly some thousands of employees it should be made clear whether—

(i) Other recreation schemes are catering for the rest.

(ii) The proposal is to use a central club for committees and organizations which will affect large numbers outside its actual walls.

(iii) Any schemes, such as dances or sports, are contemplated which will include large numbers.

In the case of national factories the treasury is prepared to consider similar contributions. The procedure as far as the local recreation committee is concerned is the same as for a controlled factory, i. e., the manager of the factory must approve the application for a grant, and the scheme must equally have the approval of the welfare and health section of the Ministry of Munitions.

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U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES } . . . { WHOLE NUMBER 230
BUREAU OF LABOR STATISTICS }

INDUSTRIAL ACCIDENTS AND HYGIENE SERIES: No. 16

INDUSTRIAL EFFICIENCY
AND FATIGUE IN BRITISH
MUNITION FACTORIES

REPRINTS OF INTERIM REPORT AND
MEMORANDA OF THE BRITISH HEALTH
OF MUNITION WORKERS COMMITTEE

2



JULY, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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**BULLETIN OF THE
U. S. BUREAU OF LABOR STATISTICS.**

WHOLE NO. 230.

WASHINGTON.

JULY, 1917

**INDUSTRIAL EFFICIENCY AND FATIGUE IN BRITISH
MUNITION FACTORIES.**

INTRODUCTION.

The British Health of Munition Workers Committee was appointed in the middle of September, 1915, by the Minister of Munitions, with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops."

The composition of the committee is as follows:

Sir George Newman, M. D. (chairman).

Sir Thomas Barlow, Bart., K. C. V. O., M. D., F. R. S.

G. Bellhouse, Factory Department, Home Office.

Prof. A. E. Boycott, M. D., F. R. S.

J. R. Clynes, M. P.

E. L. Collis, M. B., Factory Department, Home Office.

W. M. Fletcher, M. D., F. R. S., secretary of Medical Research Committee.

Leonard E. Hill, M. B., F. R. S.

Samuel Osborn, J. P., Sheffield.

Miss R. E. Squire, Factory Department, Home Office.

Mrs. H. J. Tennant.

E. H. Pelham (secretary).

The committee took evidence in various industrial centers from employers, representatives of workers, and other interested persons, and made numerous special studies and investigations. In addition, members have visited a large number of factories and workshops, and discussed matters with the management, with foremen, and with individual workers. With this information, and having the advantage of the special knowledge and experience already possessed by members of the committee, it has published up to the present time (June, 1917) 17 memoranda, dealing with one or more of the subjects intrusted to it.

As these memoranda are the work of a committee especially qualified by technical knowledge and special experience, and as they contain many suggestions and recommendations made with the purpose of securing maximum output over a period of months, or even years, and at the same time safeguarding the health and physical efficiency of the workers, it is believed that their reproduction at this time may be of value in a similar way to industry and labor in this country. In pursuance of this plan the related subjects in memoranda Nos. 1 to 15, inclusive,¹ have been brought together and reprinted as bulletins of the United States Bureau of Labor Statistics under the following titles:²

BULLETIN NO. 221, HOURS, FATIGUE, AND HEALTH IN BRITISH MUNITION FACTORIES.

Sunday Labor (Memorandum No. 1). November, 1915. 6 pp. [Cd. 8132.]

(Summarized in MONTHLY REVIEW of the U. S. Bureau of Labor Statistics, May, 1916, pp. 66, 67.)

Hours of Work (Memorandum No. 5). January, 1916. 9 pp. [Cd. 8186.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 77-79.)

Statistical Information Concerning Output in Relation to Hours of Work (Memorandum No. 12). (Report by H. M. Vernon, M. D.) August, 1916. 11 pp. [Cd. 8344.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 105-119.)

Industrial Fatigue and its Causes (Memorandum No. 7). January, 1916. 11 pp. [Cd. 8213.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 79-81.)

Sickness and Injury (Memorandum No 10). January, 1916. 10 pp. [Cd. 8216.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 88-90.)

Special Industrial Diseases (Memorandum No. 8). February, 1916. 8 pp. [Cd. 8214.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 83-88.)

Ventilation and Lighting of Munition Factories and Workshops (Memorandum No. 9). January, 1916. 9 pp. [Cd. 8215.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 81-83.)

The Effect of Industrial Conditions Upon Eyesight (Memorandum No. 15). October, 1916. 8 pp. [Cd. 8409.]

(Summarized in MONTHLY REVIEW, April, 1917, pp. 538-540.)

¹ Memoranda Nos. 16 and 17 were not available at the time these bulletins were issued.

² The list here given contains only the memoranda of the Health of Munitions Workers Committee. Each of the bulletins, however, includes also other official and nonofficial material dealing with related subjects. The contents of Bulletins 221, 222, and 223 are given in full on pages 195 and 196 of this bulletin.

BULLETIN NO. 222, WELFARE WORK IN BRITISH MUNITION FACTORIES.

Welfare Supervision (Memorandum No. 2). December, 1915. 7 pp. [Cd. 8151.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 68, 69.)

Industrial Canteens (Memorandum No. 3). November, 1915. 7 pp. [Cd. 8133.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 69, 70.)

Canteen Construction and Equipment (Memorandum No. 6). (Appendix to No. 3.) January, 1916. 7 pp. and plates. [Cd. 8199.]

(Summarized in MONTHLY REVIEW, June, 1916, p. 91.)

Investigation of Workers' Food and Suggestions as to Dietary (Memorandum No. 11). (Report by Leonard E. Hill, F. R. S.) August, 1916. 11 pp. [Cd. 8370.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 56, 57.)

Washing Facilities and Baths (Memorandum No. 14), August, 1916. 8 pp. [Cd. 8387.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 150, 151.)

BULLETIN NO. 223, EMPLOYMENT OF WOMEN AND JUVENILES IN GREAT BRITAIN DURING THE WAR.

Employment of Women (Memorandum No. 4). January, 1916. 10 pp. [Cd. 8185.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 74-76.)

Juvenile Employment (Memorandum No. 13). August, 1916. 8 pp. [Cd. 8362.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 92-97.)

Since the publication of these bulletins memoranda Nos. 16 and 17 have become available and are included in the present bulletin, which also contains a reprint of the interim report (except memoranda Nos. 7 and 12, entitled, respectively, "Industrial fatigue and its causes," and "Output in relation to hours of work," both reprinted in Bulletin No. 221) of the Health of Munition Workers Committee, published in February, 1917, and entitled "Industrial efficiency and fatigue." This title has been given to the present bulletin, which covers the following subjects:

BULLETIN NO. 230, INDUSTRIAL EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

The comparative efficiencies of daywork and nightwork in munition factories. 15 pp.

The causes and conditions of lost time. (Report by T. Loveday, M. A.) December, 1916. 35 pp.

Incentives to work, with special reference to wages. 16 pp.

10 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

Medical studies. (Reports by Capt. T. H. Agnew, R. A. M. C., and by Miss Janet Campbell, M. D., and Miss Lilian Wilson, M. D.) October, 1916. 37 pp.

(These four reports summarized in MONTHLY REVIEW, July, 1917, pp. 14 to 19.)

Medical certificates for munition workers (Memorandum No. 16). February, 1917. 4 pp. [Cd. 8522.]

Health and welfare of munition workers outside the factory (Memorandum No. 17). January, 1917. 9 pp.

(To be summarized in MONTHLY REVIEW, August, 1917.)

In the present bulletin there is first presented a summary of the more important findings of the committee, followed by a reproduction in full of the studies and memoranda referred to.

SUMMARY OF THE COMMITTEE'S CONCLUSIONS.

In its interim report here reproduced in part, the Health of Munition Workers Committee first presents the results of a quite exhaustive investigation, supplemented by experimental tests and comprehensive medical studies of individuals, into the comparative efficiencies of workers on the day and night shifts, with a view to determining whether or not hours worked at night unfavorably affect the capacity of the workers, and if so, the extent to which this impaired efficiency is reflected in reduced output.

It may be stated at the outset that the data collected are in all cases prejudicial to night work, which is therefore, although necessary in the present crisis, to be considered undesirable. But granting that night work must be performed, the committee found that the rate of output on the night shift is substantially the same as on the day shift, where both shifts are managed on the discontinuous system, but that continuous night work is productive of definitely less output than discontinuous night work. Among men working on a continuous day system it appears that the rate of output may be less and the loss of time greater than when they work on a discontinuous system, while among women of 19 years of age and upward, working for alternate weeks on day and night shifts, the timekeeping seems to be even better maintained than when working on permanent day shifts. The practical conclusion at which the committee arrives is that both men and women can more profitably be organized under the discontinuous than under the continuous system of night work.

The causes and conditions of lost time were considered by the committee from two standpoints—lost time due to uncontrollable causes, chiefly sickness, accidents, weather, etc., and lost time attributable to controllable causes, that is, intemperance, overtime work, discontent with working conditions, etc. Particularly is the unprofitableness of extensive overtime emphasized, the committee showing how time gained by extraordinary hours may be lost in normal hours even under favorable factory conditions. This is illustrated by citing the engineering department of a firm engaged in heavy work where the normal day-shift week is 53 hours and the night-shift week is 60 hours, in which 53 per cent of the time gained by overtime work in a given four weeks in May, 1916, was lost by bad timekeeping and sickness, while 59.6 per cent was lost in a given

two weeks in June, 1916. This high percentage of loss, it was found, is mainly due to a very high sickness rate, itself the result of long hours on heavy work since the beginning of the war. In four selected cases where timekeeping was reasonably good and records carefully made, the unavoidable loss, chiefly due to sickness, was more than half the total loss. The strain of long hours seems to have had its effect not only upon operatives, but on officials and foremen who have broken down in considerable numbers.

Another fruitful cause of lost time characterized by the committee as "uneconomical" and "unprofitable" is the practice long followed in Great Britain of requiring workers to put in a brief period before breakfast, the pause for the morning meal and the noonday meal constituting the so-called "two-break system" in contradistinction to the "one-break system," where operatives go to work after breakfast. In one factory working 53 hours per week and requiring work before breakfast 30.9 per cent of the men lost 5 per cent of the possible normal hours, while in another factory also working 53 hours per week and requiring no work before breakfast only 1 per cent of the men lost 2.38 per cent of the possible normal hours, both avoidably and on account of sickness. It is the opinion of the committee that work before breakfast gives inferior output, lowers health, and leads to great loss of time as the first spell is so frequently missed, and it is suggested that the practice has been advantageously abolished both prior to and even during the war and ought not to be instituted in any factory opened during the further course of the war.

In considering the matter of incentives to work, with special reference to wages, the committee was impressed by the fact that earnings influence the health and efficiency of workers, and that output may be influenced by the wage system in force. Many munition workers are paid for the time during which work is done, but this system was found to have no direct influence in stimulating inclination to work, since some workers may keep well within their powers while others, whose inclination to work is greater, may feel it is a grievance that extra work brings with it no extra rate. Payment by the piece, however, seems to bring a direct stimulus to bear upon the natural inclination to work. An illustration of these facts is presented in a table giving a comparison of time wages and piece rates, showing that 17 girls drilling fuses and working on the piece-rate basis in one week increased their output by 24 per cent on the day shift and by 40 per cent on the night shift, over what they were able to accomplish when doing the same work on a time-rate basis. Similarly, three girls retapping fuses by hand, working on a piece-rate basis, increased their output 28 per cent on the day shift and 48 per cent on the night shift over their output

when working on a time-wage basis. For a wage scheme to act as an incentive to workers, it must be easily understood and equitably adjusted, must offer opportunity to spend the money earned, must create in the workers a desire to earn more, and must not lead to overspeeding. If the work is repetition work, such as is carried on in munition factories, especially if it be monotonous, it would seem that piece rates may be expected to give a greater output than time wages. Appended to the report is a discussion of wage systems in force in munition factories.

The medical studies, comprising Part II of the interim report, deal with examinations of 1,543 men over military age, 1,509 boys, and 1,326 women and girls employed in factories in all parts of the country. Though evidence was found of strain and fatigue, the majority of the workers appeared to be in good health at the time of the examinations "and the medical examiners undoubtedly found less ill health than they anticipated." However, the committee does not assume that because no serious breakdown in health has yet occurred the risk of future breakdown is negligible. With reference to the men, sleepiness on the night shift, headache, footache, and muscular pains, coupled with nervous symptoms, are noted as the most common signs of overwork. Among the 1,543 men examined the time lost during 12 months from all causes was 12,964 days, of which 20 per cent was due to accident and 80 per cent to sickness. The examination of women and girls emphasized the importance of adequate provision for the health and comfort of the workers.

The report describes the factory and social environment of the employees, and information is given as to the conditions under which workers lived and labored during the period covered by the investigation, including such matters as nature of the food eaten, housing and transit, the amount of sleep obtained by workers when on day shift and night shift, respectively, and the employment of married women.

Memorandum No. 16 includes a form of medical certificate for munition workers.

Quite as important as welfare supervision and comfort of workers while on duty is the consideration of their health outside the factory. To this question the committee devoted some study, the result of which is reported in Memorandum No. 17. In the present crisis many women and girls are exported for work in munition factories, and the committee is of the opinion that it becomes the duty of the State suitably to house these transplanted workers and secure the safeguards needful for their health and morals. Suggestions to this end are included in the memorandum on "Health and welfare of munition workers outside the factory," which is reproduced herein.

THE COMPARATIVE EFFICIENCIES OF DAY WORK AND NIGHT WORK IN MUNITION FACTORIES.

1. Civilized nations have recognized that except in case of necessity or in times of great emergency night work is undesirable; but the sudden and urgent demand for output which the present war has brought with it has necessitated much night work for all classes of operatives.

2. Many general considerations would require examination if the whole question of night work in industries were under review, such as—

(1) The remotely injurious effects of permanent night work, effects which are not manifested until after a long latent period;

(2) The disturbance of normal home life; and

(3) The undesirability of hours which necessitate the passage of young women through the streets of large towns during the night.

The moral side of this question is of undoubted importance, but the committees have before them no facts, either collected by their investigators or published elsewhere, which can be made the basis of useful discussion. The following remarks by Prof. Loveday are, however, of interest. He reports that a certain firm had decided to discontinue a three-shift system, and that "one reason is the extremely bad time kept in the night shift. In bad weather, with darkened streets, many women seize any excuse for not going down to factories at 10 p. m."

Although of extreme importance when night work is envisaged as a permanent feature of our civilization, these considerations do not assume the same place when we are dealing with an admittedly temporary state of things.

3. The committee, however, is avowedly taking a short and not a long view of the subject, and is solely concerned with the factors which are of importance during the present emergency. Thus, to take an extreme case, were it to be shown that the efficiency of night work, measured in terms of output, were but a small fraction of that of day work, it would not necessarily follow that night work should be discontinued. If the night workers produce any appreciable quantity of manufactured articles, their employment increases the absolute supply of munitions, and is therefore justifiable; provided always that the lower efficiency is not an indication of such damage to health as must, in the near future, involve a

diminution of the already limited supply of available labor, and, therefore, in the end, a diminution of gross output before the necessity for a maximal supply has passed away. Conversely, a high degree of relative efficiency in night shifts would not justify the system if it were purchased by a rapid exhaustion of the health and strength of available workers.

4. Judgment on this restricted aspect of night work must be based upon a knowledge of both the comparative output efficiency, and of the prevalence of invalidity, sickness, and bad timekeeping among night and day workers.

5. In view of the grave objections which have been urged against night work on medical and physiological, as well as on purely economic grounds, especially in the case of women, the committee became anxious as to the possibility of grave results to health ensuing with diminished output as a consequence. They therefore some time ago instructed investigators to study this closely. This study seemed the more urgent as no accurate data were available upon which conclusions could be based as to the least harmful system of employing persons by night, and the committee in an earlier memorandum (No. 5, sec. 17) found it necessary to leave the matter sub judice.

PREVIOUS PHYSIOLOGICAL OBSERVATIONS.

6. The temperature of the human body is not constant, but is known to exhibit a distinct cycle during the 24 hours, the maximum appearing between 4 p. m. and 8 p. m., and the minimum between 2 a. m. and 6 a. m. The difference, although the actual maxima and minima are not the same in different persons, may be said to be between 1° and 2° F. The natural explanation of this cycle is that it reflects the diurnal variations of bodily combustion, in particular that going on in the muscles; and this surmise is borne out by numerous observations, such as those of Simpson¹ and Johannsson² to the effect that absolute muscular rest in the fasting condition greatly reduces the amplitude of the daily variation. Gibson,³ Osborne,⁴ and Simpson have also shown that the temperature cycle conforms to local time; that is to say, if a person's day maximum has been found to occur at 6 p. m. (New York time) in New York, it still occurs at 6 p. m. (Greenwich time) when he comes to Glasgow, and not at 1 p. m., as it should were the rhythm independent of bodily activities. It ought, therefore, to follow that the temperature cycle in a man who works at night and sleeps by day is reversed, the maximum appearing in the early morning and the minimum in the early even-

¹ Trans. Roy. Soc., Edin. XLVIII (Part II), 1912, p. 231.

² Skand. Archiv. für Physiolog. VIII, 1898, p. 85.

³ American Journ. Med. Sc., 1905, p. 1048.

⁴ Journ. Physiology (Proc. Phys. Soc.), 1908.

ing. Some observers, such as Jaeger, who reported on army bakers, claimed that the expected reversal really occurred; but their methods were inexact, and the careful observations of Benedict¹ led to the conclusion that the curve was modified, but not reversed; rest and sleep during the day lowered the temperature, but work during the night did not appreciably raise it.

This result is susceptible of two explanations. Either the cause of the diurnal rhythm lies deeper than variations of metabolism, or, in a society the habits of which are based upon the allocation of daylight hours to work and hours of darkness to rest, the minority which strives to change its habits is practically unsuccessful. That the second explanation is the true one has been demonstrated in two ways. A colony of monkeys can be subjected to much more rigid discipline than can human beings, and the routine of its existence can be completely inverted. Simpson and Galbraith² performed such an experiment and found that in monkeys, kept active at night and allowed to sleep in light and sound proof cages by day, the temperature rhythm was completely reversed.

The second proof is furnished by the observations of Linhard, who was medical officer to the Danish Arctic Expedition of 1906-08. During the polar night all work, practically speaking, is done indoors and by artificial light. When the lamps are put out, which is done at a fixed hour determined by the commander, it is night; when they are relighted it becomes day. External temperature changes are slight in extent. An experiment was carried out by delaying bedtime once four hours and then eight hours, and by inserting an extra meal, so that in two days a complete reversal of "night" and "day" was effected. More than half the 26 members of the party felt just as usual so soon as the transition had been accomplished; by the end of five or six days only a few were a little indisposed to work, not sleeping so well at "night" and becoming sleepy at odd times of the "day." The function which was changed with the utmost difficulty was the time of defæcation, and in some it took about a week before this occurred at the "normal" time. - All the temperature curves taken pointed to reversal of rhythm, a delay of adaptation being found in the cases of those few who experienced some difficulty in at once adapting themselves to the changed conditions.

These results are of considerable practical importance. They show clearly, at least for the period of the experiments, that the accustomed routine of day work and night rest can be reversed, without injury to health or efficiency, but they also show that a necessary condition is that the workers must either be endowed with more than

¹ American Journ. Physiology, XI, 1904, p. 143.

² Trans. Roy. Soc., Edin., XLV (Part I), 1905, p. 65.

common powers of self-control to enable them to surmount the temptation to make the best of both worlds, or must live under strict discipline. The evidence collected by the committee's investigators places many permanent night workers, whether judged by the test or output or of lost time, in an unfavorable light in comparison with day workers, and the explanation is probably contained in the preceding sentences.

METHODS OF NIGHT WORK.

7. The main distinction is between what may be termed continuous night work, in which employees work by night and do not attend the shop at all in the daytime, and discontinuous night work, in which the employees pass into the night shift at regular intervals, generally every other week. Between the extremes of entirely continuous night work and regular weekly alternation, all variations may exist and many have been found in practice.

FEMALE LABOR.

I.—OUTPUT.

8. *Discontinuous employment of women in night shifts.*—The first data to be considered¹ were provided by Dr. H. M. Vernon, and this material is of rather special importance, because Dr. Vernon was able to compare the effect of different systems in the same factory. The particular data relate to girls engaged in a cartridge factory, and as several of Capt. Greenwood's analyses also refer to cartridge work, a portion of Dr. Vernon's description of the processes is here given:

In the making of small-arm ammunition the brass cartridge cases pass through 16 main processes, in addition to the annealings, whilst the bullets pass through 11 processes. (NOTE.—The exact number is not the same in all factories, certain operations being combined.) The operations are carried out almost exclusively by women and girls, and represent the acme of monotonous repetition work, for no individual operation takes more than about a second to perform. In about half of the cartridge case operations the rate of production is to some extent limited by the nature of the machinery, for in four of the "draws" and in the subsequent rectifying and piercing processes the cartridge cases are inserted one by one into holes at the periphery of a horizontal wheel, which slowly jerks onward about twice a second. As most of the operatives are able to fill in nearly all of the holes, it follows that the quickest of them are unable to reap the full benefit of their quickness, and so the range of variation in the output of the quickest and slowest workers is somewhat smaller than in most of the other operations.

¹ The information collected by the committee's various investigators of which use is made in this memorandum has been embodied in several reports, frequently of an elaborate character, which discuss in detail many problems receiving only a passing reference in this memorandum. The committee desire to state that the extracts given do not always completely represent the amount of work performed by the investigators, or in some cases the precise deductions drawn by them.

There are also, as Dr. Vernon points out, some differences in the demands made upon muscular power on the one hand and alertness on the other. "Head-trimming," for instance—an operation in which the cartridge case is inserted in a machine operated by pulling a lever—requires a fair amount of muscular exertion. In "mouth reaming" the girls take up a handful of cartridge cases and slip them on and off a rotating taper hand mill, or roughened spindle, at the rate of about three a second. This requires more alertness and quickness than the other operations. In a few of the processes, such as "countersinking" and "mouth boring," the pace is set by the operator, for the machine is not acting until she presses a lever or pedal. (These two operations did not come within the scope of Dr. Vernon's inquiry.)

9. Dr. Vernon's data relate to 29 women on "second draw," 39 on "head-trimming," 24 on "second cut-off" (sometimes called "edging"), and 20 on "reaming." They worked on the discontinuous system, changing weekly; the average hours worked were 51.7 by day, 55.9 by night, and the period of observation was 22 consecutive weeks from January 3, 1916.

Taking the mean hourly production over the whole period to be 100, Dr. Vernon found means for the four sets on day shift of 99, 101, 100, 99, and for the same workers on night shifts 101, 99, 100, 101. If each night average be divided by the corresponding day average and the result multiplied by 100 to render the figures comparable with those of Capt. Greenwood—who has usually adopted such a ratio as a comparative figure—we have 102, 98, 100, 102. Multiplying each of these figures by the number of girls concerned in each, adding the results together and dividing by the total number of girls, we reach 100.1 as the mean of the whole series; i. e., perfect equality between the mean hourly outputs. This equality is not, taken by itself, a proof that night work produces no injurious effects upon output. Thus, were night work harmful, its effect might react upon the subsequent day work, so that the general average was lowered, although the ratio between the day and night production might be that of equality. Dr. Vernon was able to test this point by comparing the performances of girls on continuous or discontinuous day or night work in the same factory, and found that the comparison was not unfavorable to the discontinuous system with weekly changes. The details of this investigation will, however, be more conveniently considered in the section devoted to the study of continuous night work.

10. The above investigation relates to discontinuous night work with a weekly change. Dr. Vernon also investigated the effects of a fortnightly change in the case of 41 women engaged on bullet operations. The period available for study was shorter and the data

complicated by irregularities in the supply of material to the night shift, but Dr. Vernon concluded that the hourly output was probably somewhat better in the night shifts than in the day shifts.

11. He secured more extensive data in the case of women turning aluminium fuse bodies on capstan lathes. Two groups were available, one of them—21 in number—for two 4-week periods; the other—26 in number—for three 4-week periods. The average output in the second week of each fortnight on day shift was 3 per cent greater than in the first week, and that in the second week of each fortnight of the night shift 5 per cent less than in the first week, but the average output in night shifts was 7 per cent higher than that of day shifts. Dr. Vernon writes:

The probable reason of this unexpected excess of output is an interesting and important one. It depended on the better arrangement of spells of work and rest pauses of the night shift. This shift usually worked six nights a week, from 6.30 p. m. to 10.30 p. m., from 11.30 p. m. to 3 a. m., and 3.30 a. m. to 6.30 a. m., or for spells of four hours, three and a half hours, and three hours, separated by breaks of one hour and half an hour. The day shift, on the other hand, usually worked from 7 a. m. to 12 noon, and 1 p. m. to 6 p. m., or for two spells of five hours each, except on Saturday, when they worked for spells of four and three-quarters hours and four and a quarter hours, and on Sunday, when they worked for two spells of four hours each. A spell of five hours is probably too long for almost any type of labor, and it was certainly too long for women engaged in moderately heavy lathe work. Careful observation shows that during working hours the women on day shift took voluntary rest pauses which amounted altogether to over an hour out of the 10-hour day, in addition to the hour or so of compulsory rest required for attention to the machines by the tool setters. These rests were taken at irregular and often unsuitable intervals, while the night-shift workers were compelled to stop work at times which divided the working hours into spells of suitable duration.

12. In face of these peculiarities it would not, as Dr. Vernon points out, be logical to regard the results as demonstrating the superiority of fortnightly changes of shift over weekly changes, and his results for the latter system have been shown to indicate a practical equality of hourly output between the day and night shifts.

13. Capt. Greenwood has furnished the committee with five sets of data having reference to the discontinuous night work of women. Three of these relate to cartridge factories, one to lathe work on 18-pounder shell fuses, and one to certain operations in the manufacture of 9.2-inch naval shells. These data have an advantage over those supplied by Dr. Vernon in respect of numbers of individuals studied, but they are inferior in that the length of period available for study was usually shorter, and the exact number of hours worked was not always recorded in the factory. The method of statistical comparison adopted in all but one of the series (for which the necessary particulars were unattainable) was to treat each individual worker separately. Her average hourly output by night was divided

by her average hourly output by day, and the result multiplied by 100. The mean of the resulting percentage ratios was then taken to characterize the group, regard being had to its "probable error."

14. The first series consisted of 50 girls engaged on cartridge-case operations, observed through 12 weeks, from April 8, 1916. The mean weekly hours worked were 52 in day and 55 in night shifts. The mean percentage ratio of hourly output by night to hourly output by day was 101.5 ± 0.5 ,¹ i. e., there was no significant difference. Even the apparent increase of 1.5 per cent, however, slightly exaggerates the difference; for the outputs improved on the average from the beginning to the end of the period under observation to the extent of rather less than 0.5 per cent per week. As the series begins with a day week and ends with a night one, it would be expected that, if the conditions were identical, the night production would be slightly higher, since, on the average, the night work is a week later than the day work. Deducting 0.5 per cent from the 101.5 per cent, we reach a value which is within a fraction of Dr. Vernon's. This series, therefore, is completely concordant with the previous one.

15. The second of Capt. Greenwood's series is also derived from a cartridge factory and refers to 11 bullet-shop operatives, observed from the week ending April 29 down to the week ending July 15, and 27 workers in the case department, observed from the week ending January 23 to the week ending April 2. The average number of hours worked were, for both the bullet sample and the case sample, 55 by day and 49 by night. The average for the bullet workers is not typical of the ordinary conditions, as the first week of the period observed was broken by holidays. Further, the case workers changed weekly, but the bullet workers, with one or two exceptions, worked every third week on night shift. The mean percentage ratio proved to be 89.3 ± 0.7 for the case workers and 95.9 ± 1.7 for the bullet-shop workers. In commenting on these results, Capt. Greenwood points out that the second figure is not, having regard to its probable error, significantly different from 100, and that the former is based upon observations in the winter months, a fact which is apparently of some importance, as in another series, which will be considered later, the same relative disadvantage of night workers in the winter is found. This observation indicates that in this factory the hourly output in night shifts is somewhat lower than in day shifts.

¹The quantities to which are prefixed the sign \pm allow for "probable errors," and measure the reliability of the averages to which they refer. Thus if, on *a priori* grounds, we should expect a certain average to be, say, 100, and we actually find on trial of a limited number of measurements that the average is, say, 98 ± 2 , the observed value being only less than the expected value by a quantity equal to the former's probable error can not be said to differ significantly from the expected value. The limit conventionally chosen is three times the probable error, and averages which do not differ by as much as three times the probable error of their difference are not deemed to differ "significantly."

16. The third series of data, from a national factory producing cartridges, is, so far as numbers of individuals are concerned, much more extensive, but the period of observation is short, only extending from the week ending on June 6 to that ending on July 11, 1916. In all, the outputs of 339 girls distributed over 14 operations were studied. The day and night shifts were of equal length, viz., 10 hours 10 minutes. The mean percentage ratio was found to be 98.7 ± 0.3 , or slightly less than 100 per cent. The ratios for the separate operations varied from 104.8 ± 1.2 , in the case of the "first draw" (29 girls employed), down to 94.9 ± 0.9 in the case of "mouth-boring" (48 girls employed), see Table I. This variation is an interesting confirmation of a surmise of Dr. Vernon's. After noting that his results pointed to the discontinuous system with weekly changes being the best, Dr. Vernon wrote: "It is to be remembered that cartridge making is more monotonous than almost any other type of munition work, and so the favorable influence of working alternate weeks of day and night shift may be due partly to the fact that it offers a slight relief from this intense monotony." As stated above, the drawing operations are typical instances of monotonous processes, while "mouth-boring," in which the operator can largely work at her own pace and is not forced or stimulated to maintain a particular rate by the machine, is somewhat less monotonous. In the former case we find no inferiority and in the latter a definite inferiority of production by night shifts in Capt. Greenwood's data.

17. One further point is brought out owing to the large number of individuals in this series. In their memorandum on "Industrial Fatigue" ¹ the committee wrote:

Measurements of output must obviously be recorded at so much for each individual or for each unit group. The size of total output will be meaningless, of course, without reference to the numbers engaged. But it will also be important for proper management to take account of the output of particular individuals. This in many factory processes is easily possible, and when it has been done the results have shown surprising variations of individual output, which are independent of personal willingness and industry, and have generally been quite unsuspected by the workers and their supervisors before the test was made. Information so gained is valuable in two respects. Good individual output is often the result of escape from fatigue, by conscious or unconscious adoption of particular habits of manipulation or rhythm. Its discovery allows the propagation of good methods among the other workers. In the second place, these tests of individual capacity (or its loss by fatigue) give an opportunity for a rearrangement of workers and their assignment to particular processes of work. Astonishing results, bringing advantage both to employers and employed, have been gained in other countries by the careful selection of individuals for particular tasks, based, not upon the impressions of foremen, but upon the results of experiments.

¹ See Memorandum No. 7, par. 10, published in Bul. 221 of the U. S. Bureau of Labor Statistics, p. 53.

The method of this recommendation is applicable to the comparison of day and night work. In daily life we find that different individuals can work best at different times of day, and those who can control the arrangement of their working hours, many literary and some scientific workers, for instance, take advantage of the fact. Probably the same rule holds good for factory hands, and if so it might find expression in the existence of small numbers whose outputs were very uneven, either greatly in excess by day or by night, of larger numbers showing smaller discrepancies, and of still larger numbers approximately equalizing day and night outputs. The following Table II from Capt. Greenwood's data shows that the expectation is fulfilled:

TABLE I.—Night-day ratios.			TABLE II.—Distributions.		
Operation.	Number of girls.	Ratio.	Night to day ratio.	Observed.	Calculated.
First draw	29	104.8±1.2	0-74	0.0	1.32
Second draw	22	101.7±1.3	74-78	1.0	3.03
Third draw	19	91.3±1.4	78-82	9.5	7.82
Fourth draw	28	100.5±1.2	82-86	21.5	16.80
First indent	24	93.6±1.3	86-90	28.0	30.05
Second indent	23	100.0±1.2	90-94	32.0	44.75
Second taper	18	101.1±1.5	94-98	62.0	55.50
Third taper	21	91.8±1.4	98-102	63.5	57.31
Heading	20	100.8±1.4	102-106	47.0	49.28
Piercing	21	95.7±1.4	106-110	30.5	35.29
Semiannealing	18	96.4±1.5	110-114	20.5	21.04
Head turning	24	101.1±1.3	114-118	5.5	10.44
Trimming	19	101.5±1.4	118-122	6.0	4.32
Mouth boring	48	94.9±.9	122-126	4.0	1.48
			126-130	0.0	.43
			130-	1.0	.12
General mean	339	98.7	Total	339.0	338.98
S. D.		9.2			

¹ This table is to be read as follows: The figures in the second column are the actually observed numbers of girls whose average hourly output when on night work was the percentage of their average hourly output on daywork shown in column 1. For instance, 23 girls produced, when on night work, from 86 to 90 per cent of their daytime output. The appearance in some groups of fractions is due to the occurrence of girls producing percentages on the limit of a group. Thus a girl whose night production was just 82 per cent of her production by day would be entered as 0.5 in the group 78 to 82, and also as 0.5 in the group 82 to 86. (The third column is a redistribution of the frequencies in different groups on the assumption that the observations are adequately described by a certain symmetrical curve. The resulting distribution does not, of course, appear to be symmetrical, as the mean of the whole series does not happen to fall at the center of any of the groups formed.)

The figures in the third column show the distribution which would be anticipated if the observations were symmetrically distributed above and below the mean value in accordance with a curve, which has been found to describe effectively many forms of anthropometric variations. The observed distributions in the second column agree very fairly with the calculated ones, and tested by exact methods the agreement has been found to be satisfactory. Clearly, there are appreciable numbers of individuals whose outputs differ greatly in the alternating shifts and it is probable that some of these

are unfavorably affected by the alternation or fail, in some way, to adapt themselves to the varying conditions. The particular study of such cases might result in a general improvement of output by elimination of unsuitable individuals or amelioration of special conditions.

18. The next set of data was obtained by Capt. Greenwood and Mr. S. H. Burchell from a factory turning out fuses for 18-pounder shells and refers to 68 girls engaged on semiautomatic operations, chiefly capstan-lathe operations. The system was discontinuous, with weekly change, and the period of observation from the week ending January 9 to the week ending March 26, 1916. The full day-shift week was 56 hours, the full night-shift week 45 hours; the actual daily working hours of a full day shift were $9\frac{1}{2}$ and of a full night shift $10\frac{1}{2}$. The mean night to day ratio of hourly output was 101.3 ± 0.6 , i. e., in this series also there is no sensible difference between the rate of production at night or by day.

19. The last series of data concerning women, analyzed by Capt. Greenwood, was obtained by him and Mr. S. H. Burchell from a factory engaged in the manufacture of 9.2-inch naval shells. The period of observation was of 11 weeks, from July 1, 1916. The organization was into three 8-hour shifts, so that an individual would be in the third, or night, shift every third week. The system of records did not enable the investigators to obtain the outputs of individuals and they were of opinion that the data were less reliable than those of the previous series. Six operations were investigated—"rough turning," employing approximately 54 women; "finish turning," with 17 workers; "boring," with 25; "basing and facing," with 9; "parting," with 16; and "radiusing heads," with 6. If the output of the morning shift be taken as 100 the relative outputs of the afternoon shift and the night shift for the whole period were:

	Afternoon shift.	Night shift.
Rough turning-----	100.2	100.6
Finish turning-----	97.3	95.2
Boring-----	103.0	98.6
Basing and facing-----	106.1	103.4
Parting-----	100.2	101.3
Radiusing heads-----	102.4	96.2

The mean values (weighting each with the approximate number of workers involved and dividing by the total number) are 100.9 and 99.5; in other words, there is no material difference between the outputs of the three shifts. This result falls into line with the majority of Dr. Vernon's and Capt. Greenwood's series, but the nature of the material does not permit of any more detailed analysis.

20. Data have also been provided by Mr. P. Sargent Florence. Mr. Florence's chief series is derived from a cartridge factory,

organized on the discontinuous system, with weekly change. The working hours, exclusive of meals, were 10 by day and $10\frac{1}{2}$ by night; there was no Saturday night work, and the daywork lasted $7\frac{1}{2}$ hours; on Sunday it was $9\frac{1}{2}$. In comparing the outputs of night and day shifts Mr. Florence adopted the following device: "If the night output of any one week, from Wednesday to Tuesday, be compared with the day output, less that of Saturday, of the same week, there will be on each side of the comparison three days by one shift and three days by the other; the only correction required will be due to the six nights totaling 63 hours (66 before Oct. 6), the days totaling $57\frac{1}{2}$ hours ($10 \times 5 + 7\frac{1}{2}$ for Sunday)." Only full workers were considered, and the observations cover the four weeks from August 31, 1915. It is not clear what the actual number of different individuals was, but it can not have been less than 171, employed in different operations; no single operation, however, provides records for more than two weeks. Mr. Florence found that the night output was 95 per cent of the day output for the whole series (the appropriate correction having been made for differences in the lengths of the shifts). If each operation is considered separately, and the mean of the separate ratios computed, this is found to be 94.2 ± 1.4 . The range of variation within the series is very considerable, the ratio falling as low as 70 in one operation, and rising to 103 in another. The mean is lower than all but one of the previously considered series, but, having regard to its probable error, can not be said to differ significantly from the rest. That this interpretation is the correct one is suggested by a further observation of Mr. Florence. He compared the gross outputs of the cartridge-case department in the same factory in two selected fortnights later in the year, and found that the percentage ratios (allowing as before for differences in length of shift) were 103.5 and 100. His observations may, therefore, be said to agree with those of the other observers.

21. Mr. Florence's next series is the outcome of a different class of work. This consisted in drilling and tapping small fuse parts on sensitive drilling machines. The processes concerned are less monotonous than the cartridge operations. The system is discontinuous, with weekly change; the hours are $10\frac{1}{2}$ on day and 10 on night shifts, the weekly hours 56 to 58 for day weeks, 50 for night weeks. The following comparison was instituted: The efficiencies of the operators during seven weeks from January 30 to March 12, 1916, were analyzed and all cases extracted where an operator worked more than 10 hours on a certain job during the days of one week and more than 10 hours on the same job in the night shift of another week. The number of girls involved was 44, and the comparative effi-

ciency of night work, in terms of day work, was 91.6 per cent. A similar difference was found in the case of an intensive study of the outputs of two individual workers, viz, a reduction of output to the extent of about 10 per cent at night. In only one of the earlier series (see par. 15, p. 20) was so great a difference found. The form in which Mr. Florence's data are presented makes it impossible to determine the error of sampling to which the average is subject, but assuming that the difference is statistically significant, it adds point to the remarks of Dr Vernon¹ with regard to the possibility of the peculiarly monotonous nature of cartridge work having something to do with the equality of day and night outputs. In this connection some remarks of Mr. Florence are of interest. He writes:

A personal visit to the cartridge case department at night showed that girls tend to drop straight off to sleep immediately their machine breaks down and they need no longer work. They would appear, indeed, to be continually on the verge of sleep and yet the output is maintained at the day-shift rate. Apart from the fact that lengthy repairs to machines are not undertaken at night and that there is then generally less interference from the staff with the course of work, the explanation of the paradox lies mainly in the nature of the work. * * * The operatives have only to fill a slot or reservoir with the material right end up; the machine does the rest.² The girls soon learn to "automatize" the movement required in filling, and can continue to execute them even when half asleep.

Since the operations just dealt with were less monotonous than the cartridge work the result is in agreement with Mr. Florence's and Dr. Vernon's surmises. The explanation is not, however, sufficient to cover the whole of the facts. Both Dr. Vernon and Capt. Greenwood found an equality, or even a slight superiority, of the night output in the case of fuse work, and although Dr. Vernon's explanation of his result as due to better arrangement of spells during the night shift may be accepted, no such interpretation covers Capt. Greenwood's case. In the factory he dealt with no uninterrupted spell of day work exceeded four hours.

22. The last set of observations provided by Mr. Florence was obtained incidentally and is of no great extent. It refers to six girls, engaged in drilling plugs and observed for four weeks, and the nightly rate of output was found to be 90.7 of the daily rate. This result agrees with the last set of observations and shows again an inferiority in comparison with most of the cartridge records. Mr. Florence attributed the difference to "the greater concentration required in lathe work, such as the above (i. e., the operation in question), which is unofficially described as 'drill two keyholes and fix

¹ See Memorandum No. 12, Output in relation to hours of work, published in Bul. 221 of the U. S. Bureau of Labor Statistics.

² This remark refers to the operations Mr. Florence was discussing, not to all cartridge processes.

screw holes.' The plugs are placed in position by eye under the two These drills descend very near the fingers and attention is required to avoid an accident."

23. This observation completes the data collected under the direction of the committee with respect to output by women and girls under the system of discontinuous night work in munition factories. In the aggregate the investigations comprise some hundreds of employees in representative factories and may justly be regarded as typical of the conditions obtaining to-day. The individual results vary, but their general trend is unmistakable and the inference seems valid that in monotonous processes which call for little physical effort, such as those concerned with cartridge making, discontinuous night work of women gives an output which rarely falls much more than 10 per cent below and usually closely approximates to that obtained by day. There is a certain amount of evidence that in the case of less highly monotonous processes the inferiority of night output is somewhat greater, but even in that case percentages much below 90 have not been obtained.

24. Before basing an argument on this finding it is well to recur to the point made by Dr. Vernon that an equality of output does not prove the harmlessness of night work, since a control experiment, in which the absolute output can be contrasted with that reached by workers on day shifts, who do not work at all by night, is required. Dr. Vernon secured such a control, but as in all the other factories the workers who were only employed by day were of less skill and experience than their fellows, no similar second control was possible. Capt. Greenwood, however, endeavored to provide an indirect control in the following way: If night work injuriously affects the worker, then, provided all other conditions were the same, the output of the day workers in a factory managed on the continuous system (i. e., the night workers never employed by day and conversely) should, on the average, exceed that of the workers in a factory managed on the discontinuous system, where, by hypothesis, all spend a part of their time in the night shift. It is, of course, a task of extreme difficulty to secure the postulated equality of all other conditions; indeed, as Capt. Greenwood pointed out, it was impossible to obtain more than an approximation to this. He did, however, find a small number (five) of cartridge processes, carried out by four important firms on identical machines, the firms being of equally high standing. An investigation of the hourly outputs showed that the day workers did not occupy a constantly superior position to the discontinuous workers. The output for each of the five processes was compared, and the place of the day workers in the continuous factory was first, second, third, third, and fourth;

that is to say, they took an average position between the second and third; or, in other words, their production was not superior to the average of the other factories working the discontinuous system. The value of this indirect control is, for reasons pointed out by Capt. Greenwood in his report, definitely less than that of the direct control furnished by Dr. Vernon, but it leads to the same conclusion, and the committee think that the generally favorable results of the day-night comparisons in factories worked on the discontinuous system are not vitiated by any serious fallacy of the kind suggested above.

25. *Continuous employment of women in night shifts.*—The continuous employment of women in night shifts is not of common occurrence in munition factories, and the data available for analysis consist of two sets, provided respectively by Dr. Vernon and Capt. Greenwood; the great importance of the subject, however, necessitates a somewhat detailed examination. Dr. Vernon's observations will be dealt with first.

Dr. Vernon's chief data refer to 72 cartridge workers, who, after working on the discontinuous system, went on to continuous daywork for a period of 5 weeks, thereafter reverting to the discontinuous system; and to 74, who vice versa worked continuously in the night shift for the same period of 5 weeks, thereafter also reverting to the alternating system. Three of the operations concerned are included in those discussed above; the remainder were "sorting after head trim," "rectifying," and "piercing," all sedentary occupations, and the two latter semiautomatic. For the purposes of analysis the whole period was divided into four intervals—(i) a discontinuous period of 6 weeks, followed by (ii) a continuous period of 4 weeks, to which succeeded (iii) and (iv) a discontinuous period of 10 weeks divided into two portions of 5 weeks each. The hourly rate of output of the workers employed on continuous day shift was 0.9 per cent less than the average output during the preceding and succeeding intervals when alternate weeks were worked. In the case of the continuous night workers, the hourly output was 4.4 per cent less than the average of the same workers when on discontinuous night work before and after the period. The results for the individual operations are irregular, as might be anticipated, in view of the small numbers of individuals of each group, but there is a decrease in every case among the continuous night workers, varying from 8.7 per cent to 1.1 per cent. The continuous day workers showed a diminution in 4 out of the 6 operations, the range being from a decline of 2.5 per cent to an increase of 1.1 per cent. On account of the irregularities just noted, the committee do not feel justified in concluding that continuous daywork was less advan-

tageous than discontinuous day and night work, though they think it was not appreciably more advantageous.

26. Dr. Vernon's second set of data relates to 12 women employed on continuous night work in "sorting cartridge cases." They were observed through 12 weeks, between January 3 and March 25, 1916, after which they changed to the discontinuous system, with weekly change. The mean output for the 12 weeks on continuous night work was 89, while for the subsequent 10 weeks, on discontinuous night work, it rose to 99, an improvement of 11 per cent. Another group of 13 workers, who had been on the discontinuous system throughout, gave means of 106 and 107 for the two periods, an improvement of less than 1 per cent, so that the 11 per cent increase observed would appear to be due to the discontinuous system.

27. Capt. Greenwood's report was based upon a study of the output of workers in the "case and bullet department" of a cartridge factory employing the continuous system. No Sunday work was done. The night shifts were of 7 hours (actual working time) or 42 hours a week, the day shifts were $7\frac{1}{2}$ hours daily, except Saturdays, when the shifts were $7\frac{1}{2}$ hours and 4 hours alternately (the organization was into three shifts, one night and two day shifts.) All the workers were on strict piece work, and the outputs were determined from the piece payments. As to the respective skill of the day and night workers, Capt. Greenwood reports thus:

At first an attempt was made to allocate to the night shift the most skillful and reliable workers only. This only partially succeeded, but it is probably true that, particularly in the case of the bullet shops, there is a rather higher proportion of exceptionally skilled workers on the night shift. This original intention was, however, largely defeated by the refusal of various girls whom it was desired to allocate to night work to accept it. In recent months there has been no difficulty in obtaining volunteers for night work (the piece rate is, of course, higher for night workers), and such selection as has been exercised has been directed to securing the more reliable (not necessarily the more skillful) and, perhaps, socially superior girls, since supervision at night is necessarily less easy to carry out. So far as there is a difference between the workers, the night hands have the advantage, but it should be emphasized that the difference, if any, is not great.

Two sets of observations were made. The first set covers a period of 11 weeks from the week ending January 24, 1916 (excluding the week ending February 14, the records of which were missing), and refers to 84 day workers and 25 night workers in the "case department." Fortnightly observations were made over the same period upon the output of 163 day workers in the "bullet shop" and of 63 night workers.

28. The second set comprises nine weeks' observations of the output of 92 day and 31 night workers in the "case department" and of 96 day and 48 night workers in the "bullet department." This

COMPARATIVE EFFICIENCIES OF DAY WORK AND NIGHT WORK. 29

period began with the week ending May 1, 1916, and the persons observed include many of those dealt with in the first set. The mean rates of production (expressed in an arbitrary unit) were found to be—

Winter observations.

Case department:		Bullet department:	
Day workers -----	150±3.2	Day workers -----	157±2.4
Night workers -----	125±5.3	Night workers -----	141±3.7
Percentage inferiority of the night workers, 17±4.1		Percentage inferiority of the night workers, 10±2.8.	

Summer observations.

Case department:		Bullet department:	
Day workers -----	170±3.2	Day workers -----	169±3.2
Night workers -----	149±3.9	Night workers -----	170±3.5
Percentage inferiority of the night workers, 12±3.0.		Percentage inferiority of the night workers, 0±2.8.	

In both series of observations the night workers of the "case department" compare very unfavorably with the dayworkers. The same remark applies to the "bullet workers" during the winter period, but in the records of the summer months the two groups are practically equal. As the actual means in the second series are all higher than in the first, it might be thought that the partial approximation was due to the effects of practice, and that the night workers had had less experience at the commencement of the observations. Dr. Vernon has shown in connection with some data, which will be examined in the section devoted to the labor of men, that an apparent inferiority of night shifts is much reduced by allowing for experience. This is not, however, the explanation of the present results. Between the two periods of observation the piece rates were altered, and although allowance has been made for this fact, the second series of means having been multiplied by the ratio of the mean rates obtaining in the two periods, it may well have had some effect upon output. Further, the successive weekly means do not show signs of regular improvement in either series; in one particular case they show the reverse.

Capt. Greenwood also analyzed these data from the point of view of ascertaining whether the continuous night workers progressively deteriorated in comparison with the day workers. He found in one series signs of such progressive deterioration, but as his other series did not effectively confirm this result, he was of opinion that the data did not warrant the formulation of any definite conclusion upon the point. Since the details of this investigation are necessarily somewhat technical, and the committee indorse Capt. Greenwood's judgment as to their outcome it has not been thought desirable to reproduce the calculations in this memorandum.

29. The day and night workers also contrast unfavorably in another respect. The general question of lost time in day and night shifts will be considered in a later section, but, as Capt. Greenwood's series is the only one based upon comparatively large numbers of women employed upon the continuous night-shift system, it is convenient to note certain of his results in this place. The analysis in the case of the winter samples rested upon 25 night and 84 day workers in the case department, but the numbers with which he started were respectively 37 and 100. Of these original totals 12 and 16 ceased to be employed within the period of observation; that is to say, 32.4 per cent of the night workers, as compared with 16 per cent of the day workers. This great discrepancy was not observed in all the samples, but when a complete summary of the possible and actual weeks worked by both classes was made, it appeared that the day workers missed 209 out of a possible total of 3,715 weeks and the night workers 133 out of a possible total of 1,529, percentages of 5.63 and 8.70. These figures do not refer to lost time as a whole, but merely to complete weeks lost. They indicate that the regularity of employment is decidedly inferior in the case of the night workers.

30. The committee think that the outcome of Dr. Vernon's and Capt. Greenwood's¹ investigations makes it highly probable that continuous night work is productive of definitely less output than is the discontinuous system; and the committee have failed to obtain evidence that the output of the continuous day shift balances this inferiority.

II.—LOST TIME.

31. The committee are devoting a separate study to the question of lost time, and only such observations as are directly relevant to the comparison of day and night efficiency are considered here; and only passing references are made to the items of which lost time is composed, e. g., lost days, lost hours, and lost weeks, and to the reasons for such lost periods, e. g., sickness and avoidable causes.

Information referring to women employed during March, 1916, on three 8-hour shifts was obtained by Prof. Loveday, who found that for a sample of 2,603 working on the day shifts 10.4 per cent of time was lost, and for a sample of 1,175 working on the night shifts 13.2 per cent. The amount marked as unavoidable was, however, rather more by day than by night—a difference which is still greater

¹ Capt. Greenwood has pointed out that the inferiority is, in his data, more evident in the case of winter observations, and he notes that one of his discontinuous series (also derived from winter observations) gave an output which, although superior to that of the continuous workers was lower than any other value in his (or Dr. Vernon's) series.

in the case of men, *vide infra*; Prof. Loveday suggests this may be due to selection, employees who appeared to be unwell being excluded from the night shift; while the greater amount of time lost on night shifts due to other and avoidable causes may be explained on the lines of the passage quoted in paragraph 2.

Further information concerning women and girls employed on 8-hour shifts was obtained by Mr. Florence. It refers to a period of three months, and shows that the gross percentage losses were 5.77, 5.30, and 6.90 for the day shifts and 4.15, 9.16, and 8.40 for the night shifts.

These observations suggest that there is, on the whole, a somewhat greater loss of time in night shifts, and this fact renders the comparison on a basis of the hourly output of individuals somewhat too favorable to the night workers. The difference is not, however, absolutely great or constant.

32. *Discontinuous and continuous systems.*—Information in respect of 701 women and girls engaged in the sedentary occupations of "viewing," gauging, and assembling the component parts of fuses was obtained by Dr. Vernon over a period extending from February 14, 1916, to July 23, 1916. The hours of work of the day shift were normally 66.5 per week, except in the second week of each month, when they were reduced to 58.5 hours owing to the remission of Sunday labor. The hours of the night shift varied from 62.5 to 56.5 per week.

TABLE III.

System of work.	Statistical period.	Girls aged 19 or 20.				Women aged 21 and over.			
		Mean percentage of time lost.				Mean percentage of time lost.			
		Due to—				Due to—			
		Broken time.	Short weeks.	Absent weeks.	Total.	Broken time.	Short weeks.	Absent weeks.	Total.
Permanent day.....	Feb. 14 to Apr. 30.....	5.0	3.0	4.3	12.3	4.4	2.8	3.4	10.6
	May 1 to July 23.....	4.1	1.4	3.3	8.8	4.1	1.9	1.2	7.2
Discontinuous weekly.	Feb. 14 to Apr. 30.....	4.2	2.7	1.8	8.7	3.3	2.2	1.8	7.3
	May 1 to July 23.....	4.6	2.1	.9	7.6	4.1	1.9	1.0	7.0
Discontinuous fortnightly.									

One group of these workers was employed during the first 11 weeks on day and night shifts in alternate weeks, and during the following 12 weeks on day and night shifts in alternate fortnights; the remainder of the workers were employed on permanent day shift throughout the whole 23 weeks, and their lost time is a valuable check upon that experienced by the groups working on the discontinuous

systems. The results obtained, which are summarized in Table III, indicate, as might have been anticipated, an improvement with the advent of summer, an improvement which for the permanent day workers is shown under each subdivision of lost time, but which for the discontinuous workers is not present when "broken time" only is considered. Dr. Vernon looks upon this latter point as in itself showing that fortnightly alternation produces worse timekeeping than weekly alternation, for he considers that "broken time" probably includes a greater proportion of time lost through unpunctuality and slackness than do "short weeks" and "absent weeks," which are more likely to be due to genuine indisposition and sickness. He concludes that:

The alternate-week system of shifts is certainly better for timekeeping than the alternate-fortnight system, for in the spring period, when alternate weeks were worked, the timekeeping was relatively much better than that of the permanent day shift, whilst in the summer period, when alternate fortnights were worked, it was almost the same as that of the permanent day shift.

TABLE IV.

Four-weekly period from—	221 women, aged 21 and upward.				89 girls, aged 19 or 20.			
	Night shift.		Day shift.		Night shift.		Day shift.	
	First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.
May 1 to 28.....	5.8	6.5	5.4	8.0	4.7	8.0	7.8	6.6
May 29 to June 25.....	6.7	7.3	8.6	6.7	6.8	6.9	7.0	6.0
June 26 to July 23.....	4.8	5.3	10.6	7.8	7.5	8.9	11.7	9.3
Mean lost time.....	5.8	6.4	8.2	7.5	6.3	7.9	8.8	7.3

He also obtained further evidence (Table IV) of the disadvantages of the alternate-fortnight system by grouping the data according as they relate to the first and second weeks of the day-shift and night-shift fortnights, when he found that—

On an average the lost time of both women and girls was distinctly greater in the second week of each night-shift fortnight than in the first week, whilst it was distinctly greater in the first week of each day-shift fortnight than in the second week, or it corresponded with the hourly output variations of fuse-turning women described in a previous section. It would appear, therefore, that night work had a cumulatively harmful effect on timekeeping just as it had on output, and that this harmful effect extended to the first week of the day-shift fortnight.

33. The absolute amount of lost time, however, during the night-shift fortnight was less than that during the day-shift fortnight, and the same thing held good for the night shift as compared with the day shift on the weekly alternation. The explanation suggested by Dr. Vernon is, first, that workers by night are not subject to the

same opportunity of oversleeping themselves as the day workers are; and, secondly, that the effects of night work do not appear for some days, and hence are mainly exhibited in the subsequent period of day work.

TABLE V.

Age of workers.	Permanent day shift.									
	11 weeks from Feb. 14 to Apr. 30.					12 weeks from May 1 to July 23.				
	Average number of workers.	Percentage of time lost as—				Average number of workers.	Percentage of time lost as—			
		Broken times.	Short weeks.	Absent weeks.	Total.		Broken times.	Short weeks.	Absent weeks.	Total.
21 and over.....	126	4.4	2.6	3.4	10.6	96	4.1	1.9	1.2	7.2
19-20.....	59	5.0	3.0	4.3	12.3	43	4.1	1.4	3.3	8.8
17-18.....	41	4.4	2.2	2.6	9.2	33	4.3	.6	.3	5.2
14-16.....	66	3.9	2.3	1.9	8.1	63	3.1	.9	2.8	6.8
	292	4.4	2.6	3.1	10.1	235	3.9	1.2	1.9	7.0
21 and over.....	Alternate weeks of day and night shift.					Alternate fortnights of day and night shift.				
	133	3.3	2.2	1.8	7.3	221	4.1	1.9	1.0	7.0
	52	4.2	2.7	1.8	8.7	89	4.6	2.1	.9	7.6
	19	3.1	2.9	3.3	9.3	30	4.2	1.4	1.7	7.3
15-16.....	12	3.6	.7	4.6	8.9	22	3.5	1.0	.4	4.9
	217	3.5	2.1	2.9	8.5	362	4.1	1.6	1.0	6.7

In addition to the data summarized above for women and girls of 19 years of age and upward, Dr. Vernon also investigated the lost timekeeping of younger girls and found that:

Girls of 14 to 16 were the best timekeepers, whilst those of 19 and 20 were the worst. This result corresponds with the data recorded in memorandum 12, which relate to 400 of these women and girls for a period reaching from November 8, 1915, to March 12, 1916. On an average the young girls kept better time than the rest, whether they were on permanent day shift or on day and night shift, but the influence of age is in no case very marked. Taking an average of the four values obtained for each age group, we find that the total lost time of girls aged 14 to 16 was 7.2 per cent; of those aged 17 and 18, 7.7 per cent; of those aged 19 and 20, 9.3 per cent; whilst for women of 21 and upwards it was 8 per cent. The girls of 15 to 18 did not take to night work so well as the girls and women of 19 and upwards, for their average lost time was 0.3 per cent greater than that of girls of the same age on permanent day shift, whilst the average lost time of the older girls and the women on day and night shifts was 2 per cent less than that of the corresponding permanent day shift.

Reviewing the data, the following conclusions may be suggested:

(a) The timekeeping of girls and women of 19 years of age and upward, working for alternate weeks of day and night shift, is even better maintained than when they work on permanent day shift.

(b) The timekeeping of girls of 14 to 18 is practically the same whether they work on permanent day shift or on day and night shift

MALE LABOR.

I.—OUTPUT.

34. *Discontinuous employment of men in night shifts.*—The statistical data relating to the employment of men collected for the committee are necessarily smaller in extent than those upon which the conclusions regarding the employment of women is based. The reason is that for the purpose of an exact measure of output it is usually requisite to study manufacturing processes of a repetitive character in which a fairly comparable unit of production is usual. This condition seldom applies to processes which are of a highly skilled character, or call for the expenditure of considerable physical force, and so comparatively few operations employing only men could be studied. All the data used refer to the manufacture of shells and have been contributed by Dr. Vernon, Capt. Greenwood and Mr. Burchell. Apart from forging, the number of operations involved in the manufacture of a shell is between 20 and 30, and a few notes on the character of these operations will enable the reader to contrast them with the type of process dealt with in the case of women. The operations which have yielded the most individual records are those of "boring the powder chamber," "turning," "finishing," "shaping," "copying," and "base and nose screwing." These operations essentially fall into two groups—that of boring, in which a conical chamber at the base of the shell is excavated to hold the explosive charge, and the other operations in which various lathe tools shape different parts of the steel cylinder and adjust its dimensions. Dr. Vernon's succinct remarks on some typical operations may conveniently be quoted. Of boring he writes:

This consists in boring out a shallow conical chamber at the base of the shell to hold the explosive charge, and in forming a shoulder above it upon which rests the diaphragm separating the powder from the shrapnel bullets above. The boring tools are fixed on three arms of the capstan, which can be automatically driven forward into the shell by the lathe gearing. As a rule, the operator preferred to drive it forward by a hand lever, as he could thereby bore considerably faster, but it meant that he was doing a considerable amount of work during the whole of the operation. After the powder chamber has been bored the shell is faced, rendered conical by hydraulic pressure, and tapped, and is then submitted to the operation known as "finish, turn, and form." A fine turning is taken off the shell, and as this is for the most part an automatic process the operative meanwhile files down a previously turned shell to its exact diameter.

Most of the other operations are more automatic:

In the operation of rough turning, the rough steel shell, after it has been cut down to the right length by the operation of "parting off," is turned approxi-

mutely to size. This takes about five minutes, during four of which the operative merely watches the lathe. In that the outer skin of steel becomes hardened in the forging, this rough turning requires more powerful lathes and tools than other operations, and there is often some delay from the replacement of a broken or blunted tool. In the operation of "parting off" the operator is performing active mechanical work, either in clamping the shell in the lathe or in adjusting the cutting tool, for about a third of the time taken by the operation and slight mechanical work during the remainder of the time. This operation does not require much skill. In the operation of "finishing rough turning" the roughly turned shell is fixed to a lighter type of lathe and has a second turning taken off it, but this time a very thin one. This operation takes less than two minutes, and during six-sevenths of the time the operator stands watching his lathe.

35. Dr. Vernon's notes refer to the manufacture of 3-inch shrapnel shells, while Capt. Greenwood's and Mr. Burchell's data are concerned with 6-inch and 9.2-inch shells. The general characters of the operations are, however, similar, and the impression created by Dr. Vernon's notes, that in comparison with the cartridge processes a somewhat greater degree of muscular energy and a more intermittent activity (e. g., the waiting of the operative while the tool pares away a skin of metal) are involved, is equally true of the heavy shell processes. The question of muscular activity deserves rather more emphasis, of course, in the case of heavy shells than in that of 3-inch shells. At each lathe operation a massive steel cylinder has to be lifted and brought to the working face of the lathe. The degree of exertion imposed on the operative depends on the perfection of the hoisting tackle. In one of the factories visited by Capt. Greenwood and Mr. Burchell the individual effort was greater than in another where the hoisting machinery was of a more elaborate pattern, with the result that in the latter shop operations, intrusted to men in the former factory, were carried out by women.

36. The data provided consist of three series from Capt. Greenwood and Mr. Burchell and one series from Dr. Vernon. The three former series relate to discontinuous night work, two with weekly changes, and one with a monthly change. Dr. Vernon's data come from a factory organized on the continuous system; they will be studied in a separate section.

37. Capt. Greenwood and Mr. Burchell's best series consist of a study of 138 men engaged upon 6-inch shells, and followed through a series of 12 weeks from the week ending January 10, 1916. The number of hours worked and the output were recorded for each individual. The men worked for four weeks in the day shift, and then for four weeks in the night shift, or conversely. The average weekly hours worked were 54 hours in day shifts and 57 in night shifts. The investigators state:

Although we had been told that most of the men were old hands, we did not know that they had always been employed upon the same operation, and before determining the night and day ratios in the way explained by one of us in

earlier reports, it was necessary to be sure that no fallacy of comparison due to increasing experience vitiated the results. In effect we found that an allowance had to be made. Thus, we could compare for each operation the outputs of the same workers after the lapse of two months by taking the relative production of successive night shifts or of successive day shifts. The result was that in all 15 operations tabulated only 1 showed a decline, and the weighted average improvement was found to be 6.9 per cent for the night-night comparison, 6 per cent for the day-day comparison, or an average weekly improvement of about 0.8 per cent. Consequently a simple comparison of the summed outputs would be misleading, for in some part of the data the night-shift month preceded the day-shift month, and in others it followed it. As the numbers in the two groups were nearly equal, the error so introduced would be small, but it has been eliminated by calculating the individual ratios in the following way. A man belonging to the night-day-night series had his mean production for the months on night work divided by the mean production of the month on day work. A man belonging to the series day-night-day had his night-month mean divided by the mean of the two day-months. The means of each of the two series did not differ appreciably one from another nor from the mean of the whole 138 ratios. The general mean was 103.8 with a "probable error" of ± 0.40 . That is to say, the night labor was slightly more productive than the day labor, significantly so, in the sense that the difference was not likely to be an error of sampling, but evidently it is of slight practical importance.

38. The investigators also determined whether the change from work in one shift to that in another was associated with a relative fall in output. They found that the night-to-day ratio, when the first week of the night shift was compared with the last week of a day shift, did not differ appreciably from the general average. They also compared the average outputs for successive weeks of night work in several operations and found no uniform changes. Thus in the operation of "nose screwing" the successive weekly averages were 1.189, 1.223, 1.244, and 1.308; in the operation of "copying," 1.285, 1.289, 1.328, and 1.311; and in the operation of "base screwing," 1.348, 1.342, 1.527, and 1.438. The conclusion to be drawn appeared to be that no deleterious effects of night work upon output could be demonstrated, and that on the whole the night shifts were slightly the more productive.

39. Limitation of output was alleged to be taking place at this factory, and the question was investigated in the following way: The variability of output of men working precisely the same number of hours should be slight if serious limitation of output exists. The percentage variabilities of men working exactly 60 hours in the case of "nose screwing" and that of "base screwing" were found to be 17.01 ± 1.2 and 8.8 ± 0.6 ; the similar percentages of men working just 66 hours were 20.5 ± 1.4 and 8.1 ± 0.6 . The weighted average for the four sets was 13.9. This variability was rather greater than that found in girls employed on three operations in a cartridge factory, viz, 7.3 per cent. The investigators write:

The later (i. e., the cartridge workers) no doubt approach the lower limit of variation in industrial output, since the pace is much more closely set by the

machine than it is in shell production, where a considerable fraction of the working time is necessarily occupied in lifting and adjusting the heavy metal cylinders submitted to the various lathe operations. The greater variability is therefore what we should anticipate, and the result is not a conclusive proof that no limitation of the natural variation has been produced. It is, however, evident that output had not been reduced to a dead level.

40. Capt. Greenwood's and Mr. Burchell's next series comes from the factory providing the three-shift data quoted in paragraph 19. The men worked in two shifts, a day shift of $9\frac{1}{2}$ hours and a night shift of $11\frac{1}{2}$ hours. No night work is done on Saturdays. Shifts change weekly. Four operations were investigated from the week ending July 1, 1916, to the week ending October 7, 1916 (inclusive). The hourly output of the night shift, expressed as a percentage of the day-shift hourly output, was found to be 100.9 in "profiling," 102.5 in an operation called "drawback necks," 95.1 for "boring" and "facing noses," and 104.3 for "grinding." The numbers of employees are approximately known in the case of three out of four of the processes, viz, 28 for "profiling," 4 for "boring" and "facing noses," and 17 for "drawback necks." These statistics are of inferior value to the previous series, but agree in the general result, viz, no sustained inferiority of night work.

41. The last series is a set of observations upon the hourly output of the forging squad in a shell factory. The average strength of the squad was nine in the day and nine in the night shift, and they changed weekly. The weekly hours were 53 for each shift. Two sets of observations were available relating to the same men. The first covers a period of five weeks from September 3, during which period the men were on time work. The second covers four weeks, and the men were then on piecework. During the former period the percentage ratio of hourly production by night to hourly production by day was 95.5. For the second period it rose to 109.3. The apparent rise in relative efficiency of the night shift, when the time payment was replaced by piece payment, was thought by the firm to be due to the fact that supervision is necessarily less close in the night shift, so that the incentive of piece remuneration is required to call forth the maximum efforts of the men. The series is, however, a short one, and the variations from week to week are considerable, so that no great stress can be put upon the result.

42. These three series of data, particularly the first, which is the most detailed, create an impression similar to that produced by the more extensive data of female employees, namely, that there is no significant difference between the rate of output in night and day shifts managed on the discontinuous system. If there be any difference, it would seem that the output is slightly better by night for the particular class of work involved.

43. *Continuous employment of men in night shifts.*—Dr. Vernon's data consisted, as mentioned above, of records derived from a factory producing 3-inch shrapnel shells. The day shifts usually worked 53 hours a week, exceptionally 64 hours. The night shift worked either 47½ hours or 57½ hours, sometimes 67 hours. In the operation of boring the powder chamber the output was investigated during 14 consecutive weeks from August 30, 1915, the numbers involved being 23 in the day and 17 in the night shift:

In the first four weeks, viz, from August 30 to September 26, the average hourly output of 17 men on night shift was 25 per cent less than that of 23 men on day shift. This great defect was largely due to the fact that the night shift was newer to the work and had been on the operation only three weeks previous to the statistical period, while the day shift had been 10 weeks on an average. The men appear to take about three months to work up to their maximum output. The data show that the output is fairly steady after the day shift had had 19 weeks' experience, and the night shift 12 weeks' experience.

Week ending—	23 men on day shift.			17 men on night shift.			Percentage of night-shift output on day-shift output.
	Relative hourly output.	Actual hours of work per week.	Percentage of broken time per week.	Relative hourly output.	Actual hours of work per week.	Percentage of broken time per week.	
Nov. 7	108.0	48.5	2.0	95.0	46.3	2.5	88.0
Nov. 14	108.0	47.0	5.1	89.0	46.6	1.9	82.0
Nov. 21	115.0	59.5	7.0	93.0	46.8	1.5	81.0
Nov. 28	106.0	60.5	5.5	94.0	66.9	.2	89.0
December 5	101.0	59.1	2.3	92.0	64.6	3.6	91.0
Mean.....	107.6	54.9	4.4	92.6	54.2	1.9	86.2

These data show that the average output of the night shift was 13.8 per cent less than that of the day shift over a five-week interval. During the last fortnight it was only 10 per cent less, but in any case the inferiority of output was considerable. In another group of men who were using a different type of lathe to bore the powder chamber, the average hourly output of 18 men on day shift was 100, 106, and 105, respectively, in the three weeks ending September 5, 12, and 19, while the average hourly output of 20 men on night shift was 96, 94, and 99 for the same weeks. On an average the night-shift output was 7 per cent less than that of the day shift, but in that the night shift had had only 7 weeks experience at the operation previous to the statistical period dealt with, while the day shift had had 10 weeks, it is probable that the difference of output would ultimately have become less than this figure. We may sum up by saying that the average output of both groups of night workers was probably 9 per cent or 10 per cent less than that of the day shift.

44. In the operation of "finishing, turning, and forming" 22 men on day shift were compared with 17 on night shift for seven weeks. In this case the comparison was also complicated by differences in length of employment and by the fact that, prior to the period investigated, the hours worked were 12 to 15 hours longer per week

than during the period itself. Dr. Vernon concluded that the difference shown during the last two weeks, viz, 1.5 per cent, was more nearly a measure of the real difference than the average over the whole period, viz, 7.9 per cent. In the operation of "rough turning" a comparison of 18 men on day shift with 20 men on night shift showed the hourly output of the night workers during the last five weeks of the statistical period to be 6 per cent less than that of the day workers. Dr. Vernon further states:

If the deficit in the output of the night shift on that of the day shift in the "powder-chamber boring" operation be taken as 10 per cent and in the "finish, turn, and form" operation as 2 per cent, the mean deficit comes to 6 per cent, or the same as for "rough turning." In two other smaller groups of operatives the mean deficit likewise amounted to 6 per cent, though probably by reason of the smaller numbers involved the differences of day and night shift output in the two operations was considerable. Thus, in the operation of "finish rough turning," or taking a thin turning off the roughly turned shell, the output of nine night-shift workmen was 14 per cent less than that of nine day-shift workmen over a period of four weeks. In the operation of "parting off," or cutting down the rough shell to the right length, the output of seven workmen on night shift was 2 per cent greater than that of seven on day shift over a period of three weeks.

45. If now the general results of the investigations of Capt. Greenwood and Mr. Burchell on the one hand and of Dr. Vernon on the other be contrasted it seems that with men, as well as with women, the discontinuous system is preferable to continuous night work.

II—LOST TIME.

46. Consideration of time lost by night must always be weighted by the fact that at night the rate of remuneration is higher, and therefore that there is a greater incentive for workers not to lose time as compared with workers by day.

Discontinuous system.—Prof. Loveday has provided data relating to some 5,500 skilled workers employed by day who lost 11 per cent of time "avoidably" and 5.5 per cent unavoidably; that is to say, 16.5 per cent in all; and of 2,700 skilled workers employed by night who lost 6.3 per cent of time avoidably and 2.1 per cent unavoidably; that is to say, 8.4 per cent in all; and also of over 8,600 unskilled workers employed by day who lost 10 per cent avoidably and 5.2 per cent unavoidably; that is to say, 15.2 per cent in all; and, lastly, of 4,376 unskilled workers employed by night who lost 8.1 per cent and 2.2 per cent, respectively, 10.3 per cent in all.

These data definitely suggest that men employed on the discontinuous system lose less time at night. All comparison, however, of the time lost by day with that lost by night must make allowance for one important probable cause of bad timekeeping in the day period, namely, time lost before breakfast in the morning, which accounts generally for a very high proportion of the total amount of time lost during day work. This matter is examined in a separate

study, but it takes away any value the percentages might be thought to have as evidence of the inherent advantage in night shifts.

47. *Continuous system*.—Dr. Vernon has provided data which refer to 83 permanent day-shift workers and 50 permanent night-shift workers for an average period of eight weeks lying between July 25 and December 5, 1915. He found that the total lost time of the night workers was 5 per cent and that of the day workers 4.4 per cent, or 0.6 per cent less, a difference which was due to the smaller number of short weeks put in by the day workers. He considered the data sufficient to be some indication that the health of the permanent night-shift male workers is not quite so good as that of the permanent day-shift workers, but does not consider the difference one of much practical importance. Capt. Greenwood investigated the timekeeping in another factory employing a permanent night shift through 47 weeks between June, 1915, and September, 1916. During this period out of 409,727 possible day shifts 16,418 were lost, a percentage of 4. Out of 132,334 night shifts 7,593 were lost, a percentage of 5.7. In both shifts there was a substantial improvement in shift keeping (the data refer to absolute losses of shifts, not to broken time) in the summer; but over the whole period the night shift keeping was nearly 43 per cent worse than the day shift keeping. Capt. Greenwood pointed out that the relative losses were similar to those found in the cartridge factory managed on the continuous system. This observation confirms that of Dr. Vernon and strengthens the case against permanent night work for men.

GENERAL CONCLUSIONS.

48. The investigations were not primarily aimed at comparing the output of day work with that of night work, as the case against night work was considered to be sufficiently established; some of the data, however, permit a comparison to be made, and in each case the comparison is to the detriment of night work. Night work, though necessary in the present crisis, is, then, undesirable; but the committee consider that the extensive and varied data which have been summarized above provide material upon which certain conclusions, having reference to relatively light repetition work, may be based as to the result upon output to be anticipated from different schemes of night work.

49. *Women*.—(1) In monotonous processes which call for little physical effort, such as those concerned with cartridge making, discontinuous night work of women gives an output which rarely falls much more than 10 per cent below, and usually approximates closely to that obtained by day.

(2) Continuous night work is productive of definitely less output than is the discontinuous system; and the committee have failed to

obtain evidence that the output of the continuous day shift balances this inferiority.

(3) (a) The timekeeping of girls and of women of 19 years of age and upward, working for alternate weeks of day and night shifts, is even better maintained than when they work on permanent day shifts.

(b) Timekeeping of girls of 14 to 18 is practically the same whether they work on permanent day shifts or on day and night shifts.

The committee, basing their opinion upon these conclusions, consider it undesirable to adopt for women continuous night shifts in any factory not at present so working or not yet open, and suggest that wherever practicable this system should be discontinued.

50. The committee believe that this inferiority of the continuous night worker may ultimately be referred to a failure to secure proper rest and sleep in the day time. Women on continuous night work are likely to perform domestic duties which, when they work alternately in the two shifts, is impracticable; and this extra domestic strain may account for the inferior results of their industrial activities. The committee has, indeed, some evidence of women employed in permanent night shifts who still carry on their ordinary daytime avocations, but it is not sufficiently extensive (statistically) to be offered as a proof of the suggestion just made.

51. *Men*.—The conclusions arrived at with respect to women are true, with slight modifications, for men.

(1) There is no significant difference between the rate of output in night and day shifts managed on the discontinuous system.

(2) With men, as well as with women, the discontinuous system is preferable to continuous night work.

There is no reason to think that the nightly output need be much, if at all, inferior to the output by day in the case of a discontinuous system, and there is evidence that the timekeeping by night is rather better than by day. The contrast between permanent night shifts and permanent day shifts is, however, less striking than in the case of women. On the whole, it appears that the rate of output may be less and the loss of time greater than in the discontinuous system. This result is what might be expected if the surmise regarding the cause of the inferiority seen among women were correct. Men do not naturally take so much part in domestic work as women, and the temptation to burn the candle at both ends is, from this point of view, smaller. On the other hand, the incitement to devote the time which should be given to sleep to amusement is certainly as intense among men as among women, so that some inferiority might be anticipated.

The practical conclusion seems to be therefore that, equally with women, men can more profitably be organized under the discontinuous than under the continuous system of night work.

THE CAUSES AND CONDITIONS OF LOST TIME.

BY T. LOVEDAY, M. A.

I. INTRODUCTION.

(A) GENERAL REMARKS.

1. The following notes are based in the main on an inspection of the records of lost time in a number of factories situated in different parts of Scotland and England. Occasionally I have made use of figures from factories which I have not visited, when I knew the figures to be well authenticated. I have also had the benefit of the opinions of a number of directors, managers, and other officials, as well as of employees, to all of whom I am greatly indebted.¹ In all matters affecting lost time the variables are so numerous as between different factories, and even as between different departments in a single factory, that more weight ought properly to be attached to coincidence or divergence of opinions among experienced persons than to coincidence or divergence of figures; unfortunately, the former are less easily reproduced on paper and are apt to lose force in telling. But much of what follows is based on an estimation of experienced opinions. I am very sensible of, and wish to emphasize at the outset, the danger of easy generalizations about lost time. Much that has been written on the subject is marred by a failure to recognize the large element of conjecture necessarily present in any general conclusions on the subject. At the same time it is likely that a comparison of results under varying conditions may convey to persons interested some useful information.

2. The present communication does not pretend to treat exhaustively the whole problem of lost time in factories. The chief causes of loss of time operative at present may be summarized as follows:

A. CAUSES MAINLY UNCONTROLLABLE.

- | | |
|--|---|
| (1) Necessity of employing persons of inferior physique or irregular habits. | (4) Bad weather and dark streets. |
| (2) Lack of housing accommodation. | (5) Lack of material coming from outside. |
| (3) Lack of transport facilities. | (6) Domestic duties of married women. |
| | (7) Sickness and accident. |

¹ I have also to express my great obligation to Mr. H. O. Quin, of the Ministry of Munitions.

B. CAUSES MAINLY CONTROLLABLE.

- | | |
|---|---|
| (1) Drink. | (5) Overtime work. |
| (2) Indifference. | (6) Faulty internal organization, leaving employees without work. |
| (3) Discontent with conditions of work. | |
| (4) Morning "quarters." | |

Other causes, of less importance, might be added, and even those mentioned differ considerably both in influence and in generality. The first seven of them are for the most part beyond the control of either employer or employee; the remainder might to a great extent be remedied by the one or the other. The discussion that follows is mainly concerned with the proportions of lost time that are due to sickness and to "sleeping in" or loss of morning "quarters"; but in both connections some discussion of the influence of overtime is unavoidable.

3. I have in the main confined myself to the records of factories which existed before the war, are still largely engaged upon work not very remotely different from that on which they are normally engaged, are admittedly well managed, and in which the relations between employers and employed are tolerably harmonious. My attempt has been not to lay undue stress on extreme, uncharacteristic figures, but rather to compare average results in well managed concerns. So far as conclusions are drawn or suggested at all, they appear to me to have a bearing upon problems that will arise after the war as well as upon immediate practical questions, and this is most emphatically true concerning the necessity of improving the form and raising the value of medical certificates.

4. The kind of work on which a factory is engaged is distinguished as light, medium, heavy, and so on. This classification, though accurate in respect to particular shops, is somewhat arbitrary in respect of whole factories, since even in marine engineering and other heavy works a considerable proportion of the labor is light; these terms, therefore, must be taken as characterizing only the main features of a factory. All the factories recorded may be brought under the general title of "engineering" (used broadly) with the the exceptions of two cotton factories and one in which women were engaged upon rope making. All but the cotton factories are "controlled." Shipbuilding is excluded from consideration, except in one table introduced for comparison.

5. Correct and ample records of timekeeping and sickness are rare. In small factories they are often considered unnecessary; a mental note or a few jottings in the works manager's pocketbook are often all that is available. This is unfortunate, for the ease of supervision in carefully managed small factories makes their records specially valuable. Factories which are well satisfied with their employees'

timekeeping often hold that continuous records are not worth while—again a scientific misfortune, since comparison with other factories becomes impossible. In large factories, on the other hand, stress of work and depletion of staff have often made it necessary to abandon records which were once carefully kept. Fortunately, however, in a few cases I have found records either instituted or enlarged during the past two years, and they have been of great utility.

(B) THE FORM OF TIME-ANALYSIS RECORDS.

6. The lost time records of different firms vary greatly in form. A very convenient form for purposes of calculation is a weekly record tabulated as follows:

WEEK ENDING

Shop or department.	Number employed.	Number of normal hours actually worked.		Number of hours worked overtime.		Number of hours lost.		
		Day shift.	Night shift.	Week days.	Sundays.	Avoidably.	By sickness.	By leave.
.....								
.....								
.....								

The individual figures in each department can be read off the employees' cards with great rapidity by clerks accustomed to the work and entered on lists, which may then usefully be preserved with the summary table.

The summary may be expanded as desired by adding columns for such further information as "added time," the number of employees on overtime, the number of "quarters" lost, the number of employees sick, the number of bad timekeepers, and time lost on day shift as distinguished from night shift; while some of the columns (or, preferably, percentages calculated from them) may usefully be recorded from week to week in graphic curves.

(C) CALCULATIONS OF LOST TIME AND OF OVERTIME.

7. Subsequent calculations may be made in averages of hours per employee or in percentages; for some comparisons both methods are needed.

Time lost either with leave given or for sickness or for other adequate reasons is considered as time lost unavoidably; and time lost which is not accounted for in these ways is spoken of as time lost avoidably, i. e., by "bad timekeeping." In making calculations, if percentages be used, the strictest measure of time lost avoidably, i. e.,

by "bad timekeeping," is $\frac{\text{hours lost avoidably} \times 100}{\text{gross normal hours less those unavoidably lost}}$ but in comparing time lost due to "bad timekeeping" with that due to sickness, the data for these two causes respectively must be expressed as percentages of gross normal hours less those lost by leave; while time lost for all causes must be expressed as a percentage of gross normal hours simply.

In the following pages the stricter measures are sometimes used, but it will be seen that as a rule the percentages are not greatly altered by taking gross instead of "practically possible hours"¹ as the denominator throughout.

8. It is sometimes argued that calculations based on the amount of normal time lost are misleading and should be replaced by calculations based on the average number of hours worked, whether normal or overtime. An example will make this argument clear: Suppose a factory in which the average normal hours a week are 55 and the average hours worked overtime are 10, and that the average hours lost are 5 per man, or about 9 per cent of the normal hours. This percentage can not be fairly compared with that of another factory whose average normal hours are 50, with no overtime, and where the average hours lost are $2\frac{1}{2}$ per man, i. e., 5 per cent of normal hours; for, in fact, the men in the former factory are working 60 hours a week and those in the latter only $47\frac{1}{2}$.

9. This argument is so far sound that comparisons of the lost time percentages of different firms are of little value unless accompanied by comparisons of the average hours worked. But it neglects two important points:

(1) Absences of workmen, especially when unexpected, entail a certain amount of disorganization and therefore (quite apart from questions of fatigue) the comparative effective value of the longer hours with a high percentage of lost time is diminished; and

(2) So far as work overtime causes loss of normal time the results are greater cost and (usually, at any rate) lower efficiency.

10. To find a satisfactory measure of overtime for purposes of comparison between different factories is difficult. The ratio of hours worked overtime to ordinary hours actually worked is totally useless. The ratio of hours worked overtime to gross possible normal hours is a very rough measure, since there may be much unavoidable absence in one factory and little in another. The total number of hours worked overtime divided by the total number of employees is also a very rough measure for the same reason, and because the proportions of employees working overtime may differ greatly. The simplest and best measure, when the information can

¹The term "practically possible hours" will be used throughout to mean gross possible normal hours less those lost unavoidably.

be obtained, is (a) the percentage of employees working overtime together with the average hours worked overtime by each employee so working, and it may be combined with (b) the ratio of hours worked overtime to practically possible ordinary hours, allowance being made for unavoidable absence. But in using these measures consideration must be given to the length of the normal working week if the comparison is not to be very misleading, and in using (b) reference should be made, under the two-shift system, to the size of the night shift if the night week is longer than the day week, for in a factory working little or no night shift the ratio will be higher than when the night shift is large though the hours actually worked overtime are the same.

(D) THE RELATIONS BETWEEN LOST TIME AND OVERTIME.

11. If the term "overtime" be taken in the ordinary sense of hours worked beyond the normal time of a factory any attempt to correlate lost time and overtime is apt to be misleading, since the normal hours of different factories vary. Nor is the attempt much more hopeful if some such figure as 53 hours be arbitrarily selected as a normal working week and any excess reckoned as overtime; for length of hours is only one of many conditions of lost time and it would be difficult to find two factories varying in that condition alone. Yet overtime admittedly does cause loss of normal time. The point will be frequently illustrated later on in this memorandum, but a few general observations may be in place here.

Overtime may act either as final or as efficient cause of lost time.

(1) Employees may deliberately miss normal hours in order to make the better-paid hours overtime necessary. In no factory that I have visited has the management believed this practice to be followed by any but an insignificant minority of the employees. If it be anywhere at all common, an extension of the rule found in many places would seem desirable, by which the full normal week must be worked before overtime is paid as such—always provided that normal time is not excessive and that allowance is made for sickness and other unavoidable absence.

(2) Work overtime may have loss of time for a consequence.

(a) If this happens in the way that high earnings lead to slackness—and this has certainly been so among the less responsible employees in many places—the case is not practically, though it is theoretically, very different from that just considered; and the same remedy is indicated.

(b) In so far as long hours lead to loss of time by fatigue and sickness, insistence upon them is most deplorable. The keenest men are not always the most robust, and it is the keenest who have most

strain to bear. The hours gained are more costly than the hours lost, and, coming as a rule at the end of a long day, their cost is altogether disproportionate to their output; and the resulting fatigue which drives some men to bed produces lassitude and decreased efficiency in many of those who continue to attend regularly, so that the output of normal hours also declines. The effects of Sunday labor are, as has now been recognized, still worse than those of overtime hours in the evening or on Saturday afternoon.

12. How considerable a proportion of the time gained by extraordinary hours may be lost in normal hours even in a well-managed factory in which the good will of the employees is undisputed, is illustrated by the following figures which refer to the engineering departments of a firm engaged on heavy work. The normal day-shift week is 53 hours and the night-shift week 60 hours.

TABLE I.

Period.	Percentage of employees working overtime.	Average hours worked overtime by those so working.	Percentage ratio of hours worked overtime to practically possible normal hours of all employees.	Percentage of employees working on Sunday.	Percentage ratio of Sunday hours to total overtime.	Percentage ratio of hours lost by bad timekeeping and sickness to hours gained by work overtime.
May, 1916 (4 weeks).....	78.4	13.0	19.7	62.0	61.0	53.0
June, 1916 (2 weeks).....	72.0	12.7	16.9	60.0	57.0	59.8

The high percentage of loss is mainly attributable to a very high sickness rate, itself the result of long hours on heavy work since the beginning of the war. Further figures illustrating this point will be quoted below (cp. especially Table II).

Obviously, however, a mere comparison of hours gained by overtime and normal hours lost is worthless if unaccompanied by other figures; since if little overtime be worked it may be more than counterbalanced by a very moderate loss of normal time, not in any way due to the overtime work.

13. The very long hours worked in many factories during the past two years have, perhaps, been necessary, but so far as my experience goes the necessity has been imposed upon and is deplored by employers and managers, who have noted the decreasing briskness and resilience of the workers. The strain has told, not only upon operatives, but still more upon officials and upon foremen, who have broken down in considerable numbers. Unhappily, the men too often welcome long hours because of the extra pay. In one factory where

overtime had been kept as low as possible men told me quite frankly that there was a good deal of grumbling in consequence. But the sickness rate in that factory was correspondingly low and there can be no doubt that for the average man high wages earned by long hours are too dearly earned.

II. SICKNESS.

(A) THE DIFFERENTIATION OF BAD TIMEKEEPING AND SICKNESS AND OF AVOIDABLE AND UNAVOIDABLE LOST TIME.

14. Of firms which keep a continuous record of lost time only a small minority attempt to determine accurately what proportion is due to sickness or to distinguish accurately between avoidable and unavoidable loss of time. In some factories no distinction is tabulated at all; sometimes it depends wholly on foremen's opinions; sometimes absence is classified as sickness only if a medical certificate is handed in and certificates are carefully demanded; in other factories the word of trusted employees is accepted and their absence classified under sickness; in others, again, their word is accepted, but their absence in default of a certificate is reckoned under bad timekeeping. Here all absences for less than two or three days are counted as bad timekeeping, but certificates are demanded after long absence; next door longer absences are simply assumed to be unavoidable except in the case of notorious slackers.

15. One principal cause of the present confusion is the dissatisfaction of employers with medical certificates. This dissatisfaction is very widespread; it is not confined to any particular locality, or any particular size of town, or any particular kind of employment. Moreover, it is in the main justified. Upon analysis it resolves itself into two principal grievances:

(1) Some certificates are given when they are not deserved. This must under any circumstances happen not infrequently, if a doctor has no data for his judgment beyond the statement of a man whom he has rarely, if ever, seen before. But, while this difficulty must be fully recognized, there is no doubt that some undeserved certificates are the result, not of excusable error, but of extreme slackness or sometimes of deliberate dishonesty upon the part of medical men. Unconscientious doctors are comparatively rare, but they are widely distributed; one or two are to be found in nearly every populous district; they find their mates in equally unconscientious employees (like themselves, a small minority of the whole); and they infect the minds of employers with a distrust which unfortunately reaches beyond themselves.

(2) Very many certificates, though honest, are so brief as to be practically useless. Often they state nothing beyond the bare fact

that a man is unwell and unable to follow his employment. Now the employer would perhaps learn little from the name of the patient's complaint, but he is seriously interested to know, especially at the present time, whether the patient must leave work at once or may continue on something urgent for a few days, and also to know, if possible, how long he is likely to be away. On the other hand, a statement of the patient's age and of the nature of his complaint, though not always directly useful to the employer, would be of the utmost service to the investigation of industrial disease, supposing that certificates, when no longer required, were sent for tabulation to the Medical Research Committee.

16. Some advantage that would follow from more trustworthy and informative certificates are these:

(1) Employers would receive information assisting them in the organization and coordination of work, and so facilitating output;

(2) Employers would be encouraged to distinguish accurately sickness as a factor of lost time, and so to keep closer watch on the conditions of health among their employees; and

(3) There would be furnished data for a study of the statistics of industrial diseases.

The first is the most important point at this moment, but after the end of the war the second and third advantages will become increasingly important.

17. The need of improved certificates is urgent, both temporarily in reference to munition workers and afterwards permanently in reference to all employees in factories. Much could be done immediately by supplying a standard medical certificate to panel practitioners and other medical practitioners in the neighborhood of munition factories and controlled establishments, with a request that the form be used for all certificates given to munition workers.

18. A result of defective records seems to be a very frequent under-estimation of the part played by sickness as a factor of lost time, and generally of the proportion of unavoidable to avoidable loss of time.

19. The following table concerns a body of over 1,200 men (with a very few women) in an engineering department. Smithy and foundry are excluded from these figures, but the general character of the work is heavy (though, of course, some shops are exceptions), and in most weeks of the record there has been much work overtime, especially on Sundays. The figures for sickness refer to well-authenticated and for the most part to certified cases only, and accidents are left out of account; there is an inducement to employees to send in certificates when sick, and the record of sickness is carefully kept. The normal day-shift week is 53 hours and the night-shift week 60 hours.

TABLE II.

Weekending—										Notes.
1	2	3	4	5	6	7	8	9	10	
	Percentage ratio of time lost by bad timekeeping to practically possible normal time.	Percentage ratio of time lost by bad timekeeping to gross normal time less time lost by leave.	Percentage ratio of time lost by sickness to gross normal time less time lost by leave.	Percentage ratio of time lost by bad timekeeping to gross normal time.	Percentage ratio of time lost by sickness and leave to gross normal time.	Percentage ratio of total time lost to gross normal time.	Percentage ratio of time lost by sickness and leave to gross normal time.	Percentage ratio of time lost by sickness and leave to total lost time.	Average hours (normal and over-time) worked per employee.	
1915.										
June 2.....	3.5	3.3	4.5	3.3	5.3	8.6	67.3	61.5	61	
Dec. 21.....	3.6	3.4	5.3	3.4	5.8	9.2	60.7	63.0		
1916.										
Apr. 4.....	4.4	4.0	7.2	4.0	7.8	11.9	64.0	68.0	56½	
May 9.....	3.7	3.4	6.0	3.4	6.5	9.9	63.2	65.2	58½	
May 16.....	2.9	2.7	6.0	2.7	6.5	9.2	62.6	70.2	59½	
May 23.....	4.0	3.7	6.7	3.7	7.4	11.2	64.1	68.1	55½	Daylight saving.
May 30.....	4.4	4.1	6.0	4.1	6.5	10.7	59.1	61.2	58	
June 6.....	3.7	3.5	6.2	3.5	6.5	10.0	63.6	64.8	59½	
June 13.....	3.4	3.2	5.8	3.2	6.3	9.6	63.9	66.0	57½	Extra pay on Whitmonday.
June 20.....	4.1	3.8	5.8	3.8	7.3	11.1	60.1	66.0	57	
June 27.....	4.3	4.0	5.7	3.9	7.9	11.8	58.8	66.6	56½	Extra pay on June 27 and 28.
July 4.....	3.0	2.8	5.3	2.8	6.6	9.5	65.0	71.6	58½	
July 11.....	3.6	3.4	5.3	3.4	5.8	9.2	60.7	62.6	58½	
July 18.....	3.6	3.5	6.4	3.4	6.8	10.3	64.7	66.1	57½	
July 25.....	4.6	4.3	6.9	4.3	7.6	11.9	61.4	69.5	56½	
Aug. 1.....	4.7	4.4	6.4	4.3	7.8	12.2	59.0	64.0	55½	
Aug. 8.....	7.2	6.7	6.8	6.6	8.2	14.8	50.5	55.4	48½	Extra pay on the 7th. Over-time much reduced; little Sunday work.
Aug. 15.....	5.4	4.9	8.6	4.9	9.8	14.7	63.5	65.6	48½	An extra day in this pay. Holidays.
Aug. 23.....	3.8	3.6	5.4	3.6	6.1	9.7	59.8	62.6		
Aug. 26-Sept. 4.....										
Sept. 12.....	3.9	3.7	4.8	3.6	5.4	9.0	62.2	69.5	57	
Sept. 19.....	4.1	3.9	3.7	3.9	4.0	8.0	48.3	60.1	55½	
Sept. 26.....	3.7	3.5	4.1	3.5	4.6	8.1	43.6	66.8	57½	

20. In every week recorded save one the proportion of lost time, apart from absence with leave, due to sickness alone (column 8) is more than a half, and in most weeks it is over 60 per cent, while in all weeks certified sickness and leave together (column 9) account for more than half the total time lost, and in all weeks save four they account for over 60 per cent of it, and twice for over 70 per cent of it. The part played by these factors is diminished on two occasions, and then for two opposite reasons. In the first part of August there was less urgency of work, and the men, knowing this, were inclined to take a rest to which the time of year also prompted them, so that "bad timekeeping" increased; and after the holidays at the end of August there was a remarkable improvement in health.

21. It is doubtful, however, whether even the careful records kept by the firm to whom these figures refer do complete justice to the facts. There remains the possibility that some part of what is reckoned as "bad timekeeping" is due to fatigue and minor ailments which are genuine enough, though no one would ask for or give a

medical certificate in respect of them. If that be so, the curves of "bad timekeeping" and of sickness will tend to move in the same direction. Now, in Diagram I, which represents graphically columns 2, 4, and 6 of Table II, this tendency is apparent; the curve of bad timekeeping does on the whole move in the same direction either as the curve of sickness or (e. g., at the end of June, when a generous amount of leave was granted for the sake of the men's health) as the curve of sickness and leave combined. But after the holidays at the end of August, there is no such coincidence. It seems likely, therefore, that during the main period the figures of "bad timekeeping" include some absences which should be attributed to a sort of invalidity rather than to slackness. This is specially likely to be true of lost "quarters," which, in the steadiest shops, account for a very great part of the so-called bad timekeeping in this factory.¹

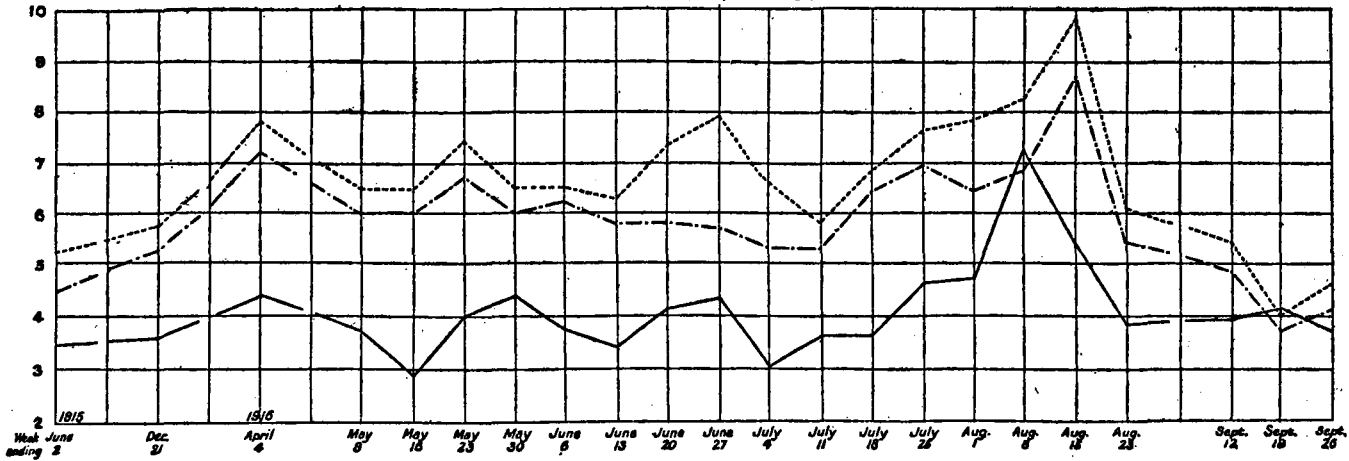
22. In the attempt to ascertain by a comparison of curves whether the figures of "bad timekeeping" include absences due to physical disabilities of a minor kind, it is more important to notice whether the curves rise than whether they fall concomitantly, especially when hours are long, for the factors which first produce absences deemed avoidable may go on to produce definite sickness, and thus the curve of bad timekeeping may fall while that of sickness rises, simply because those are now declared sick who were previously "off color." In other words, it is sometimes necessary to observe whether a rise in the bad timekeeping curve is followed rather than accompanied by a rise in the sickness rate. In the records of one factory employing about 950 males I examined the figures for 58 successive weeks. After setting aside 8 weeks in which they were seriously affected by holidays, I found that in the remaining 50 the curve of bad timekeeping rose 24 times. In 13 of those 24 weeks the rise was accompanied by an increase of recorded sickness; in 7 weeks by a fall; while four times the sickness rate was unchanged. On six of the seven occasions when the rise in bad timekeeping was accompanied by a fall in sickness, and on three of the four occasions when there was no simultaneous movement in the sickness curve, the amount of sickness increased in the following week. I had other reasons for supposing that sickness was considerably understated in this factory, and these figures confirmed the supposition. Where the facts of sickness are more carefully ascertained and the doubt is only concerning minor ailments, such definite figures are scarcely to be expected.²

¹ See below (pars. 33 (5) and 47) the figures of timekeeping for certain heavy machine shops.

² Further data concerning the correlation or lack of correlation between figures of bad timekeeping and of sickness are desirable; and I should be glad if any employer interested in the subject, who keeps carefully collected and tabulated records, would communicate with me through the secretary of the committee and would allow me to inspect them.

DIAGRAM I.

----- Ratio of sickness plus leave to gross normal hours.
 - - - - - " " " to gross normal hours less leave.
 _____ " " " bed timekeeping to practically possible normal hours.



23. It might be supposed that so high a proportion of unavoidable lost time as that given in Table II is peculiar to heavy work carried on at very high pressure, but the following table shows that this is not necessarily true. It refers to a body of about 270 males and 290 females engaged upon light work in one department of a large factory. Sickness is not separately recorded, but careful inquiries are made into the reasons for all lateness or absence. More than half the lost time, and usually much more than half, is lost unavoidably. It will also be noticed that, though the total time lost by the females is higher than that lost by the males, the proportion unavoidably lost by the females is also higher in most weeks.

TABLE III.

Week ending—	Percentage ratio of time lost unavoidably to practically possible normal time.		Percentage ratio of time lost unavoidably to gross normal time, taken as 52½ hours a week per employee.		Percentage ratio of time lost unavoidably to gross normal time.		Percentage ratio of total time lost to gross normal time.			Percentage ratio of time lost unavoidably to total time lost.	
	Males.	Fe-males.	Males.	Fe-males.	Males.	Fe-males.	Males.	Fe-males.	All.	Males.	Fe-males.
1916.											
June 6.....	2.4	1.4	2.3	1.3	2.6	3.7	5.0	5.0	5.0	68.9	73.2
June 13.....	2.0	1.0	1.9	1.0	2.8	4.3	4.9	5.3	5.2	60.9	81.0
June 20.....	1.8	2.0	1.7	1.9	4.9	5.2	6.7	7.1	6.9	73.0	72.9
June 27.....	2.1	1.9	2.0	1.7	4.8	7.5	6.9	9.2	8.1	70.0	81.0
July 4.....	2.0	1.4	2.0	1.3	2.7	6.2	4.7	7.6	6.2	68.0	82.1
July 11.....	1.9	2.3	1.8	2.2	4.6	6.9	6.5	9.1	7.9	71.2	76.7
July 18.....	2.5	1.8	2.4	1.7	3.5	7.2	5.9	8.9	7.5	69.8	80.9
July 25.....	2.5	2.0	2.4	1.9	3.9	7.3	6.3	8.3	7.9	81.1	73.1
Aug. 1.....	1.8	2.7	1.8	2.5	4.2	7.2	6.0	9.7	7.9	69.8	73.9
Aug. 8.....	1.3	1.2	1.3	1.2	3.5	5.3	4.8	6.6	5.7	73.9	81.5
Aug. 15.....	2.1	1.5	2.0	1.5	4.5	4.7	6.6	6.2	6.4	69.5	76.0
Aug. 22.....	1.3	2.4	1.2	2.2	3.2	5.8	4.4	8.0	6.2	71.8	71.9
Aug. 29 ¹											
Sept. 8.....	1.8	2.6	1.7	2.4	3.0	5.6	4.8	8.1	6.5	63.2	69.3
Sept. 12.....	1.5	2.9	1.5	2.7	2.8	4.0	4.4	6.8	5.6	66.1	69.4
Sept. 19.....	1.8	1.6	1.7	1.5	2.6	5.0	4.4	6.5	5.5	60.2	76.4
Average for the period.....	1.9	1.9	1.9	1.8	3.6	5.7	5.5	7.6	6.6	66.7	75.8

¹ Department closed.

In only two other factories besides those to which Tables II and III refer have I up to the present discovered figures of sickness or unavoidable absence generally that appear to me reasonably trustworthy. Both are small factories, engaged on moderately heavy work, with moderate overtime. In one, employing about 240 men, the total loss of possible time for 12 months to the end of September, 1916, was 7.27 per cent, and sickness alone accounted for 54 per cent of this loss. In the other the total loss in a period of August, 1916, among about 130 men in the engineering and tool shops was 5 per cent; sickness accounted for 46.7 of this loss and unavoidable causes generally for 59.9 per cent of it.

24. In all these four places, then, where timekeeping was reasonably good and records were carefully made, the unavoidable loss is more than half the total loss; and the inference is, therefore, suggested that elsewhere also, unless attendance is very slack, more careful inquiry than is usually made into reasons for absence would reveal the same fact. Obviously, however, in factories where timekeeping is really bad, the proportions of time lost avoidably and unavoidably may be reversed. The following figures are of some interest in this connection, though in default of more precise information as to the means of determining sickness and as to the precision of the returns not much stress can be laid on them.

25. For the week ending February 4, 1916 (a period in which lost time was likely to be considerable, and the sickness rate especially likely to be high), of 77 firms returning their time lost as not more than 6 per cent of possible time, 56 attribute at least half to sickness (including accidents), and 21 attribute less than half of it to this cause; of 41 firms returning a percentage over 6 and not more than 10, 24 attribute at least half to sickness and 17 attribute less; and of 25 firms whose employees lost more than 10 per cent of possible time only 7 attribute more, and 18 attribute less than half the loss to sickness.

26. The following tables are an example of records in a factory where the timekeeping was not satisfactory. Table IV refers to an engineering department mostly engaged on heavy work except in some shell shops; Table V distinguishes the women operatives in shell shops, who were included in the preceding table; and Table VI, which refers to a shipbuilding department, is added for comparison. The record is for week ending March 4, 1916, at which period a high percentage of lost time is to be expected, especially as overtime was considerable, the percentage ratio of hours worked overtime to practically possible normal hours being in the engineering department for the skilled day shift 17.1, for the skilled night shift 16.9, for the unskilled day shift 17.4, and for the unskilled night shift 22.4; among the women on day work 14.6, and on night work 23.3; and in the shipbuilding department for the skilled day shift 19.1, for the skilled night shift 13.5, for the unskilled day shift 20.3, and for the unskilled night 21.2. The normal day-shift hours were in most shops except the shell shops 53, and the normal night-shift hours 57½.

TABLE IV.

Grade and shift.	Number employed (approximately).	Percentage ratio of time lost avoidably to practically possible normal time.	Percentage ratio of time lost avoidably to gross normal time.	Percentage ratio of time lost unavoidably to gross normal time.	Percentage ratio of total time lost to gross normal time.	Percentage ratio of time lost unavoidably to total time lost.	Average hours (normal and overtime) worked per employee.
1	2	3	4	5	6	7	8
Skilled, day shift (except shell shops).....	4,500	11.0	10.4	5.2	15.7	55.1	52½
Skilled, day shift, in shell shops.....	1,000	14.6	13.6	6.9	20.5	55.5	52½
All skilled, day shift.....	5,500	11.7	11.0	5.5	16.5	55.3	52½
Skilled, night shift (except shell shops).....	1,950	5.4	5.3	2.5	7.8	52.0	62
Skilled, night shift, in shell shops.....	750	9.7	9.6	.8	10.5	8.0	55
All skilled, night shift.....	2,700	6.5	6.3	2.1	8.4	24.9	60
All skilled employees.....	8,200	9.8	9.4	4.3	13.8	31.5	55
Unskilled, day shift (except shell shops).....	3,740	10.7	9.9	7.6	17.5	45.1	52½
Unskilled, day shift, in shell shops.....	4,930	10.6	10.2	3.2	13.4	24.0	48½
All unskilled, day shift.....	8,670	10.6	10.0	5.2	15.3	34.1	50½
Unskilled, night shift (except shell shops).....	1,230	4.0	4.0	1.1	5.2	22.7	66½
Unskilled, night shift, in shell shops.....	3,150	10.5	10.2	2.7	12.9	31.1	47
All unskilled, night shift.....	4,380	8.3	8.1	2.2	10.3	21.4	52½
All unskilled employees.....	13,050	9.8	9.4	4.2	13.7	31.0	51
All employees.....	21,250	9.8	9.4	4.3	13.7	31.3	52½

TABLE V.

Grade and shift.	Number employed (approximately).	Percentage ratio of time lost avoidably to practically possible normal time.	Percentage ratio of time lost avoidably to gross normal time.	Percentage ratio of time lost unavoidably to gross normal time.	Percentage ratio of total time lost to gross normal time.	Percentage ratio of time lost unavoidably to total time lost.	Average hours (normal and overtime) worked per employee.
1	2	3	4	5	6	7	8
Women, day, in shell shops.....	2,600	8.6	8.4	1.9	10.4	19.0	42
Women, nights, in shell shops.....	1,170	12.3	12.2	1.0	13.3	7.6	42½
All women in shell shops.....	3,770	9.8	9.6	1.7	11.3	14.5	42½

TABLE VI.

Grade and shift.	Number employed (approximately).	Percentage ratio of time lost avoidably to practically possible normal time.	Percentage ratio of time lost avoidably to gross normal time.	Percentage ratio of time lost unavoidably to gross normal time.	Percentage ratio of total time lost to gross normal time.	Percentage ratio of time lost unavoidably to total time lost.	Average hours (normal and overtime) worked per employee.
1	2	3	4	5	6	7	8
Skilled, day shift...	2,530	17.3	16.5	5.1	21.6	23.4	50½
Skilled, night shift...	360	11.6	11.3	2.4	13.7	17.0	52½
Unskilled, day shift...	1,260	19.6	18.9	3.9	22.8	17.4	51
Unskilled, night shift.....	160	7.8	7.8	-----	7.8	.0	69
All employees.....	4,310	17.0	16.2	3.6	19.8	20.8	52

27. The percentage of possible time lost is high throughout, the proportion ranked as unavoidably low. A low proportion of unavoidable loss is to be expected on night shift, since employees who are obviously "off color" will, as far as possible, be kept on day work if the management is sensible; but here even on day shift the unavoidable loss is barely more than a third of the total lost time. That it has been underestimated is a reasonable conjecture, but it probably was well under half the total loss, for attendance was evidently slack. It is noticeable that the "unavoidable" proportion is markedly higher among unskilled than among skilled men on day shift except in the shell shops where (allowance being made for the women's bad time-keeping) the men's records are nearly the same for skilled and unskilled. In the very bad figures of the shipbuilding department, however, this difference is not repeated.

28. It might be expected that the most accurate records of unavoidably lost time would be those based on the records of foremen or officials who have satisfied themselves concerning reasons offered for absence. In fact, however, such records are not very trustworthy except where some superior official, e. g., a departmental manager, takes an interest in the matter, as in the department to which Table III refers. Foremen vary in strictness and sometimes in personal preference, and those employees who are trusted and know themselves to be in no danger of the tribunal often fail to report their quite valid reasons for absence. Moreover, in large factories foremen often forget to enter a note of sound reasons, which accordingly never reach the time office.

29. The payment of a bonus for good timekeeping, against which sickness does not rank, is more likely to insure good data for records by making it worth employees' while to send in certificates when they are ill. Even the payment of a bonus, however, does not guarantee absolute accuracy. Where there is a keen and reputable body of employees the few cases of dishonest certificates will be balanced by the few cases in which men forget or, having already lost time unduly, do not think it worth while to send in certificates though genuinely sick. But there remains the likelihood that some proportion of what is reckoned as bad timekeeping is due to minor ailments; and a further cause of inaccuracy arises if attendance is slack and if a number of the employees are able to earn wages much higher than those to which they are used, the result being sometimes that they are indifferent to the bonus and careless about sending in certificates. (To a certain extent the tribunals have checked such carelessness and so have indirectly improved records.) The following figures relating to about 200 men on very heavy work are an illustration: Their normal day shift was 53 hours; only three or four men were on night shift; overtime was moderate, about 40 to 60 per cent of the men averaging

nine hours each (80 per cent in June, 1915), and there was practically no work on Sundays. While they are probably a harder lot of men than those in most machine shops and the like, and while their undoubtedly bad timekeeping has very likely helped to keep down sickness, still it is most improbable that the proportion of lost time due to sickness in 1915 is accurately given in column 8. It is evident that they have been induced both to keep better time and to report sickness more carefully, though it is possible that even the 1916 figures understate the real amount of sickness.

TABLE VII.

Week ending—	Percentage ratio of time lost by bad time-keeping to practically possible normal time.	Percentage ratio of time lost by bad time-keeping to gross normal time, less leave.	Percentage ratio of time lost by sickness to gross normal time, less leave.	Percentage ratio of time lost by bad time-keeping to gross normal time.	Percentage ratio of time lost by sickness and leave to gross normal time.	Percentage ratio of total time lost to gross normal time.	Percentage ratio of time lost by sickness to time lost by bad time-keeping and sickness.	Percentage ratio of time lost by sickness and leave to total lost time.	Average hours (normal and over-time) worked per employee.
1	2	3	4	5	6	7	8	9	10
1915.									
June 2.....	13.9	13.7	1.7	13.6	2.2	15.8	11.4	15.9	51
Dec. 21.....	15.6	15.6	1.3	15.4	1.7	17.1	7.9	10.0	.....
1916.									
Apr. 4.....	9.9	9.5	4.1	9.5	4.3	13.8	30.0	31.0	49½
May 9.....	9.2	8.7	4.9	8.7	5.1	13.9	36.0	37.0	50½
May 16.....	8.5	8.1	5.0	8.1	8.0	13.1	33.3	33.3	51
May 23.....	9.9	9.3	5.0	9.2	5.1	14.4	34.9	35.7	51½
May 31.....	8.8	8.6	3.1	8.5	3.7	12.2	27.0	30.2	51
June 6.....	10.4	9.9	4.3	9.9	4.5	14.5	30.2	31.5	50

30. An easy and frequently useful test of the accuracy of sickness records is to compare the number of absences for a whole week recorded as due to sickness with the number of absences for shorter periods so recorded. It is common experience that one is more likely to be ill for a day or two than for a week, and this experience is reflected in accurate records. Thus in Table VIII, which refers to the same men as Table II, about 3 per cent of the employees lost a whole week from sickness in May and June, 1916, while nearly three times as many were sick for shorter periods. Even among the men just mentioned in Table VII the average figures for the weeks of May were—absent sick the whole week 2.9 per cent, less than the whole week 4.4 per cent. If, then, weeks lost by sickness are found in records to equal or outnumber the shorter periods, it is probable that employees are not troubling to report genuine sickness unless it is worth their while for other reasons to obtain certificates. For example, in one factory 134 men are recorded as losing in nine weeks of August, September, and October, 1916, 17 weeks or longer periods by sickness and only nine periods of less than a week. This was a case in which the payment of a (rather small) bonus for good timekeep-

ing to a limited number of examiners, specially important mechanics etc., had very little effect; the 134 whose records were examined by Mr. S. H. Burchell and myself lost in those weeks 10.6 per cent of possible normal time, allowance being made for leave, accidents, and the like, 2.1 per cent being attributed to sickness and 8.5 per cent regarded as avoidable. Timekeeping was certainly bad, but the test suggested makes it certain that a considerable amount of sickness remained unrecorded, despite the bonus.

TABLE VIII.

Week ending—	Percentage of employ-ees losing the whole week by sickness.	Percentage of employ-ees losing any time by sickness.	Average number of hours lost by each employ-ee who lost less than the whole week.
1915.			
June 2.....	2.2	9.2	18
1916.			
Apr. 4.....	3.7	14.9	14½
May 9.....	3.4	11.6	16½
May 16.....	3.3	12.0	16½
May 23.....	3.4	12.9	17½
May 30.....	3.3	12.1	16½
June 6.....	3.0	12.4	18½

31. Another test of the accuracy with which sickness is discriminated from bad timekeeping [is to] inquire whether the time recorded as avoidably lost in days is abnormally high in proportion to the time recorded as avoidably lost in "quarters," where the two-break day shift is worked; for in that case the days reckoned as avoidably lost very likely include some lost by sickness. This test is useless if attendance is very slack and men are willfully missing days in great numbers;¹ but when timekeeping is reasonably good the loss before breakfast may be expected to be at least 35 per cent of the total avoidable loss. If it is less than that, and if the ratio of unavoidable loss to total loss is also low, the sickness record may be regarded with suspicion.

32. My conclusions may be summarized as follows:

(1) Sickness records which suggest that even the best managed factories are health resorts are probably untrustworthy. Nearly all records understate, and most records understate greatly, the proportion of lost time due to sickness and other unavoidable causes.

(2) The main reason for the unsatisfactory sickness records is employers' distrust of medical certificates.

(3) On other and practically urgent grounds it is imperative to improve the form and the credit of medical certificates.

¹ Or if there is no work owing to lack of material, and men are not discouraged from taking days off, since if they attended and were refused work on consecutive days they might claim leaving certificates.

(4) The best tests of the accuracy of sickness records are to inquire:

(a) Do the curves of bad timekeeping and sickness coincide in direction?

(b) Is the number of whole weeks lost through sickness abnormally high when compared with the number of shorter periods similarly lost?

(c) Is the number of days lost through sickness abnormally high when compared with the number of quarters similarly lost?

An affirmative answer to any of these questions, unless explicable otherwise, gives good reason for supposing the rate of sickness to be understated.

More definite conclusions are not to be expected with the present unsatisfactory medical certificates and consequently defective records. But it should be noted that, while in some places and in some trades timekeeping has really been slack, yet the underestimation of sickness and unavoidable absence generally has led to much misinformed and unjust rhetoric about the lethargy and irregularity of the whole body of employees in controlled factories. The chief offenders in this matter, however, have not been employers.

(B) SOME CAUSES OF FLUCTUATION IN SICKNESS CURVES.

33. The following notes are not concerned with a comparison between different factories or different occupations, nor with those factors of sickness that may be regarded as constants in any given factory, but with a few of the variables which produce conspicuous temporary changes in the rate of sickness in any given factory.

(1) *Climatic conditions.*—It is, of course, a familiar fact that fluctuations in the sickness rate are mainly seasonal. The graphs in Diagram II are based on the statistics of a large and very important trade-union concerning the percentage of members on sick benefit in each month of the years 1910 to 1915. That the curves for different years may be comparable one with another, the mean of the percentages of members on sick benefit in the months of each year has been found and taken as = 10, and the variation of each month from the mean for the year is shown as a variation from 10. The curves are comparable, therefore, only in respect of their form, and not in respect of the total amounts of sickness in the several years. There is added a typical curve for the six years, showing the mean monthly variations from the mean of the means of these years. The rate of sickness is always above the mean in January, February, March and April, and occasionally so in November; in the remaining seven months it is always below the mean; July and August usually show

DIAGRAM II.

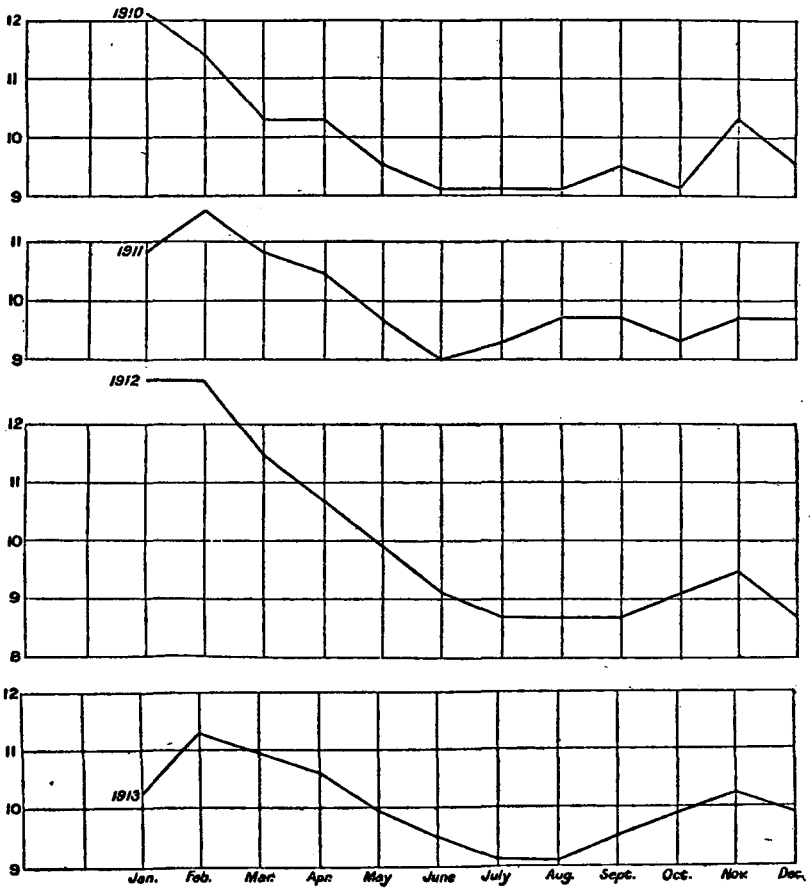
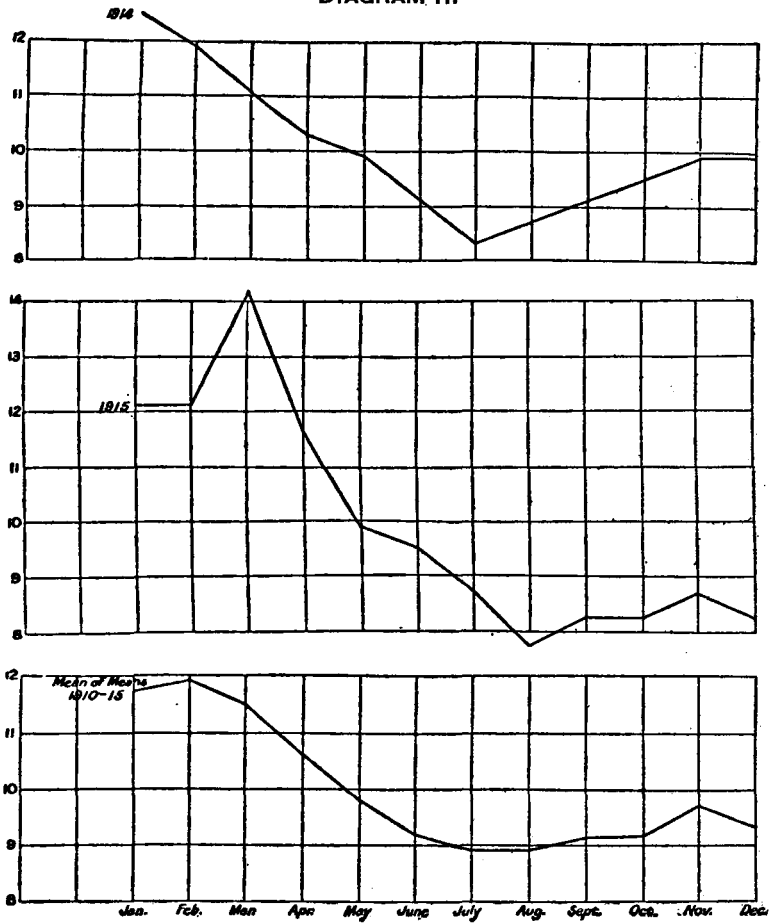


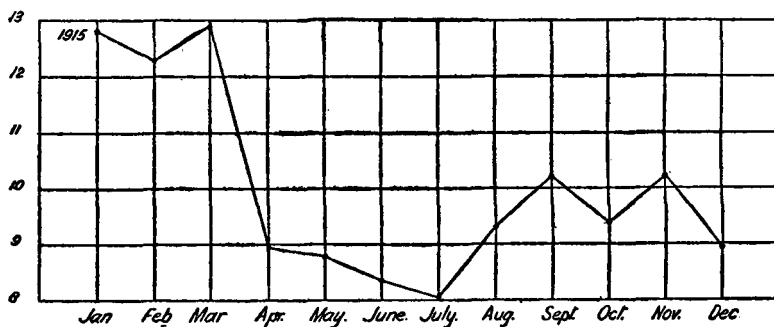
DIAGRAM II.



least sickness.¹ Despite minor irregularities and great differences in the amount of mean variations, the curves are generally very similar, especially in respect of the fall in late spring and early summer and of the tendency to rise in November.

The figures upon which these curves are based refer to all parts of the country. Diagram III refers to a factory near London, with

DIAGRAM III.



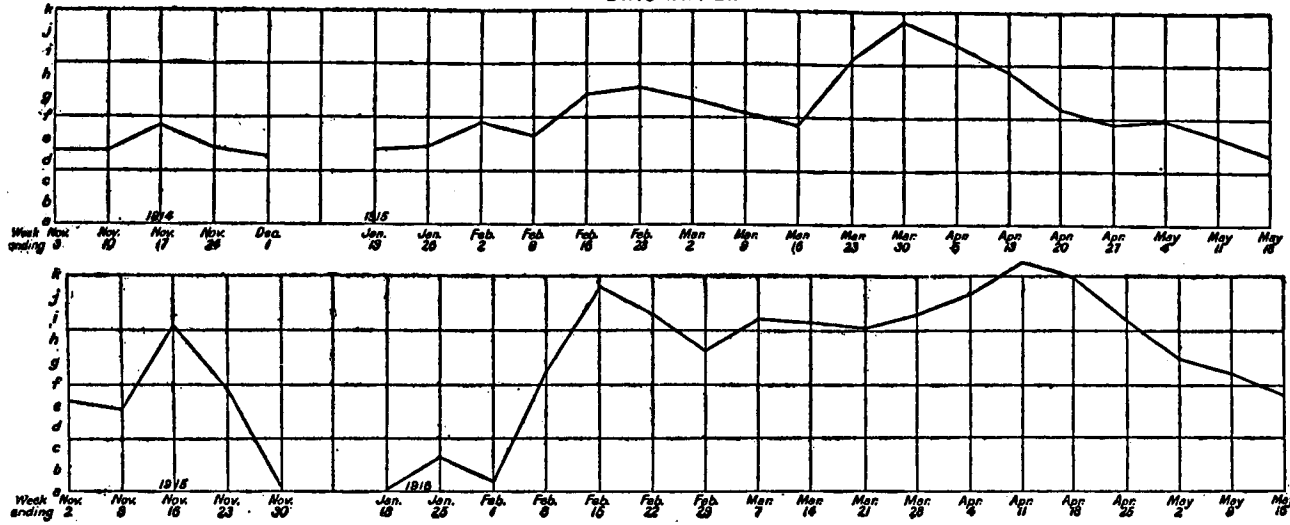
about 8,000 employees on light work, and shows the fluctuations in the sickness rate for 1915, calculated in the same way. The general features are similar, though the effect of the onset of spring is more marked, and the hot weather of August has had an unfavorable effect. The marked rise in the sickness rate for September does not appear to be genuine, but to have been the result of air raids.

In Diagram IV are given extracts from the curves of sickness among over 900 males in a factory in northeast England which further illustrate the close dependence of health on climatic conditions. They represent absolute numbers of employees sending in medical certificates, but as only the form of the curves is here of interest the absolute numbers are replaced by letters. The curves reflect the conditions of weather with remarkable fidelity. In both Novembers the weather was bad in the middle of the month and then improved again. In both years, as is usual in that district, mid-winter was less inclement than the later part of February and March. In 1916 January was unusually mild and bright, but the weather broke in the first part of February and remained cold and for the most part wet and sunless till the middle of April. In 1915 the advent of springlike weather was at the beginning of April, and correspondingly the curve declines a fortnight earlier than in 1916.

The general influence of climatic conditions upon health being admitted, it follows that if the sickness curve of a factory, though

¹This is probably due in part to holidays. In some localities and in many kinds of work the hot weather brings an increase over the sickness rate of June. Holidays may also account in part for the low December levels.

DIAGRAM IV.



calculated with reasonable accuracy, does not respond to considerable changes in the weather, or fluctuates independently of the weather, there are present other determining conditions which deserve consideration by the management.

(2) Of these, one of the most conspicuous, though not of the most important, is the approach of holidays, which very frequently occasions a reduction in the sickness rate. This reduction is most marked before Christmas, and by no means always occurs before other holidays. The following table shows the character of changes before holidays in the sickness curves of two factories, one near London, the other in northeast England. (R = rise in sickness rate, F = fall, S = steady.) The week in which the holiday actually occurs or begins is not included, as for a number of obvious reasons the records of the broken week itself are unreliable; as a rule, though not always, it is marked by a fall in the curve.

TABLE IX.

Firm.	Year.	Before Easter.		Before Whitsun.		Before King's birthday.		Before race week (end of June).		Before August holiday.		Before Christmas.	
		Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.	Second week.	First week.
I.....	1914	R	R	R	R	R	R	.....	.....	S	R	F	F
I.....	1915	F	F	(¹)	(¹)	.....	.....	.....	.....	F	F	F	S
II.....	1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	F
II.....	1915	R	R	F	F	.....	.....	R	F	F	R	F	F
II.....	1916	F	F	.....	.....	.....	.....	.....	.....	.....	.....	.....	F

¹ No holiday.

With these data may be compared the marked fall of the sickness rate for week ending August 23, 1916, in Table II; but it is impossible to say how much of this fall is attributable to approaching holidays and how much to restriction of Sunday labor in the preceding fortnight.

The drop in sickness curves before the longer holidays, and especially before Christmas, is sometimes taken to argue, if not malingering, at any rate an unjustifiable readiness of employees to "go sick" at other times; they can come down to work when they want to earn money before the holidays, and therefore they ought to have come down in previous weeks. This conclusion, though no doubt true of some persons in any large body of employees, does not follow from the data and is probably unjust if generally applied. For, in the first place, it sometimes happens that the Easter and Christmas holidays occur at a time when the sickness curve would in any case decline—Easter, when spring is setting in, and Christmas, when the characteristic outbreak of sickness is over that occurs in mid-Novem-

ber, and people are becoming more acclimatized to the weather of late autumn and early winter. And, secondly, it does not follow because a man, while feeling unwell, goes down to work when a holiday is coming within a week or two, that therefore he would be judicious or would be able to carry on were he, under the same conditions of health, to go to work with no prospect of a break.

(3) A more important factor of change in a sickness curve is a holiday just past. It should cause a fall, and usually does so, as is shown in the next table, in which the sickness rate of the week following that in which the holiday occurs or ends is compared with the rate of the week preceding that in which the holiday occurs or begins.

TABLE X.

Firm.	Year.	After Christmas and New Year.	After Easter.	After Whitsun.	After King's birthday.	After race week.	After August holiday.
I.....	1914	.....	R	F	F	.....	F
I.....	1915	R	F	.....	.....	.....	R
I.....	1916	F	.....	.....	.....	.....	.....
I.....	1915	R	.....	R	.....	F	F
II.....	1916	F	F	.....	.....	.....	.....

A very striking example of the restorative effect of a holiday is to be found in Table II, when the sickness rate for the three weeks immediately following a considerable holiday at the end of August and beginning of September is 4.2 per cent, as against 5.4 per cent in the week immediately preceding the holiday, and 8.6 per cent in the week before that; it had not been so low for many months previously.

It follows here that if the sickness curve fails to respond to a holiday, especially to a break of several days, and if its steadiness or rise can not be attributed to worsened climatic conditions, epidemics of influenza, or the like, there is reason for receiving employees' reports of sickness with caution, and sometimes with suspicion.

(4) Patriotic enthusiasm certainly affects sickness curves. There are many employees who will keep at work when they are convinced of its urgency, even though they are unwell and really need the rest which they take when the urgent demand for their labor is past. This factor can seldom be illustrated by figures but an example will be found in Table II; the reduction of overtime in the first half of August, after a long period of very heavy pressure, indicated that some relaxation of effort was allowable, and not only the bad timekeeping but the sickness rate also rose to a very high figure. Several managers have expressed their sense of the devotion of many of their employees, though some of them (but some only)

consider that the readiness to "go sick" on comparatively slight grounds is now again more frequent than it was in the early stages of the war, and that there is now little difference in this respect from times of peace. For this, in addition to the familiar difficulty of maintaining an exalted mood indefinitely, there are in some cases two special reasons, firstly, that long hours of work have diminished the men's resilience, and, secondly, that they have too often been told that a piece of work was specially urgent and been pressed to stick to it against the interests of their health, and then have seen the completed product of their labor lying for weeks in the factory before removal. This failure to remove what has been made at high pressure produces incredulity and has a lamentable effect upon attendance.

(5) The effect of long hours, much overtime, and especially of Sunday labor, upon health is undoubtedly most deleterious. In one factory in the Midlands, when there was much Sunday work in the spring, no fewer than 22 per cent of the men were at one time sick; but the number of men on the sick list in August, when Sunday work had been much reduced (though overtime on week days remained heavy), was only a trifle over 4 per cent of the whole body. This enormous reduction is partly attributable to the change of season, but the figures of a neighboring factory showed that in that district last spring, though inclement, was not abnormally unhealthy, and I see no reason to doubt the manager's view that the weather was less accountable than the restriction of Sunday work.

Excessively long hours, and especially Sunday work, are similarly responsible for the high sickness figures in Tables II and VIII and for the remarkable reluctance of the sickness curve to drop with the improving weather. Neither the loss of men to the forces, which took place chiefly early in the war, nor the introduction of a small number of women (about 40) accounts for the rise between 1915 and 1916, and the 1915 figures themselves are not particularly low. There appears to be in these figures clear evidence of increasing strain due to incessant work.

Further analysis, however, discovers a striking difference between different departments in this factory. The following table refers to a body of about 180 extremely keen and steady men in heavy machine shops. In June, 1916, their average age was about 39 years, but 40 of the men were between 50 and 70 years of age. Roughly, 80 were skilled, 60 semiskilled, and 40 unskilled. The night shift was large and overtime was severe, especially on Sundays. The amount of time lost avoidably was wonderfully low, considering the nature of the work, but the total time lost shows a great increase, owing to the remarkable rise in the sickness rate.

TABLE XI.

Week ending—		2	3	4	5	6	7	8	9	10
1		Percentage ratio of normal hours worked on night shift to total normal hours actually worked.	Percentage of employees on overtime at all.	Percentage ratio of hours worked overtime to practically possible normal hours.	Percentage of employees working on Sunday.	Percentage ratio of hours worked on Sunday to total hours worked overtime. ¹	Percentage ratio of hours lost by bad timekeeping to practically possible normal hours.	Percentage ratio of hours lost by sickness to gross normal hours less leave.	Percentage ratio of hours lost by bad timekeeping and sickness to gross normal hours less leave.	Average hours (normal and overtime) worked per employee.
1915.										
June 2.....		43.8	91.7	23.9			1.3	3.1	4.5	65½
1916.										
Apr. 4.....		42.9		20.3			2.3	7.8	9.9	57½
May 9.....		42.3	87.0	21.1			1.4	6.4	7.3	62
May 16.....		41.5	85.9	20.8			1.1	7.0	8.1	61½
May 23.....		41.4	83.5	21.0	81.2	71.0	1.6	8.3	9.9	61
May 30.....		41.5	79.8	20.2	74.8	67.5	2.4	8.0	10.2	59½
June 6.....		40.0	83.6	19.6	81.9	68.8	1.4	8.4	9.7	60
June 13.....		43.6	83.2	19.6	80.0	73.0	1.1	8.3	8.4	63½
June 20.....		43.2	83.3	19.2	80.0	74.5	2.7	6.8	9.3	59½

¹ In the earlier weeks of these records Sunday overtime, though worked, was not separately entered.

The next table concerns between 300 and 400 men on heavy work in shops with considerable smaller night shifts and Sunday shifts. The record is in all respects less regular, but there is again an increase in the sickness rate, as well as in bad timekeeping, despite some reduction of overtime.

TABLE XII.

Week ending—		2	3	4	5	6	7	8	9	10
1		Percentage ratio of normal hours worked on night shift to total normal hours actually worked.	Percentage of employees on overtime at all.	Percentage ratio of hours worked overtime to practically possible normal hours.	Percentage of employees working on Sunday.	Percentage ratio of hours worked on Sunday to total hours worked overtime. ¹	Percentage ratio of hours lost by bad timekeeping to practically possible normal hours.	Percentage ratio of hours lost by sickness to gross normal hours less leave.	Percentage ratio of hours lost by bad timekeeping and sickness to gross hours less leave.	Average hours (normal and overtime) worked per employee.
1915.										
June 2.....		32.9	77.9	19.0			3.3	5.2	6.4	61
1916.										
Apr. 4.....		30.1		15.3			4.6	7.1	11.4	55½
May 9.....		29.4	75.3	16.9			3.7	3.4	6.9	57
May 16.....		33.1	75.2	17.4			2.5	4.9	7.3	59½
May 23.....		36.6	57.8	15.4	55.5	75.6	4.0	6.5	10.2	56½
May 30.....		33.5	69.6	16.9	68.5	72.9	5.3	5.8	10.3	57½
June 6.....		33.6	58.6	15.2	57.2	73.2	4.2	6.1	10.1	56½

¹ In the earlier weeks of these records Sunday overtime, though worked, was not separately entered.

On the other hand, in four light shops with about 200 employees, whose figures follow, the record for 1916 compares on the whole favorably with that for 1915. The sickness rate is rather high throughout, but it shows a tendency to respond to the influences of improving weather and decreasing overtime, with the result that the average hours worked at the beginning of June, 1916, are nearly as many as in the heavy machine shops, though far more overtime was worked in the latter.

TABLE XIII.

Week ending—	Percentage ratio of normal hours worked on night shift to total normal hours actually worked.	Percentage of employees on overtime at all.	Percentage ratio of hours worked overtime to practically possible normal hours.	Percentage of employees working on Sunday.	Percentage ratio of hours worked on Sunday to total hours worked overtime.	Percentage ratio of hours lost by bad timekeeping to practically possible normal hours.	Percentage ratio of hours lost by sickness to gross normal hours less leave.	Percentage ratio of hours lost by bad timekeeping and sickness to gross normal hours less leave.	Average hours (normal and overtime) worked per employee.
1	2	3	4	5	6	7	8	9	10
1915.									
June 2.....	35.3	84.6	23.5			3.5	6.6	9.9	60½
1916.									
Apr. 4.....	40.8		17.4			5.0	7.8	12.1	52½
May 9.....	34.9	65	15.8			2.9	7.3	10.0	57
May 16.....	35.5	66.8	16.7			2.8	6.0	8.7	57½
May 23.....	34.3	58.9	14.4	54.1	68.4	3.2	5.7	8.8	57
May 30.....	35.2	60.2	15.2	58.9	72.8	3.1	5.5	8.4	59½
June 6.....	39.8	60.7	13.1	59.9	69.1	3.8	8.9	7.6	59½

(C) SICKNESS BEFORE AND SINCE THE OUTBREAK OF WAR.

34. Comparisons of figures of sickness before and since August, 1914, are hard to make and of little value when made, because, even in factories which have not greatly expanded, the groups of employees would be constituted to a very great extent of different persons. Right at the beginning of the war a large proportion of the most vigorous and robust men left the factories, being reservists, territorials, and so on; many others volunteered; and only a small proportion (say 10 per cent) of the most necessary men had, last summer, returned from the army to civil occupations. In one factory 42 per cent of the men between 18 and 35 left at the outbreak of war; another had by July, 1916, lost over 800 out of the whole body of about 1,800 men and recovered 85; another had lost over 180 out of 800 and recovered 20; and so on.

35. The loss of so many of the physically strongest men has meant their replacement by boys, women, older men, and physically inferior men. One firm writes in a very carefully considered letter that some of their men "had not done any regular work for years and are probably not physically fit for even a normal working week. One or two of them have been receiving parish relief, and one has been in the workhouse." Aged, decrepit men to whom charitable persons used to give occasional light jobs in a garden now form part of the regular body of employees in controlled establishments.

36. An increase in the sickness rate is therefore to be expected, the newcomers being less robust and frequently unused to the noise and atmosphere and hustle of factory life. The increase has certainly occurred where and while very long hours have been worked, especially where work has been heavy in character. It has also occurred most conspicuously among officials and foremen. But where hours have been reasonable, and where, having been long, they have been reduced, it seems that, on the whole, sickness has been lower than in normal times, especially among those engaged in light work.

The figures of one large trade-union show that the percentage of members on sick benefit in 1915 (after allowing for those serving in the forces) was lower than in any of the five preceding years; and though the number of members had greatly increased, and they were no doubt largely different persons, these changes merely reflect the changes which have taken place in factories and do not detract from the value of the evidence.

Similarly, in a large factory in the Midlands, while the number of men coming under the State insurance scheme had decreased by a sixth only, as between the spring months of 1914 and those of 1916, the amount paid in sick benefit decreased by a fourth; and under a voluntary scheme the amount paid decreased by over a fourth, though the membership had actually increased.

37. The explanation of this somewhat unexpected result lies in the fact that periods of good employment are periods of decreased invalidity. This law is excellently illustrated by the too little known curves of attendances at the out-patients' department of the London Hospital, which the superintendent (Mr. H. C. Barker, M. A., LL.B.) has kept for the last eight years, bringing them into relation with the general curve of unemployment published in the Board of Trade Labor Gazette, and with a special curve of unemployment in the London district so long as figures for the latter were avail-

able. I have to thank Mr. Barker for his kindness in allowing me to consult these valuable diagrams. From them it is apparent that, when allowance has been made for seasonal fluctuations, holidays on which the department is closed, and other temporarily distracting influences, there is regularly an increase in the number of patients in the general medical department during protracted periods of unemployment, and a diminution of their number to a certain minimum as employment recovers. For instance, during 1908, when the percentage of unemployment rose from about $5\frac{1}{2}$ to over 9, the monthly attendances rose from 5,000 to nearly 7,000; in 1909 unemployment fell gradually to about $6\frac{1}{2}$ per cent, and the attendances to under 6,000; about midsummer, 1913, the figures had dropped after various fluctuations to 1.9 per cent and 3,600; early in 1914 both curves rose again; and in 1915, as unemployment fell away to under 1 per cent, the attendances were once more reduced below 4,000, and have since remained remarkably steady at a minimum determined by other factors than employment. It is also noticeable in Mr. Barker's curves with what regularity the figures of attendances, unless already at this minimum, drop in each year during several weeks preceding Christmas, these weeks being a busy season in that part of London. The attendance of out-patients at a hospital are, of course, not directly comparable in all respects with the figures of sickness in factories, but they are in part affected by the same influences, and if good employment improves the health of the whole working-class district of east London, we should expect its effect to be still more apparent in factories themselves. What may cause surprise is that its effect has been so great as at least to counter-balance that of the withdrawal of a large proportion of the strongest and most healthy men from factories. But employment has been good, not only in the sense of being general, but also as being well paid. The explanation therefore is partly that employees have been too busy to visit the doctor or to meditate on the state of their health, and partly that they have been more amply fed and with more nutritious food, more warmly clad, and (not least) more adequately shod; so that high wages, while they may (as is often alleged) have produced some loss of time by way of slackness, have prevented a far greater loss by way of sickness. Not a little credit, too, is due in many places to the efforts of the welfare supervisors, especially among women, and to the provision of canteens where food may be obtained at reasonable prices.

III. LOST "QUARTERS."

(A) GENERAL REMARKS.

38. Work before breakfast is a topic closely connected with industrial sickness, for there is evidence, as will be seen below, that the abolition of early hours often results in an improvement of health. It is well known that, when the day shift is worked on the two-break system, a large proportion of time avoidably lost is commonly lost before breakfast. The following table illustrates this fact:

TABLE XIV.

Class of work. 1	Period. 2	Number of employees considered (approximately). 3	Normal day shift week. 4	Overtime.		Hours before breakfast. 7	Percentage of practically possible day shift hours lost avoidably. 8	Percentage of such avoidable loss on day shift that is lost before breakfast. 9	Percentage of practically possible early hours lost. 10
				Amount. 5	When worked. 6				
I. Light (females).....	May-October, 1916	900	Hours. 53½	Considerable to end of July; little since.	Evenings.....	A. M. 6.20-8			17.3
II. Light.....	May, 1916.....	1,400	53	Considerable.....	Evenings and Saturday.	6.45-8.30	2.7	35.0	4.9
III. Light.....	May and August, 1916 (average).	1,300	53	..do.....	..do.....	6.45-8.30	c. 3.0	45.3	7.9
IV. Medium.....	August, 1916.....	300	53	Moderate.....	Evenings.....	7-9	2.8	54.1	6.6
V. Medium.....	Year 1915-16.....	230	54	..do.....	..do.....	6-8.15	c. 3.3	c. 95.0	c. 12.7
VI. Mixed.....	February - May, 1916.	9,000	53	Heavy.....	Chiefly Sunday...	6-8	* 14.0	20.0	c. 13.5
VII. Fairly heavy.....	Year 1915-16.....	900	53	Moderate (fluctuating).	Chiefly evenings...	6-8	11.2	29.0	* 14.3
VIII. Heavy.....	October, 1916.....	120	53	Very heavy.....	Evenings and Saturday.	6-8	6.1	58.0	15.7
IX. Mixed.....	August - October, 1916.	130	53	Considerable.....	..do.....	6-8	* 8.6	43.0	c. 17.0
X. Heavy.....	May, 1916.....	1,200	53	Very heavy.....	Evenings and Sunday.	6-8	5.9	57.0	14.6
XI. Very heavy.....	..do.....	200	53	Moderate.....	Evenings.....	6-8	9.0	53.0	21.0
XII. Very heavy.....	..do.....	250	53	Very heavy.....	Evenings and Sunday.	6-8	9.5	51.0	21.4
XIII. Heavy.....	May-June, 1916...	1,000	53	Moderate.....	Chiefly evenings...	6-8	* 5.6	35.9	c. 12.0
XIV. Very heavy.....	..do.....	400	53	Considerable.....	..do.....	6-8	* 6.0	58.5	c. 18.5

¹ Percentage of practically possible "quarters" only; shorter periods not recorded.

² Percentage of gross normal day shift hours lost for any reason.

³ Percentage of all practically possible hours; no allowance for night shift.

⁴ Percentage of gross normal hours (day and night) lost for any reason.

In this table Nos. III, IV, V, and Nos. X, XI, and XII, together, refer to entire factories; in No. I a comparatively few men are omitted, and in Nos. VI and VII a comparatively few women; Nos. II, VIII, IX, and XII, and XIV, refer to some shops or departments only in large factories. All the factories are situated in populous areas except No. V, which is a small country town.

39. In column 9 the percentage of avoidable loss on day shift that goes before breakfast is slightly understated for No. IX, where it has been impossible to distinguish day-shift hours from all practically possible hours; it is considerably understated for No. VII, since the firm's figures undoubtedly exaggerate the amount of avoidable loss by underestimating the amount of sickness, and do not record losses of less than a full "quarter"; and it is equally understated for Nos. VI, XIII, and XIV, where the loss in "quarters" is compared with total lost time and not with avoidable lost time only. The figures in this column, therefore, are rough, and probably rather too low throughout, despite the fact that sometimes employees coming a few minutes late are recorded as losing the full quarter hour or half hour which they are fined. Allowance made for underestimation, it is clear that loss of early hours in all these 10 factories constitutes at least 30 per cent of the so-called "avoidable" loss on day shift, and probably more than 30 per cent throughout, while sometimes the proportion is so high as to be the main determinant of the curve of bad timekeeping.

40. It must be borne in mind, however, that not all loss of early hours is really avoidable. It often happens that a large number of the employees live at a distance from the factory, and any breakdown in transport may entail loss of time. As would be expected, it is often the most keen and sensible men who choose to live well away from their work, and on the whole they may lose less time than those who live near by; still, they are bound to lose quarter hours and half hours occasionally through no fault of their own, which go to swell the total loss in factories which fail to distinguish unavoidable lateness very carefully. At the present time, of course, factories which have greatly increased their numbers are often employing very many operatives, keen and slack alike, who can not find lodging near their work.

41. Further, part of the loss of quarters is in some cases really due to fatigue and to minor ailments. The man who is "fagged" and "off-color" after long hours of work, the man who has a heavy cold on a wintry morning, the man who suffers from rheumatism and has to start from home at 5 o'clock through the rain, may sometimes lose a quarter unnecessarily, but very often they save themselves from a more serious loss by occasionally "sleeping in." The officials of carefully managed firms are generally well aware that not all bad timekeeping is morally bad, and in their minds make allowance for this fact; but in records, as a rule, the point is not made apparent.

42. Column 10 of the same table, giving the percentage of practically possible early hours lost, refers only to loss of quarters or shorter periods as such, and does not include the loss of a quarter involved in the loss of a half day or day; in factories No. I and No. VII

only full quarters are accounted, the loss of shorter periods not being recorded. In Nos. VI, XIII, and XIV a conjectural allowance has been made for sickness, etc., in arriving at the percentage, so as to make the figures comparable with the rest, but they are to be taken as approximate only.

43. It will be noticed that the loss of possible early hours is much less in the factories which start after 6 a. m. than in those which start at that hour, and this appears to be the general rule, though of course there are exceptions. In only one case do I happen to have obtained figures from a factory starting work at 6 o'clock where the percentage of possible quarters lost was low, and those figures were not sufficiently accurate to be included in the above table. The factory was engaged on heavy work, with considerable overtime but little night shift. In May last roughly about 3.6 per cent of practically possible day-shift hours were lost avoidably; of this loss 41.5 per cent occurred before breakfast, but as the quarter was $2\frac{1}{2}$ hours, this means a loss of only about 5.3 per cent of possible quarters. In March the loss had been much heavier, and altogether these figures seem to be exceptional rather than typical.

44. Officials are often inclined to surmise that if their rules about late entry were stricter, when they are easy, or more lax, when they are strict, attendance would improve. The arguments for and against either course are obvious. The tendency during the war has been toward a relaxation of rules, especially when a large number of the employees live at a distance. In point of fact, however, there does not seem to be any normal relation between degrees of punctuality and degrees of strictness or laxity in rules. On the whole, experience seems to favor rather strict rules combined with a reasonable willingness to make exceptions in case of transport breakdown or other unavoidable accident; but in large factories this is difficult to arrange, and even in small factories strict rules are not always successful. E. g., No. V, above refers to a small factory, most of whose employees live near by; the rule is that after 6 a. m. up to 6.15 a man is counted as having lost half an hour, and after 6.15 can not enter till 9; most of the men are time workers, and in addition to losing their time rate, late comers are (by arrangement between the firm and employees) fined for the benefit of the men's sick club; and yet the percentage of time lost before breakfast is high, practically all the avoidably lost time going in the early hours.

45. In some of the factories whose results are tabulated above the proportion of lost quarters is higher than in normal times, and this for four principal reasons:

First, employees have been taken on who are unused to factory life, and some of whom are too unstable either physically or morally or in both respects to work full hours.

Secondly, dearth of men, especially in some skilled heavy trades, compels employers to tolerate irregularity which would be punished by dismissal in time of peace.

Thirdly, the present darkness of the streets on winter mornings militates in some places against punctuality.

46. The first and second reasons apply to lost time generally, but especially to lost quarters, and against them must be set regularity above the normal on the part of the best and keenest employees. The effect of overtime on lost quarters is difficult to determine at all precisely. The different ways in which overtime may cause loss of normal time have already been mentioned; here the only question is how far it necessitates lost quarters by overstrain. Evidently, if a person by "sleeping in" occasionally prevents a breakdown in health which would mean a much longer absence, the loss of a quarter now and then may be entered as bad timekeeping, but is really commendable.

47. Now in some cases where heavy overtime is worked the lost quarters are partly attributable in this way to fatigue and reasonable prudence. Thus, e. g., the men in heavy machine shops recorded in Table XI, whose overtime hours in May were over a fifth of their practically possible normal hours, and whose average loss of such normal hours by bad timekeeping in that month was only 1.6 per cent (or a little over three-quarters of an hour a man), made on an average 71 per cent of that loss before breakfast (or about 36 minutes a man). There is no doubt in the case of these amazingly steady workers that the bulk of this loss (which equals 5 per cent of possible early hours) is really unavoidable. As was pointed out on page 6, the same is probably true of a proportion of the quarters lost by the whole body of employees recorded in Table II. At the same time it can not be argued that overtime accounts for the majority of lost quarters. If it did, we should find (1) reduction of overtime constantly accompanied by a drop in the number of latecomers, and we should probably also find (2) some relation between the days on which overtime is worked and the days on which most quarters are lost. Frequently, however, no such connections can be traced. Thus:

(1) In the factory whose figures are given under No. I in Table XIV, the women were up to the end of July working $2\frac{1}{2}$ hours overtime on three or four evenings each week. (The normal day shift ended at 5.30; they had then, when on overtime, $\frac{1}{4}$ hour for tea, which was provided free, and worked on from 5.45 to 8.30.) It might have been expected that cessation of overtime would have reduced the number of quarters lost, especially as over 50 per cent of the girls live at a distance, with very poor transport facilities; as a matter of fact, however, the attendance in the morning decreased in August, and showed no improvement even in September after a holiday. Again, the men recorded in No. XI of the same table,

working moderate overtime, lost many more quarters than those in No. X, and nearly as many as those in No. XII, both working very heavy overtime.

(2) The days on which quarters are principally lost bear no relation to those on which overtime is worked. Monday is universally the worst day; as a rule the morning after the day to which pay is accounted is next to it in loss of quarters. The day-to-day curve of lost quarters is sometimes remarkable for the regularity of its movements. In Diagram V the absolute figures, which are high, are replaced by letters. Pay in the factory referred to is accounted to Tuesday; Monday is the worst day, Wednesday comes next to it, and Saturday (being a short shift) is the best. The curve has had this form for years past; this extract from it refers to four weeks in May and June, 1916.

One curious result of this selection of days is that a holiday on Monday is apt to lower, and a holiday on Saturday to raise, the weekly percentage of time lost avoidably. Monday is from this point of view the most economical full day for a holiday.

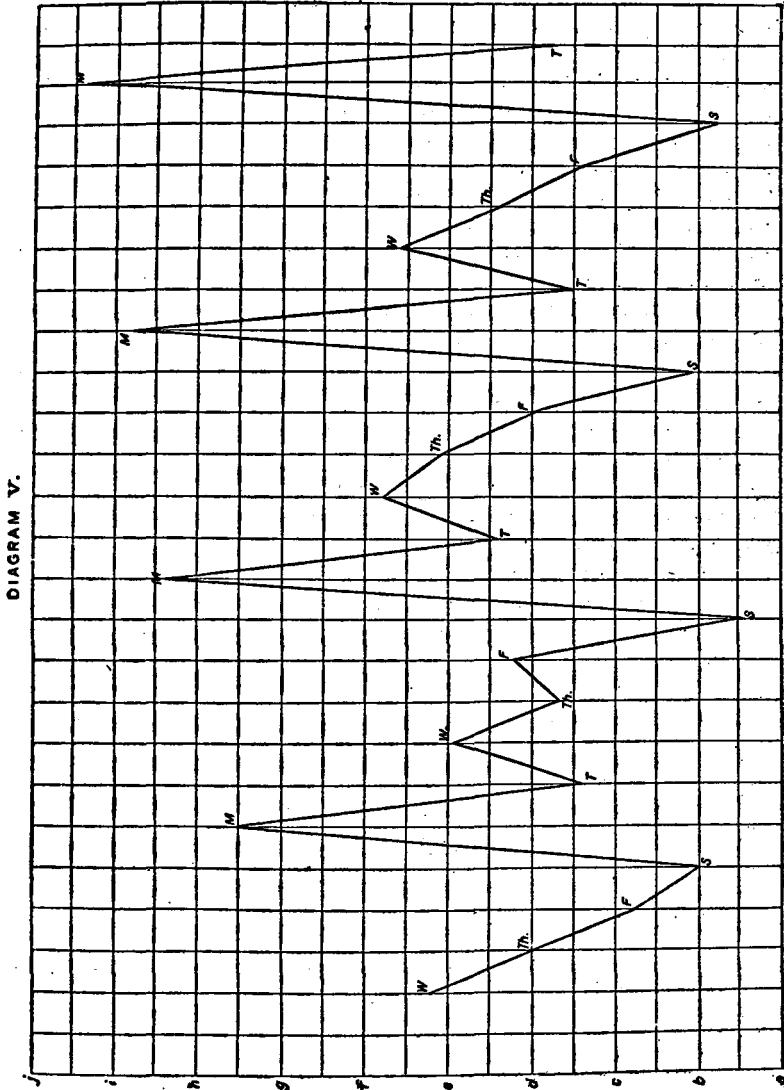
48. The regularity with which a greater number of quarters is lost on certain days indicates deliberate choice of those days, and the preference for "sleeping in" on Monday, even when there has been no Sunday shift, disproves any direct connection between overtime and much of the loss of early hours. It is, of course, true that a man who feels "fagged" or "off color" may to some extent choose his peaceful mornings with other considerations in view besides his need of rest, but if definite fatigue were the main motive, the tendency would be for most absences to occur in the second part of the week among men not engaged in work on Sunday. Another negative argument is the heavy loss of quarters on the day after a general holiday. The true motive, there, as on Mondays, is the drag of the flesh against beginning the same old grind again.

(B) ONE-BREAK AND TWO-BREAK SYSTEMS.¹

49. Seeing that in the factories quoted in Table XIV the best results are obtained when work is started later than 6 a. m., the further question suggests itself whether the two-break system would not be better abolished. The mere number of absences, whether avoidable or not, is by itself a serious matter. It involves considerable disorganization; sometimes a night-shift man has to be kept at a machine on overtime rates when he ought to be in bed; sometimes a man has to be brought from other work to a vacant machine; frequently the supply of material to a further stage in manufacture is retarded.

¹ As hereafter used, the term "one-break system" means starting work after breakfast, and the term "two-break system" means starting before breakfast. The terms have no reference to what may be the optimum number of subsequent breaks.

50. But this is only part of the objection to the system. It is only a minority of persons that can put out their best work before having a proper meal in the morning. One manager observed that when



he was in the shops he had calculated his own output and found that, even when he was equally keen and interested, it was only about a third in the early hours of what it was after breakfast. In

heavy works this point may be obscured, and men will sometimes argue for early hours on the ground that their best work is done then. But, of course, the comparison must be between the first few hours of work when begun before breakfast and the first hours when begun after breakfast, not between the first couple and the second couple of hours on the same day.

51. A third objection to the two-break system is that every break means some waste of time before and after. Attention is apt to be diverted from the work in hand to the food's condition some time before the interval, and after the interval a shop generally takes a little time to get into full swing again. This waste of time may indeed be diminished by the provision of a breakfast canteen or by very efficient arrangements for warming the breakfasts, but power records are apt to show a gradual drop in the half hour before breakfast and again a gradual rise in the half hour after it. Fourthly, the much later entry of the superior officials has a bad moral effect upon the operatives. Fifthly, in the absence of superior officials the foremen's supervision is often lax. Lastly, lost quarters are apt to lead to lost days, as is shown by the figures of firm D below.

(1) DETAILS OF FACTORIES.

In view of these objections a certain number of firms have in recent years gone over from the two-break to the one-break system, while there are others that have throughout worked on the latter system, as, indeed, has long been done in some factories, especially those controlled by Sir William Mather and Sir Robert Hadfield. The following notes concerning some such firms contain figures which may be compared with those in previous tables.

Firm A.—Light work (textile).—Two factories in the same town. Under the old system work began at 6 a. m. and the first break was at 9 o'clock; pieceworkers worked 55 and timeworkers 55½ hours a week, the odd half hour being used for cleaning up. Some years ago hours were reduced to 49 and 49½ a week, with shifts as follows:

Monday to Friday, 8–12.30. 1.30–6.

Saturday, 8–12.

There is no night shift.

In the first factory the following records compare the absenteeism among about 3,700 female workers for the six months ending in August of the year before and the year after the change.

	Before the change.	After the change.
Average number of hours lost each week over- head for any reason.....	3.77	2.54
Percentage of gross possible hours lost for any reason.....	6.84	5.16
Percentage of employees absent one morning a week.....	10.93	2.51

(for 3 hours). (for 4½ hours).

The improvement in respect of morning attendances was most marked among the pieceworkers; before the change they lost on an average more mornings than the timeworkers, but after the change fewer, though their total percentage of time lost continued to be higher than that of the timeworkers.

In the second factory (somewhat larger, but more accessible), a comparison of three corresponding months before the change and in 1915 (some years later) shows:

	Before the change.	1915.
Average number of hours lost each week overhead for any reason-----	2.66	1.85
Percentage of gross possible hours lost for any reason-----	4.8	3.8
Percentage of employees absent at all for any reason-----	18.0	7.6

The change of system did not involve any loss to time workers; pieceworkers' earnings on an average improved all round, owing to their more regular attendance and greater vigor; health has improved; work is better both in quality and quantity; and the total output has increased, despite the reduction of hours which, although the attendance has improved, has considerably lowered the average number of hours worked. No separate record of sickness is kept, but the management considers that most of the time now lost is due to sickness, though sometimes of a minor kind.

Before the change was first introduced, a ballot of the workers was taken (in a January) to ascertain whether the 8 o'clock start was preferred for the winter months; 77.4 per cent of the workers voted in favor of it. In the May following a further ballot was taken to determine whether the change should be permanent; 62.84 per cent of the workers voted in favor of it. The reduction of the majority was probably due to several causes. First, in the summer months the early start was less disliked. Secondly, the immediate effect of the change had been some diminution of output and decrease of pieceworkers' average earnings. Thirdly, when reduced hours are said to bring in the end an increase in average pieceworkers' earnings, it must be remembered that the strongest and deftest workers, who had made most under the old system, may earn rather less than before.¹ The management after some years' experience of the change is extremely well satisfied with it, and considers that, were a ballot taken now, not 10 per cent of the employees would vote for reversion to the old system.

Firm B.—Engineers; work of medium heaviness. Factory in a small town, with fair train service and good tram service to larger

¹ Cp. the Report of the Chief Inspector of Factories, 1913, p. 60, on reduction of hours with 8 o'clock start in linen-weaving sheds at Dunfermline. Hours were reduced 15 per cent, piece rates raised 5 per cent. The best pieceworkers' earnings (though not the average) were reduced about 10 per cent.

towns (3 miles or more away) where some of the employees live. A few years ago the weekly day-shift hours were reduced from 54 to 50, with shifts as follows:

Monday to Friday, 8 to 12.30, 1.30 to 6.

Saturday, 7 to 12.

There is little or no night work. Exceptions to the change are the iron foundry, which is on two shifts, and another very hot shop, which is on three 8-hour shifts; but these two shops are small. Total employees, from 600 to 700, nearly all males.

Timeworkers received the same actual wages as before the change; pieceworkers soon came to earn as much as, or more than, before. Output, after the first few weeks, showed no decrease, but, if anything, an increase.

Men are not allowed to bring breakfast with them, and the rules of late entry are very strict. Anyone at all late runs the risk of losing the whole day. The works manager makes a point of being in the factory by 8 o'clock, so that he requires no more of the men than of himself—a point to which he attaches great importance. Loss of time, except through sickness, has practically ceased altogether; and sickness itself has shown a marked decrease. Neither management nor men would on any account revert to the old system.

It is worth noting that overtime, when necessary, is worked in the early morning. The extra pay induces regular attendance, and the most highly paid work is done when men are fresh and not when they are fagged. Moreover, it was found after experiment that early overtime is a healthier arrangement, especially in the summer, than extra hours at night.

Firm C.—Engineers: Factory in a small town; work fairly heavy; an unusually high proportion of skilled men. Number of employees over 1,000 at the time of the change of system, all males, mostly living reasonably near the factory. Until a few years ago a 53 hours day shift week was worked, starting at 6 a. m. A change was then made to the one-break system with the following hours:

Day shift.—Monday, 7.30–5.30.

Tuesday to Thursday, 7–5.30.

Friday, 7–5.

Saturday 7–11.30.

} With an hour off for
dinner.

A 51 hours week.

Night shift.—7–10, 11–7, when necessary.

The rules about late entry are now very strict. Before the change there had been quite unusual slackness, even foremen missing quarters, and the amount of time lost by bad timekeeping only (apart from sickness) was as much as 16 per cent of possible hours. Moreover, power records showed much waste of time just before and after the breakfast interval. The result of the change was to reduce the

loss by bad timekeeping to 2.5 per cent. No doubt this striking improvement is not wholly due to the change itself, but partly to stricter supervision, and to the dismissal of very slack foremen by a new and very energetic managing director. The latter himself, however, is very strongly in favor of the new system, and considers the hours particularly good. It will be noticed that an allowance is made for the difficulty men feel in getting out of bed on Monday morning, and that the strain is eased off toward the end of the week.

In order to meet the objection that under the one-break system the spells of continuous work are too long, a traveling tray goes round at about 10.15 a. m. on day shift and 2 a. m. on night shift bearing biscuits, mineral waters and (at night) tea, and so on, which men may buy and consume for quarter of an hour in the firm's time without leaving their machines.

Firm D.—Engineers: Factory situated in a small town in a very populous industrial district, employing about 900 males, with a comparatively small number of women and girls. Work mostly heavy. No regular night shift; overtime moderate. Employees mostly live fairly near the works.

The two-break system was worked until the middle of March, 1916. Under that system the hours were as follows:

Monday, 9 to 1, 2 to 5.

Tuesday to Thursday, 6 to 8.30, 9 to 1, 2 to 5.

Friday, 6 to 8.30, 9 to 1, 2 to 6.

Saturday, 6 to 8.30, 9 to 12,

making a week of 51½ hours. The day-shift week of the district is 54 hours, but the Monday "quarter" had been abandoned as hopeless.

The loss of quarters had long been a serious trouble. At one time men missing quarters were fined sixpence [12.2 cents], the fines going into a central fund which was periodically distributed in proportion to the hours men had worked; but this device was not very successful, and being also unpopular was in the end abandoned. Toward the end of 1915 the firm suggested a change to the one-break system, the hours to be 8 to 1, 2 to 6 on Mondays to Fridays, and 8 to 1 on Saturdays. Various objections were raised by the men, of which the chief was that a clash with school hours would prevent their children from bringing their dinner to the works. It was agreed to continue the old system for a month on trial, with slight modifications, but the result was unsatisfactory, and finally the change was made last March, with the strong approval of the Ministry of Munitions. To meet the objection mentioned, the spells are arranged as follows:

Monday to Friday, 8 to 12.30, 1.30 to 6,

Saturday, 8 to 1,

an arrangement which has the further advantage of avoiding a 5-hour spell except on Saturday. It has been agreed that the change

shall be in the first place for the period of the war only, and that at the end of the war a reversion shall be made to the old system, if employees so desire.

Under the new system the rules about late entry are strict. No law is allowed, but foremen are instructed to accept reasonable excuses. The day-shift week having been reduced to 50 hours, a man working the full time gets 4 hours' bonus, i. e., is rated as having worked the 54 hours of the district. But before going on to overtime rates he must actually work 54 hours (rated as 58). Overtime work is partly carried on in the morning—from 6 to 7.30 a. m.—steady men being selected for that period.

This example of the change of system is important as having been effected during the war. Some doubt may be felt whether such a change must not, even though advantageous in the long run, result in reduced output for a time. The firm's experience shows that such a reduction need not always take place; output increased immediately after the change, and the improvement has been maintained ever since.

The effect upon timekeeping is illustrated by the following figures: Under the two-break system the hours avoidably lost in days and quarters were in January, 1916, over 5 per cent of gross possible normal time, and in March over 7 per cent. Under the one-break system the avoidable loss was in July 0.8 per cent and in November 1.5 per cent. Thus while the nominal weekly hours had decreased as between February and November from 51½ to 50, the average hours actually worked (unavoidable absences apart) increased from under 48 to 49½. Exact figures of unavoidable absences are not forthcoming, but the firm is certain that sickness has also decreased.

Before the change over 40 per cent of the total avoidable loss went in quarters. But the following figures also confirm the opinion which is often expressed that lost quarters bring lost days with them.

1915	Percentage of quarters lost avoidably.	Percentage of days lost avoidably.
January.....	8.3	Over 3.2
February.....	12.1	Over 4.3
July.....	---	0.8
November.....	---	1.5

two-break system.
one-break system.

Even under the new system Monday remains the worst day for absences. In July there were on an average twice as many men away on Mondays as on the other days and in November over four times as many; indeed, the increase in loss of time in November over

July is almost entirely due to absentees on Mondays. But the general improvement in attendance is very remarkable.

Firm E.—Engineers: Factory situated in a large town; about 1,050 males and 350 females employed. Work varies from light to fairly heavy. Until June last a 53-hour day-shift week was worked with daily hours as follows:

Monday to Friday, 6.30–8.30, 9–1, 2–5.30.

Saturday, 6.30–8.30, 9–12.30.

A change was then made to a 50-hour week, with the following daily hours:

Monday to Friday, 7–12, 1–6.

The night shift is small, but when needed works from 7 p. m. to 6 a. m. with a one-hour break. It is not usually necessary for day shift and night shift to meet.

The new day-shift hours involve two 5-hour spells, but the workers are allowed to have a drink of tea and some food between 8.45 and 9 a. m. on the understanding that the work proceeds at the same time, and in the afternoon a boy is told off to prepare a can of tea for any workers who wish it on the same condition. Moreover, the men in the foundry, which is large, are allowed some latitude in going home before closing hour if their work is done. A point of special interest is the abolition of normal work on Saturday. At present most of the men are working overtime from 7 to 11 a. m. on Saturday, receiving pay at the rate of time and a quarter; but in normal times, when there is no pressure, they will have Saturday free. The firm considers that this scheme has two great advantages: When overtime is necessary it is worked when the men are comparatively fresh, and when it is unnecessary the two days' rest at the end of the week will give them time to pursue their private interests and will be beneficial to their health.

It will be noticed that this change also has been introduced during the war. A few objections were raised at first, chiefly on the ground that the new dinner hour differed from that usual in the district, but the firm considers that the men are now all in favor of the five-day week. Most of them are timeworkers, and they receive the same amount of wages for 50 hours now as for 53 hours previously. Output probably fell for two or three weeks immediately after the change, but is now greater than before, timekeeping having improved remarkably. The avoidable loss of time in the spring before the change was sometimes as much as 10 per cent of possible normal time; in December, 1916, it had dropped to 2½ per cent. Health has also improved. Rules about late entry are now strict, the right of late entry at 7.30, which was at first allowed, having led to irregu-

larity. Monthly certificates, which carry a cash bonus, are issued to those who keep perfect time, and a further annual bonus is proposed.

The following notes refer to firms which have never worked on the two-break system:

Firm F.—Engineers: Work light but in large part highly skilled. Over 1,500 employees, including now about 10 per cent women.

Day-shift week, 50 hours, with shifts as follows:

Monday to Friday, 8–12.45, 1.30–6.

Saturday, 8–11.45.

From 11 to 11.20 a. m. and 4 to 4.20 p. m. men are allowed to smoke at their work, smoking in lavatories, etc., having been prohibited. Power records show a slight decline at these times, but on the whole the result is regarded as beneficial. Women get a break of 10 minutes or so. The night shift is comparatively small. Overtime is worked in the evening. The firm would have preferred overtime on Saturday, as the normal Saturday shift is too short to be very useful; but after a trial the men objected.

Rules about late entry permit considerable latitude, allowing five minutes' grace in the forenoon and two minutes in the afternoon, after which men lose by quarter hours, coming in when they will. Records of lost time, taken occasionally, are very regular and show that the total loss is, according to the season, from 2.5 to 3.5 of possible ordinary hours, i. e., the average ordinary hours worked vary from 48½ to 48¾. Notified sickness accounts for 0.5 to 1 per cent of possible time, i. e., for quarter to half an hour in every working week, but the managing director regards a great part of the remaining lost time as being due to minor ailments. He considers that the late start combined with great cleanliness in the factory and excellent dining arrangements have a very beneficial effect on the health and vigor of the men, with the result that the quality and quantity of the work done are superior to those usual under the ordinary arrangement of hours. He was, however, inclined to think 6 p. m. a trifle late for stopping work and to think the Saturday shift rather too short.

Firm G.—Engineers: Factory in a small town employing over 2,200 males and over 600 females; weight of work very much varied.

Day shift.—Monday, 7.30–12.15, 1.15–5.45.

Tuesday to Friday, 7.15–12.15, 1.15–5.45.

Saturday, 7.15–12,

i. e., a week of 52 hours.

The night shift is comparatively small and works from 5.45 to 10, from 11 to 3.30, and from 4 to 7.15, all hours over 52 in the week

ranking as overtime. (Recently a change has been made in two-shift shops, lengthening the day-shift hours by overtime and reducing the night shift.) Munition workers on shells, etc., are on the special-schedule shifts. About half the employees were working overtime in July, 1916, averaging nine hours each.

Rules about late entry are fairly strict, and after 7.45 employees can not go in without special permission till dinner time. To encourage punctuality comparative returns are posted of the percentages of employees in different shops losing half hours in the morning. A note is added calling attention to the importance of regularity and appealing to the employees' patriotism. In most departments the number of late arrivals is from 2 to 5 per cent in good weather and from 3 to 8 per cent in bad.

In the period of 13 months to the end of July, 1916, the proportion of possible time lost for any reason, if broken holiday weeks and the week of the blizzard at the end of March are excluded, was just over 7 per cent. This is not a specially low figure, but its height is mainly due to unusually bad transport facilities; about 15 per cent of the employees live in villages up to 6 miles away, and they are largely dependent on bicycles for getting to their work. Bad weather has therefore a trebly evil effect on timekeeping, discouraging some from leaving home, making others late, and causing illness in others. The figures for the early summer of 1916 are distinctly better than those for 1914, before the war. The management of the firm emphatically prefers the one-break system and believes it to be preferred by employees also. But a rather later start would probably improve timekeeping and health in this factory.

Firm H.—Engineers: A very large factory on the outskirts of a large town; work very various in weight and comparable with Firm G's.

Day shift.—Monday to Friday, 7-12, 1-5.30. Saturday, 7-12, a 52½-hour week. —

Night shift.—8-12, 1-6, a 45-hour week. The shifts are connected by overtime where necessary.

Rules about late entry are easy, time being lost by quarter hours up to 9 a. m., after which there is no admission before dinner. Some girls are on three shifts, and their record is the worst in the factory; generally, there is no material difference from pre-war figures, though the presence of a considerable proportion of less efficient men may have increased slightly the percentage of time lost. At the end of July, 1916, this was 6.4 per cent of gross possible time (about 3.4 hours overhead) lost for any reason whatever. It had been considerably lower, but the hot weather raised the figure.

The proportion accountable to sickness and other unavoidable reasons is not separately recorded, but as 15.7 per cent of the employees lost 6 hours or more each, it is probably considerable; and this view is supported by the more detailed figures for one department quoted in Table III. There the percentage of possible time lost for any reason was 7.9 at the end of July, and of this about 61 per cent among the males and 79 per cent among the females (72 per cent overhead) was unavoidable, the percentage of practically possible time avoidably lost being 2.5 among males, 2 among females, and 2.2 overhead. In that department, during the weeks whose figures are tabulated, an average of 57.5 per cent of the males and 63.7 per cent of the females (60.6 per cent of all employees) lost no time at all each week.¹

Firm I.—Engineers: Three factories, Nos. 1 and 2 in proximity to one another in a large town, No. 3 in a small town in the same district.

Factory No. 1 (of which some shops are recorded as No. II in Table XIV) employed in the spring something under 7,000 men and about 400 women on light work, a comparatively small proportion being skilled. Factory No. 2 (the No. III of Table XIV) employed from 1,300 to 1,500 men, with a higher proportion skilled. Factory No. 3 employed under 1,500 operatives, also on light work, and a small number of women.

Factories Nos. 1 and 2 work the following day-shift hours:

Monday to Thursday, 6.45–8.30, 9–1, 2–6.

Friday, 6.45–8.30, 9–1, 2–5.30.

Saturday, 6.45–8.30, 9–12.

In factory No. 3 the day-shift hours are:

Monday to Thursday, 8–1, 2–7.

Friday, 8–1, 2–6.

Saturday, 8–12.

The day-shift week is, therefore, 53 hours in all three factories.

¹In regard to bad timekeeping generally a record of the percentage of employees losing time avoidably is a useful check upon the percentage of time avoidably lost. Thus, in the week ending May 23, 1916, the employees referred to in Table II lost 4 per cent of practically possible time, but 48 per cent of them lost no time, and another 23 per cent lost less than 4 per cent. In the same week the men recorded in Table VII lost nearly 10 per cent of practically possible hours, but of them 53.5 per cent were losing not more than 2 hours, and another 23 per cent not more than 4 hours, showing that the high loss was mainly due to a few men. In a subsequent week in September the distribution of loss was more general, but even then 40 per cent of the men accounted for 75 per cent of the time lost. Again, in the factory referred to as No. VII in Table XIV, while the avoidable loss for a period of 61 weeks was recorded as 11.2 per cent of gross possible time, over 65 per cent of the men are recorded as losing not more than 2 hours in each week, or, in other words, as being reasonably good timekeepers.

In February, 1916, a comparison of the records of the men only in the three factories gave the following results:

TABLE XV.

Factory.	System.	Percentage of men losing avoidably.				Hours lost.					
		Under 5 hours a week.	5 hours but under 10.	10 hours or more.	Any time at all.	.Avoidably.		Through sickness or leave.		Total.	
						Per employee (hours).	Per cent of possible normal hours.	Per employee (hours).	Per cent of possible normal hours.	Per employee (hours).	Per cent of possible normal hours.
No. 1	2-break.....	23.9	5.5	6.6	26.1	1.692	3.2	1.237	2.3	2.929	5.5
No. 2	2-break.....	22.3	2.8	5.7	30.9	1.459	2.7	1.197	2.2	2.655	5.0
No. 3	1-break.....	.4	.5	.06	1.0	.060	.1	1.197	2.2	1.257	2.33

In the middle of March factory No. 1 showed an avoidable loss of 1.17 hours (2.2 per cent) per male employee and 1.79 hours (3.3 per cent) per female; while in factory No. 3 the male employees lost avoidably 0.066 hours (0.1 per cent) and the 170 female employees no time at all, the average loss overhead being 0.058 hours (0.1 per cent).

Timekeeping is good in all three factories, none of which starts work very early, but uncommonly good in the third. One might be inclined to attribute its superiority to local conditions or to the fact that a larger proportion of employees were on overtime in the other works, were it not that a few years ago factory No. 1 had the same arrangement of shifts that factory No. 3 now has, and the total lost time recorded for a period under the one-break system was only 1.670 hours overhead (or 3.1 per cent). The average loss by sickness in February, 1916, is much the same in all three factories, viz, about 1.2 hours. This is not a high figure—in factory No. 1 it had mounted a fortnight later to 3.15 hours for males (7.23 for females)—and we may fairly deduct 1 hour from the 1911 record on this score. That leaves an avoidable loss of 0.6 hours per employee under the one-break system, as against 1.69 hours in February and 1.17 in March, 1916, under the two-break system. Examples of a reversion from the one-break to the older system are very rare; in this case the step was taken for reasons irrelevant to this discussion, and the results scarcely give cause for satisfaction. The records of this firm are specially interesting because the difference in early hours is not complicated by a difference in the number of hours

worked a week, whereas in all the other instances quoted of the one-break system the total hours are shorter than is usual under the two-break system.

(II) RESULTS OF THE EVIDENCE.

53. It appears:

(1) That if early hours be worked, the loss is likely to decrease if the start be later than 6 a. m.;

(2) That when the total day-shift week is the same, there are likely to be more hours actually worked without than with work before breakfast, other conditions being similar;

(3) That a reduction of hours may be compensated for or even outweighed by the abolition of early hours, partly owing to reduced absences, partly owing to reduced waste of time, and partly owing to the greater vigor of work after food.

These conclusions need some amplification and qualification.

(1) Early work in factories seems to be an inheritance partly from the necessary habits of agriculture and partly from the urban habits of a period when towns were small and unlit at night, and the population went early to bed. The modern industrial town does not begin to be interesting or stimulating, or even to veil its ugliness, until the lamps are lit. It is vain for employers to recall the customs of their forefathers (whom after all they do not emulate), and to bewail the degeneracy of these latter days. The village can rise early because it goes early to bed. But the town dweller will not go early to bed, which would mean for him having no life of his own.

The first and simplest way of meeting the difficulty is by starting a little later and ending a little later. Even to do so on Mondays only (or to abolish the early hours on Mondays only) is a gain of time; but a somewhat later start throughout is better, because it assists those employees who live at a distance and gives all more chance of taking some food before leaving home.

On the other hand this plan does not avoid the inferiority of work before a regular meal or the disadvantages of two breaks, and it presents this difficulty, that if a full two hours be worked before breakfast, the meal is put still later than on the usual system, while a shorter spell is in some classes of work too short to be effective. Of course, if timekeeping alone is considered, the shorter the spell the better.

(2) It is rarely that a direct comparison is possible, such as that between the factories of Firm I above. Differences in management, kind of work, local customs and character, amount of overtime, accessibility of the factory, and so on, are so numerous and important that comparative figures should, as a rule, be regarded as at most indicating a tendency, not as establishing a law. The opinions of experienced managers and other officials acquainted with both sys-

tems are really more valuable than any number of figures, and I have found such opinions unanimously against the two-break system, in consideration alike of effective organization, timekeeping, health, and output.

(3) A discussion of reduction of normal factory hours after the war is outside the scope of this memorandum. I have found among managers and employers a frequent (though not unanimous) opinion in favor of it, coupled with considerable difference of opinion as to the best mode of effecting it. Anyhow, where abolition of work before breakfast has been accompanied by a reduction of hours, the result has been all to the good in the factories mentioned. When loss of quarters and wasted time about the breakfast interval are at all considerable, a reduction in hours may mean a gain in time worked, if early hours are abolished. Suppose 100 men on a normal day-shift week of 53 hours, losing "avoidably" 10 per cent of possible quarters, and suppose that each man present wastes $2\frac{1}{2}$ minutes before the breakfast interval and $2\frac{1}{2}$ minutes after it, the time lost or wasted in these ways is 165 hours in all. Suppose that after a change to the one-break system 15 per cent of the men lose half an hour each day, or 45 hours a week, there will be a gain of over an hour a man each week, or, in other words, the day-shift week can be reduced by an hour with no loss in time actually worked.

The example is artificial, of course. It takes no account of sickness or of avoidably lost days; but the evidence is that both decrease on the one-break system. It supposes that before the change loss in the early hours goes entirely in whole quarters, which is never the case; but the waste of time is as bad or worse if men trickle in gradually. It certainly underestimates the amount of wasted time that is frequently found about the interval,¹ and does not put the case for the one-break system in an unfairly favorable light. The gain in time may easily be greater, and, as has been pointed out, time is only part of the gain.

54. In this connection the following table has some interest, showing the average number of normal day-shift hours actually worked in certain factories. It must be read subject to the warning already given against hasty comparisons and generalizations, and allowances must be made for the different times of year, but, that understood, it does appear to indicate that, as the nominal hours are reduced, the hours actually worked do not fall in proportion. In this table all normal time lost is allowed for, whether due to slackness or to sickness and other unavoidable causes. (The average total hours, normal and overtime, differ, of course, more widely than the average normal hours only, the highest total averages being those of Nos. 8 and 13.)

¹ Cp. Dr. Vernon, *supra*, pars. 29 and 30.

TABLE XVI.

Class of work.	System.	Period.	Number of hours before breakfast in week.	Time of start on day shift.	Normal day-shift week.	Average normal hours actually worked on day shift.
1. Light (textile).....	One-break	3 months, 1915.....		8 a. m.....	<i>Hours</i> 49	47.2
2. Light.....	do.....	Spring, 1916.....		do.....	50	48.5
3. Mixed.....	do.....	Year, 1915-16.....		7.30 a. m., Monday.. 7.15 a. m., Tuesday- Saturday.	52	48.1
4. Mixed.....	do.....	July, 1916.....		7 a. m.....	52½	49.1
5. Light.....	do.....	February, 1916.....		8 a. m.....	53	51.7
6. Light.....	Two-break	do.....	10½	6.45 a. m.....	53	56.4
7. Light.....	do.....	do.....	10½	do.....	53	50.1
7. Light.....	do.....	March, 1916.....	10½	do.....	53	48.7
7. Light (some departments).	do.....	May, 1916.....	10½	do.....	53	50.1
8. Light.....	do.....	Autumn, 1915.....	12½	9 a. m., Monday..... 8 a. m., Tuesday- Saturday.	53	49.4
9. Medium.....	do.....	April-August, 1916..	13	7 a. m.....	53	50.5
10. Medium.....	do.....	Year, 1915-16.....	13½	6 a. m.....	54	50.0
11. Fairly heavy.....	do.....	do.....	12	do.....	53	46.2
12. Heavy.....	do.....	May-June, 1916.....	12	do.....	53	50.1
13. Heavy.....	do.....	do.....	12	do.....	53	48.3
14. Heavy.....	do.....	May, 1916.....	15	do.....	53	49.4
15. Heavy.....	do.....	March, 1916.....	12	do.....	53	44.3

55. That, sickness apart, the 53 or 54 hours weekly day shift represents an ideal which is often scarcely expected to be attained may be seen from the details of arrangements for a good timekeeping bonus. One manager of great experience and insight told me that in his opinion a man on heavy work who does not lose more than three hours (a "quarter" and two half hours) in the week should be reckoned a good timekeeper, which comes to much the same thing as saying that 50 hours is a fair week. Under another scheme two hours are allowed to be lost avoidably before the bonus is forfeited; under another, where the work is lighter, two half hours are allowed and a "quarter" occasionally; and in yet another case, while the full bonus is paid only if no time be avoidably lost, five-sixths of it is paid when two hours are lost and two-thirds of it when four hours are lost.

But, however strong the arguments may be in favor of shorter hours of work, the question of doing away with the early quarter is in principle independent of them and particularly it ought not to be confounded, as it has often been, with the question of a 48-hour week.

(III) SOME OBJECTIONS CONSIDERED.

56. It appears to be a fairly common experience that proposals for abolishing early work are not liked beforehand by employees and occasionally employers who contemplated the change have given way to the objections expressed. Some of these objections are peculiar to the details of particular schemes. If the proposal is to reduce hours, time workers naturally object unless their earnings remain as

before; and it is only fair that they should not be losers if they are expected to maintain the same output by working harder. Pieceworkers, too, are apt to underestimate their power of increased production under the better and healthier conditions and, as has been mentioned, the best pieceworkers are likely to lose a little (even though the majority rather gain) unless their rates are raised. On the other hand, if hours are not shortened, employees fear over-long spells and sometimes not unjustly, unless the spells be eased by a traveling canteen, a period when smoking is allowed, or short pauses occasionally. Moreover, when hours are long and work is hard the early spell does provide the good workman, who is a trifle off-color, with an economical means of saving himself from overstrain; if it be abolished and hours remain equally long, and if rules about late entry are strict, he may have to lose a half day where previously he lost a quarter. This objection, though not very frequently advanced, is important; and while it does not outweigh the opposed difficulty that the short spell before breakfast is a standing temptation to slackness, it deserves sympathetic consideration. It may be met partly by pointing out that to start work after instead of before food by itself diminishes strain, and partly by giving foremen or other officials power to grant leave for an occasional hour or two in the morning to those who genuinely need the rest.

57. But the most general ground of objection is domestic. At present the man is often out of the house before his wife gets up. If he has sense and time he makes himself a cup of tea on a cold morning before starting and takes a cup up to her; when he is gone she gets up, makes the children's breakfast, and sends them off to school. The man's own breakfast, which he takes with him, has been prepared overnight. Under the one-break system, men fear an additional burden will be put on their wives, who must rise earlier because they themselves rise later. The sentiment is laudable, but the anticipated difficulty does not, as a rule, come to anything in point of fact. When hours are shortened and work begins at about 8 a. m. there is obviously little or no ground for complaint, and it is clearly to the good that men should have one more meal with their families. Even when work begins at 7 a. m. the difficulty seems not to materialize; thus when firm C made the change much trouble was prophesied, but it came to nothing. In that case, however, the men lived fairly near the factory and clearly there may be a real difficulty when a large number of men live, say, an hour away. When this is so it may be doubted whether work should start so early as 7 a. m.; but if it must, the difficulty may be met by providing a mess room where men can buy breakfast. Mess rooms with kitchens are increasing and will, it is hoped, become permanent institutions; and where dinner is cooked, breakfast presents no insuperable difficulty.

58. A remarkable example of prejudice (for it is little more) among employees in favor of early hours is to be found in the town where firm D's works are situated. In that town are a number of other factories engaged on work of a different character from firm D's—hot work in part, but not heavy. They employ a large number of females as well as males, the latter doing most of the hottest work. One of these factories is managed on the one-break system and there little time is lost. The remainder work $2\frac{1}{2}$ hours daily before breakfast, with a day-shift week of 54 hours, and timekeeping in them is bad. In one of them, for example, where over 500 operatives are employed, 21.8 per cent of possible quarters were avoidably lost in November. In another, employing about 150 males and 100 females, the figures were still worse. During the first six months of 1916 the men and boys appear to have lost over 20 per cent and the women and girls nearly 50 per cent of possible quarters, the loss of time before breakfast in some weeks amounting to over 10 per cent of normal day-shift hours. The total loss, especially among the women and girls, continues high. Thus, in a week of July, the male employees lost for every reason 10.6 per cent of normal hours, most of the loss occurring before breakfast; in a week of October they lost 9.1 per cent (6.1 per cent avoidably); and in a week of December 9.5 per cent (5.5 per cent avoidably). In the same weeks the women and girls lost 20.9 per cent, 23.6 per cent (16.4 per cent avoidably), and 20.8 per cent (17 per cent avoidably). In the factory last mentioned the figures of unavoidable absence may have been underestimated and the conditions of work are partly responsible for the bad timekeeping; but, however, that may be, the desirability of adopting the one-break system in this whole group of factories is patent. In the two factories that have adopted it in the town (firm D's and another), the results have been entirely satisfactory, the avoidable loss being about $1\frac{1}{2}$ per cent of gross normal time. The remaining employers wish to copy their example, starting work at 8 o'clock and reducing hours from 54 to 50. Timeworkers would not lose and all but a small minority of the pieceworkers miss so many hours at present that they could without difficulty maintain or even increase their output in the shorter week. Yet whether from mere vague suspicion or from unreasoning conservatism or because the advantages have not been lucidly explained to them the employees, and especially the men, have objected so strongly to the proposed alteration of hours (principally on domestic grounds) that up to the present, after months of negotiation, it has not been carried through. The fact seems to be that most of the objections usually raised by employees in anticipation against the change of system are rooted in custom and in a general suspicion of any pro-

posal, the results of which they do not precisely foresee. Hence it follows that the more employees are alert, well-informed, and well-educated and the more their employers have in the past studied their comfort and won their confidence by so much the more easily is the change effected.

(C) CONCLUSION.

59. The case for doing away with early quarters is strong in respect of factories engaged on light or moderately heavy work, with no night shift or a comparatively small one, and especially where women and girls are employed. Of the disadvantages already mentioned as arising from working before breakfast the most serious, perhaps—though all are serious—are the inferiority of hungry work, its bad effect upon health, and the temptation to lose time owing to the shortness of the early spell. In my opinion it is safe to conclude that work before breakfast ought not to be instituted in any factories answering to the above description which are newly opened during the further course of the war; and the evidence also shows that even during time of war it may under some circumstances be advantageously abolished in old-established factories. As a rival to the two-break system with an early quarter the one-break system at present holds the field and usually hours are shorter under this system. But to what extent hours may be reduced without diminution of output, at what hour exactly it is best to start work, whether in some kinds of work a new break later in the day might not involve less waste of time than a breakfast break commonly does and be in other respects desirable—these and similar questions, though some of them have been incidentally discussed above, depend for their answer on a number of varying local conditions, require further accumulation of experience, and are in any case secondary to the main contentions that food should precede work and that the first spell of work should be of such a length that employees do not miss it light-heartedly.

60. The range of applicability of the above conclusions has been carefully limited because in heavy works where there are a number of continuous processes or where generally a large proportion—a third or even in some shops a half—of the men are on night shift the fact that day shift and night shift must meet raises serious difficulties. It makes impossible any genuine shortening of the daily¹ day-shift hours, for it is out of the question to increase the night-

¹ The *weekly* day-shift hours are another matter. A director of a firm to which I have been specially indebted in this study told me that, in his opinion, after the present stress is over, the abolition of Saturday work (except, of course, as regards continuous processes, maintenance, etc.) might be desirable, especially as giving married men two consecutive days at home. But that suggestion belongs to the larger question of reduced hours in general. Cp., however, firm E's experiment above mentioned.

shift hours, which are as a rule in heavy works already fully long enough. No doubt the night shift might start later and end later—say at 7 a. m. But it is very doubtful whether in really heavy work a five-hour spell, from 7 a. m. to noon, would be good for the men or profitable to the firm.

Moreover, it must be admitted that, at any rate in summer, the cool of the early morning is very suitable to some kinds of heavy and hot work, if only better attendance could be secured, though the importance of this point has been diminished by the daylight saving scheme. The solution of the difficulty may be an extension of the three-shift system in heavy works. Such a solution is not applicable at present, owing to the dearth of skilled men in many trades and the difficulty of increasing the number of foremen and of staff generally. But it has the advantages of shortening hours, of giving men respite from early rising, and at the same time of keeping the plant running; and in heavy works with big machines, where the ratio of plant cost to wage cost is exceptionally high, this last advantage is of great importance. The three-shift system for women does not appear to have been universally successful. It seems likely, however, that its lack of success has been due to conditions which affect women rather than men—e. g., to the women on the third shift objecting to go long distances at night through darkened streets, and to a frequent tendency of women to overtire themselves with housework during their periods of rest. Moreover, the great majority of the women are new to factory life, and no conclusion can be drawn from their experiences as to the effect of the three-shift system on men in established industries. A study is desirable of the results of that system where it is now working, not merely in shell shops and the like, but also and specially in factories engaged upon heavy work which corresponds fairly closely to their normal work in time of peace.

IV. SUMMARY OF PRINCIPAL CONCLUSIONS.

61. (1): There is pressing need for an improvement in the form and credit of medical certificates. (Pars. 15-18.)

(2). The proportion of lost time that is due to sickness and other unavoidable causes is, as a rule, greatly underestimated in factories' records, and the proportion due to slackness consequently overestimated. (Pars. 20-25.)

(3): The accuracy of sickness records may be tested by asking—

(a) Do the curves of bad timekeeping and sickness coincide in direction?

(b) Is the number of whole weeks lost through sickness abnormally high when compared with the number of shorter periods similarly lost?

(c) Is the number of days lost through sickness abnormally high when compared with the number of quarters similarly lost?

An affirmative answer to any of these questions, unless explicable otherwise, gives good reason for supposing the rate of sickness to be understated. (Pars. 20-32.)

(4) Long hours, much overtime, and especially Sunday labor, have a pernicious effect upon health, particularly in heavy trades. (Pars. 20, 21, 33 (5).)

(5) Except where hours have been very long relatively to the class of work, sickness does not appear to have increased in factories generally since the war, despite the withdrawal of many of the most robust men; and the absence of such increase is to be ascribed to good employment and high wages. (Pars. 34-37.)

(6) Work before breakfast gives inferior output, lowers health, and leads to great loss of time, as the first short spell is so frequently missed. Experience shows that in certain descriptions of work the early quarter has been advantageously abolished both prior to and even during the course of the war, and under similar conditions it ought not to be instituted in new factories opened during the further course of the war. (Pars. 38-59.)

December, 1916.

THOMAS LOVEDAY.

INCENTIVES TO WORK, WITH SPECIAL REFERENCE TO WAGES, WITH AN APPENDIX ON WAGE SYSTEMS.

INCENTIVES TO WORK, WITH SPECIAL REFERENCE TO WAGES.

1. The rate of output, which is frequently, even for individuals, a measurable quantity, may be an indication of the presence or absence of fatigue; and the occurrence of sickness, as indicated by irregular timekeeping, and of injuries, may be some measure of the health and efficiency of operatives; but of all the varied influences affecting the health and efficiency of munition workers, the committee have found that of incentives to work the most intricate and difficult to investigate. Nevertheless the subject is of such immediate importance as to demand consideration.

2. The inclination to work rather than to be idle, even though this inclination is a variable quantity in different individuals, is an important natural phenomenon, as important as the desire for rest which follows work at periodical intervals. Various incentives, such as the necessity to earn a daily livelihood, may reinforce this inclination, and some incentives are operative to-day which are peculiar to the present crisis, such as a patriotic desire to contribute to the defense of the realm, or a wish to avenge a lost relative. When once industrial life has been entered upon, the ordered and systematic routine of a modern factory is a direct stimulus during every 24 hours to the rhythm of activity and rest; the better the organization, and the better the hygienic environment, the greater is the stimulus to activity; and the worse the organization and environment, the sooner comes the desire for rest.

3. Whatever the original motive to undertake munition work may have been, the vast majority of operatives so employed to-day earn their living thereby; and the stimulus systematically used as a reward for work done and to procure even greater activity is payment of wages. Any discussion of wages from the standpoint of political economy would be foreign to the scope of the committee's deliberations, though they recognize that considerations of the greatest moment must, on this ground, be excluded from the present study; but they have constantly found that the health, i. e., the absence of sickness, physical and mental, and efficiency of workers is influenced by their earnings, and that output, which has been closely investigated

as an indication of fatigue, may be influenced by the wage system in force. They have, therefore, considered it desirable to state how far they have found the efficiency of workers affected by the method of remuneration adopted. Other influences may arise to stimulate the inclination for work—pride in craftsmanship and in work well done, personal rivalry to outstrip a fellow worker, or hope of promotion; but the main incentive for consideration is that of wages.

The absence of incentives may be presumed to lead to neutrality, while the operation of some factors may result in actual repression of the normal working activity. Among these latter the committee would attach particular importance to any circumstances which may bring the operatives to the opinion that they are not being "fairly treated."

4. The problem of the present moment in munition factories is how best to obtain a practically unlimited supply of munitions of war, of such articles as artillery, shells, and cartridges, all of which are required in great numbers and of fixed sizes and patterns. Herein, because constant repetition work gives the best opportunity of standardizing means of production and of organizing labor, the problem is somewhat different from, and so far simpler than, that of most industrial productions which must be varied to meet the fluctuations of popular demand, and is largely influenced by the question of economic production and profits. The problem has been further simplified by the guarantee that when once a scale of pay has been fixed there shall be no "cut" in prices, a constant source of fear among operatives in the past.

METHODS OF REMUNERATION.

5. Wages may be paid either—

(i) for the time during which work is done, that is by the hour, the day or the night;

(ii) for the work done, that is by the piece; or as a minimum sum up to the completion of a certain task beyond which piece rates are paid.

(I) PAYMENT BY TIME.

6. Certain work, however subdivided and specialized the processes of manufacture become, can not be paid for by the piece, and such work, roughly speaking, lies at the two extremes of labor, the most highly skilled and the least skilled. Managers, foremen, craftsmen, skilled fitters, and pattern makers are instances of the former class, and general laborers about the yard, shop cleaners, and watchmen are instances of the latter.

Among the highly skilled workers who are paid comparatively high wages commensurate with their skill, but little further incentive

should be called for except that supplied by patriotism, and the pleasure and pride in their craft for its own sake. Certainly for this class of worker any fear of dismissal is to-day small, since the supply of skilled workers is below the demand.

Among the least skilled workers time wages act as an inducement to work, because their daily bread depends thereon, but they hold out no inducement to special endeavor. Supervision by foremen, inevitably associated with more or less friction, may be required to obtain increased effort from a proportion of workers paid by this method. Fines may be found necessary to prevent bad timekeeping, or rewards or bonuses may be offered for good timekeeping; but good timekeeping does not always mean good work.

Payment by time possesses one advantage over payment by piece in that it removes from the operative an element of uncertainty concerning his earnings; an uncertainty which, especially in the case of juvenile and female labor may create a nervous anxiety detrimental to sustained effort. Combination of time wages with piece rates has been used as a method of obtaining this advantage in connection with piece rates.

Generally speaking, payment by time alone, which is unavoidable for a large proportion of work, has no direct influence in stimulating the inclination to work; and under this system some workers may be expected to keep well within their powers, while others, whose inclination to work is greater, may feel it a grievance that extra exertion brings with it no extra return.

The good results, however, which are attained from payment by time indicate that, given suitable environment, the inclination to work is a deep-seated natural phenomenon; and it is questionable whether in the end the best results may not be obtainable by following the principle of a "good day's work for a good day's pay," with reasonable good faith on the part of both employers and workers.

(II) PAYMENT BY WORK DONE.

7. The desire to bring a direct stimulus to bear on the natural inclination to work has led to the introduction of payment by work done, or piece rates; and the manufacture of munitions of war, which is so largely constant repetition work applied to a great number of minutely subdivided processes, lends itself particularly to this form of payment.

The problem is to determine how wages can be arranged so as to provide the maximum incentive to production without so tiring the operatives that they are unable to maintain the pace over long periods, or that an ever-increasing number of "stragglers" (who might have developed into useful workers) are constantly dropping out by the way.

Many forms of piece rates have been devised and are in use in this country, and the principles underlying them are discussed in an appendix.

8. *Comparison of time wages and piece rates.*—Although good output can undoubtedly be obtained by the system of time wages, and the unfavorable environment often found in industrial concerns should, perhaps, share the blame for some of the poor results which advocates of piece rates have instanced, yet under suitable conditions, particularly for monotonous repetitive work, increased output can be secured by well-arranged piece rates. One instance is sufficient to demonstrate the incentive value of such rates; and in the following table (obtained by Mr. P. S. Florence while investigating for the committee) the daily output of the same groups of girls is compared for two consecutive weeks, for the first of which time wages were paid, and for the second progressive piece rates.

Day of the week.	June 12-16—Time wage.		June 19-23—Piece wage.	
	17 girls drilling fuses.		17 girls drilling fuses.	
	Day shift.	Night shift.	Day shift.	Night shift.
Monday.....	2,266	2,094	2,587	3,050
Tuesday.....	2,050	1,552	2,959	3,242
Wednesday.....	3,037	2,537	3,143	3,255
Thursday.....	2,610	2,394	3,066	3,114
Friday.....	3,188		3,291	2,171
Average output per shift.....	2,430	2,144	3,005	3,966
Percentage increase.....			24	40
Day of the week.	Three girls retapping fuses by hand.		Three girls retapping fuses by hand.	
	Day shift.	Night shift.	Day shift.	Night shift.
	Day shift.	Night shift.	Day shift.	Night shift.
Monday.....	1,997	1,414	3,040	2,388
Tuesday.....	1,351	1,684	1,534	2,046
Wednesday.....	1,260	1,375	2,190	1,584
Thursday.....	2,023	1,691	2,520	2,592
Friday.....	2,139	1,636	1,955	2,900
Average output per shift.....	1,754	1,560	2,246	2,302
Percentage increase.....			28	48

9. *Need for explaining piece rates.*—Whatever system of piece rates is adopted, there can be no doubt that, if it is to influence output, it must be clearly understood by the operatives; that is to say, any operative of average intelligence must be able readily to compute how much extra pay he will earn at any stage for extra output. The committee have found that sufficient attention is not paid to this question, and that workers frequently complain, either that they do not know how they are paid, or that they are simply content to trust their employers to pay more for greater output. Thus Capt. Agnew, after investigating the health and conditions of employment

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of a large number of male workers, reports in reference to wages that—

Mistrust, discontent, and misunderstanding are frequent among employees, who imagine that they are being exploited when, as not infrequently happens, they are unable to estimate for themselves their exact earnings. When wages are paid by the ton or by the piece the method is clearly understood; but when payment is made by some decimal of a total output unknown to the workers, by a share of a sum allotted to a large group of workers, or by a varying piece rate with a bonus added, the calculation is either impossible or too complicated for the wage earner, and suspicion as to its exactness is prevalent, at least among adults—indeed, the wages department itself often seems doubtful about the exactness of the methods.

10. A definite example may be given of restriction of output which was reported to the committee by Mr. P. S. Florence as coming under his observation while carrying out an investigation with the object of discovering whether the efficiency of certain workers was on the upward or downward grade over a relatively long period of overtime and night work, and attributed by him to failure on the part of the operatives to understand the system of wages in use. He reports:

Certain girls were chosen at random in an 18-pound shell-case department (where the work of each individual was of sufficiently uniform nature), and the average output per hour of each of them was found to be as follows:

Process.	Number of worker.	Date of starting work.	Average hourly output for one week in the middle of—			
			Sept., 1915.	Nov., 1915.	Dec., 1915.	Jan., 1916.
Plugging mouths.....	1	June, 1915....	157	163	202	214
	2	.....do.....	150	201	173	194
	3	July, 1915....	167	193	197	190
	4	June, 1915....	51	63	58	64
Washing and drying.....	5	.....do.....	58	54	61	65
	6	.....do.....	58	49	61	70
	7	.....do.....	48	62	60	72
	8	Dec., 1914....	28	25	26	29
Head turning.....	9	June, 1915....	25	25	25	27
	10	Jan., 1914....	25	25	25	25
	11	Jan., 1915....	25	25	25	25
	12	May, 1915....	25	25	25	25
	13	July, 1915....	25	25	24	25
	14	Jan., 1915....	38	38	38	38
Finish underheads.....	15	May, 1915....	38	38	38	38
	16	Sept., 1915....	38	38	38	38
	17	June, 1915....	25	25	25	25
Finish boring and screwing primer holes.	18	July, 1915....	25	25	25	25
	19	.....do.....	25	25	25	25
	20	Aug., 1916....	25	25	25	25
	21	Sept., 1915....	25	25	25	25
	22	.....do.....	25	25	25	25
	23	Oct., 1915....	.....	25	25	25
Boring mouths.....	24	July, 1915....	70	70	70	62
	25	June, 1915....	70	70	70	70
	26	Aug., 1915....	70	70	70	70
Rough boring primer holes.....	27	.....do.....	33.2	34.0	34.0	34.2
	28	.....do.....	34.0	34.0	34.2	33.8
	29	.....do.....	34.3	34.5	34.4	34.4
	30	Sept., 1915....	100	100	100	100
Cutting to lengths.....	31	.....do.....	100	100	100	100
	32	.....do.....	100	100	100	100

The striking feature of the above table is the extraordinary stability of output of individual girls, and the still more extraordinary similarity in output of different girls employed at the same process; and for the process of finish boring and screwing, and of "head turning," the recurrence of 25 as the rate per hour for four different weeks seems almost to attach a mystical significance to that figure; and the same thing applies to the output of 33 for the process of "finish under heads," of 70 for "boring mouths," of 34 for "rough boring primer holes," and of 100 for "cutting to lengths." Further inquiry, however, elicited that the wage system (which was what is known as the premium bonus scheme) was not understood by the wage earners; and that the foremen, unable to make it intelligible, indicated a standard of output which would satisfy the firm. Independent evidence that this standard was well within the capacity of the workers, and that they made no effort to exceed it was obtained by a study of the amount of electrical power used in driving the machines from hour to hour, which was recorded in curves by self-registering meters. These curves showed a deep and continuous fall in the power in each of the workshops concerned in the last two hours of the day and night shifts; from which the conclusion may be drawn that most of the girls completed their standard of output about two hours before the end of the shift and then went "easy." Since other girls who started work at the same factory in June or July, 1915, but who were employed on processes for which no such standard was indicated (workers numbered 1 to 7 in the table) attained an output in January, 1916, at least half as much again as their output of September, 1915, the firm seems to have lost considerably by the failure of the management to make their wage system intelligible to the workers.

11. A special clause of the factory acts (S. 116, Factory and Workshop Act, 1901) deals with wages—a clause which is of great value to pieceworkers. This applied first of all to spinning and weaving only, but has by degrees been extended to a great variety of other industries. It provides that, when workers are paid by the piece, particulars in writing shall be furnished to each worker respecting the rate of pay and the work to be done so as to enable the worker to compute the total amount payable to him. The particulars necessary for this purpose vary according to the method of calculating the wage and the nature of the work to be done; and great care has been taken in framing orders for the different industries to safeguard the worker from a mere perfunctory compliance which may rob him of the benefit it is the aim of the clause to secure—that benefit being the possession of data sufficient to enable him to compute the total amount payable and to feel confident that effort to secure increased pay by increased work will not be frustrated by fraud or negligence on the part of the employer or any of his agents. A study of the various orders made under the act since 1901 will show that there has been a progressive effort to make the giving of these particulars more precise in order that they may leave the worker in no uncertainty. But various as are the trades included, there is no order which covers munition factories. An order was in draft intended to apply to all engineering trades, and

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the draft with a covering letter had been sent to employers, but on the outbreak of war it was not proceeded with.

12. *Need for study of wages earned.*—The example given in the previous section shows the value to managers of watching closely the wages earned by individual workers. Normally, if all is going well, the output (of which the wages paid to individuals are a direct indication), while varying somewhat from week to week, should show a steady increase, rising rapidly with new workers, and more and more slowly as they became more and more efficient; any deviation from this rule should call for immediate investigation.

The following data provided by Dr. Vernon give concrete instances of this rule:

NEWLY ENGAGED WORKERS.

Process.	Number of operatives.	Relative hourly output during—								
		First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Seventh week.	Eighth week.	Ninth week.
Turning fuse bodies....	16 women...	67	91	96	96	96	100	99	101	100
Making cartridge cases:										
Second draw.....	12 women...	70	81	91	96	97	99	99	100	102
Second out-off.....	14 women....	71	79	87	89	94	99	100	98	102
Mouth reamering..	16 girls.....	48	64	67	79	78	80	80	90	101

In this table the average output during the last four weeks (or two weeks in the reamering process) is taken as 100. The operatives engaged at turning fuse bodies nearly attained their full output in three weeks, but those at the simpler cartridge operations took longer, while the girls engaged at mouth reamering, an operation involving more quickness and dexterity than the others, did not reach their full output till the eighth week. In certain shell operations, such as "boring the powder chamber" and "finishing, turning, and forming," Dr. Vernon found that men took three or four months to attain their full output.

WORKERS OF SOME EXPERIENCE.

Process.	Number of operatives.	Relative hourly output during—			
		Six weeks.	Next five weeks.	Next six weeks.	Next five weeks.
Various cartridge case operations.....	112 experienced women.....	98.5	99.4	99.8	102.4
	146 less experienced women.	95.4	97.2	103.1	104.6

In this table the output of both sets of operatives shows a steady increase, but that for the "less experienced" increased about twice as much as that for the others.

13. If the output of individuals maintains a dead level, as in the instance previously quoted, something must be wrong, and probably

with the incentive. If the output is declining something must also be wrong, and probably with the conditions of employment; the hours of work may be too long; the conditions under which the work is done may be unfavorable, e. g., bad ventilation, inadequate lighting, lack of canteen facilities; or fatigue may be arising from long journeys to and from the factory or from imperfect housing accommodation. The committee desire to lay special stress on the importance and, indeed, the necessity of constant study of this valuable source of information which is in the possession of every firm, but which their investigations have found to be commonly neglected.

SOME INSTANCES OF THE FAILURE OF WAGE SYSTEMS TO ACT AS INCENTIVES.

14. *Lack of desire to earn more.*—Piece rates have been introduced primarily to increase output by acting as a direct incentive to the wage earner to earn more wages; incidentally, they tend to relieve friction between workers and foremen. But in order to act as an incentive, the presumption is made that wage earners always desire to earn more wages. While this is undoubtedly true in the main, instances have come to light where this presumption does not hold good. Thus a report upon an investigation into lost time made by Prof. Loveday for the committee at a factory where a substantial bonus is paid for good timekeeping, and where timekeeping in most departments is good, states:

The record for another set of workers is very different. They have consistently lost far more time by bad timekeeping than by sickness, and even though the proportion is not so bad this year (1916) as last, in recent weeks they have lost under this heading about 9 per cent of practically possible time. This record is far from good, especially as their overtime has not been heavy and has included very little Sunday labor.

This criticism does not, however, apply to the whole body of men concerned; over half of them were keeping good time, and another quarter were keeping fairly good time; the remainder, less than one-fourth of the whole, were responsible for about seven-tenths of the total time lost by bad timekeeping.

The causes of this inferior record are probably social and economic. These special workers have been earning high wages which have risen relatively more than those paid to other workers in the industry, and they include a large proportion of men unable to make a satisfactory use of high wages.

The employers, faced by a shortage of labor, have had to take on and keep on men whom in normal times they would not tolerate (nearly 60 per cent of the men have been engaged since the outbreak of the war). Apparently the unusually high wages have led some of the men to neglect the possibility of earning the bonus for good timekeeping. It does not follow that lower wages and less demand for their services would improve their attendance. A rapid cure is probably impossible; but in the long run better education, bringing

a higher standard of comfort, might be a more desirable remedy than a long and hungry waiting list.

15. Similarly, Capt. Agnew, in reference to boy workers, reports that the rapid rise in wages from prewar time to those of the present day is such that the average youth does not much concern himself with the amount of his output or with punctual timekeeping, for he feels confident that, whatever he does, on pay day he will receive more than he requires for his immediate needs.

16. Evidence on this matter has also been laid before the committee by employers of labor, who declare that in certain classes of men the more they earn the less work they do. The instinct for saving being undeveloped, they naturally require leisure time in which to spend earnings above the subsistence margin. In other words, they are receiving a wage higher than is necessary for the maintenance of their normal "standard of comfort." This raises fundamental economic issues of far-reaching importance, and time, education, and experience can alone secure a happy and effective adjustment. One expressed the view that as a result of the high wages (£5 [\$24.33] to £10 [\$48.67] or even more per week) earned to-day by pieceworkers in his district, many of whom were previously unskilled men, a number of them are inclined to irregularity of attendance because they can easily make up their wages to an amount sufficient to cover their needs. A second witness further pointed out that the skilled workers, upon whom the efficiency of the whole work depends, paid a day rate from £3 to £3 10s. [\$14.60 to \$17.03] per week, suffer in contrast under an anomaly which is having a serious mental effect, prejudicial to good attendance.

In contrast may be instanced a factory where the environment of labor as regards supervision of the welfare of the workers, the hygienic conditions of the workshops, the means of transit, and the housing accommodation of the district were all far above the usual standard of industrial centers and where the rate of wages paid was distinctly low as compared with that ruling to-day in more characteristically industrial areas. A medical examination, carried out by Capt. Agnew, of a random but sufficient sample of the operatives established that their health, physique, and alertness were well above the usual standard; and it was ascertained that the firm were entirely satisfied with the regularity of attendance and with the rapidity and quality of output obtained.

These examples are sufficient to show how intimately the wages question is bound up with social, economic, and hygienic considerations.

17. *Lack of opportunity to spend.*—A further point in relation to the incentive value of wages is that wages are only of value for what they buy, and that the mere possession of money is useless

unless there is something to spend it on and an opportunity of so spending it. The inducement to save, even when suitable opportunities of investing (a form of spending) are provided, is never so powerful as the inducement to spend.

Anyone familiar with the industrial classes knows the rise of output which occurs before a public holiday with the prospect of ample opportunity of spending.¹ This point to-day is not negligible when, in the hope of obtaining increased output, work has been frequently carried on during Saturday afternoon, the time most used for spending by the industrial classes. If employers take up the whole of their operatives' time in the factory they should not be surprised to find that even the best-devised wage scheme fails to act as an incentive, especially among juvenile wage earners, who form a large proportion of the operatives employed on piece wages. From this point of view even picture palaces have their value.

18. *Lack of adjustment of wage systems.*—Another instance, which the work of Mr. S. Florence brought to the attention of the committee, may be given of the failure of a piece-rate scheme to act as an incentive, owing to a failure of adjustment of wage systems. Previous to the war two systems of payment were in use (1) a minimum sum, a time wage instituted to pay beginners, which was given for all work, however small, up to a certain amount, and (2) after that limit a plain piece rate for further work. When, however, the minimum sum to be paid was raised under war prices the limit of work to be done for this sum was raised, and it became difficult to reach an output on the piece-rate scale.

When a full-time wage is guaranteed, however low the output, it is obviously shortsighted thus to set a piece wage which on the average will not amount to much more than this guaranteed wage. If girls know that they can not exceed by very much an output of, say, 9,000 pounds, for which they get 17 shillings [\$4.14] piece wage, they will be content to produce, say 8,000 pounds and still receive 17 shillings [\$4.14] in this case as a time wage. The result amply confirmed this expectation. It was well-nigh impossible for the girls to earn piece wages in excess of the guaranteed time wage. Consequently they did not try, and the majority even of the more efficient girls were found to be working, in fact, not on a piece wage but on a time wage. The loss in incentive, and incidentally in discipline, must have been measurable in tens of thousands of cartridges per month.

19. The scheme of paying a minimum sum as a time wage for all output below a certain standard (always presuming this standard is fixed well within the powers of the workers) and piece rates for work done in excess of that standard, commends itself to the committee as a useful method for removing mental strain from a worker who on account of feeling fagged may be overanxious as to her capacity for earning a bare livelihood. Such a worker, with this

¹ See Memorandum No. 12, Output in relation to hours of work, Table 1, published in Bul. 221 of the U. S. Bureau of Labor Statistics, p. 33.

strain removed, may end by producing a full week's work; with it present, an injudicious effort may result in an unnecessary breakdown. And the committee have noted with satisfaction that in the first schedule of the Munitions Order No. 1, dated September 13, 1916, it is laid down that "the appropriate time rate shall in the case of any woman or girl on piecework or premium bonus system be guaranteed and paid." Another method also used for obtaining the same end is the fellowship system, where the operatives work in groups and are individually paid a share of the total earnings of the group; where friendship exists among the members of each group this method is productive of excellent results, but complaints are liable to arise that one or another member of the group is not contributing a fair share to the common stock, when inquiries and adjustments may have to be made. Further, this fellowship system seems to defeat its end when applied to large groups of workers, amounting in some cases to several thousands; here the wages of each worker depend to so slight extent on individual effort that there is practically no incentive whatever in the system.

20. *Piece rates may cause overspeeding.*—The next point for consideration is the possible influence of piece rates in stimulating the operatives to overwork; an influence more likely to affect the better and keener class of workers who are to-day of special importance. Such workers require in their own interests to be protected against their eagerness. Again and again investigators have reported to the committee that the data at their disposal for examining output over sufficiently long periods are curtailed by the disappearance of a certain proportion of the operatives.

Thus Dr. Vernon, reporting on the output of lathe operators at a munition factory, states:

The strongest women available were picked out for the work, but many of them could not stand it for more than a few weeks. Of the 95 operatives of whose history I possess an adequate record, 22 gave up after four weeks or less, and 11 more after 10 weeks or less, but I have no information as to the cause of their retirement.

The committee have also ascertained in reference to a munition factory employing between seven and eight thousand males under the age of 21 years, that every three months 25 per cent of this total disappear.

Capt. Greenwood further reports that at another factory, out of one group of 287 girls at work in the week ending January 24, 1916, 30 had disappeared by April 3, a period of 11 weeks; out of another group of 77, 14 had disappeared in the same period; out of another group of 37, 12 had disappeared; and out of another 100, 16.

Since "the whole of the operatives providing the data were, so far as could be ascertained, strict pieceworkers, who had, prior to

the periods studied, sufficient experience to have attained their normal level of productive power," even after due allowance has been made for the nomadic habits of workers, the committee considers that such figures indicate a serious and undue wastage of skilled labor. Steps are being taken to investigate more fully the extent and causation of this wastage.

SUMMARY.

21. The preceding sections suggest that certain definite influences are important when arranging incentives intended to stimulate the natural inclination to work.

1. A healthy environment in the factory and in the home is the first necessity in order to obtain a healthy population of wage earners to whom a wage scheme may appeal as an incentive to work.

2. Under conditions of repetition work, especially if it be monotonous, piece rates may be expected to give a greater output than time wages.

3. The rise and fall of wages (paid on a well-planned piece rate) earned by individual workers is a valuable indication of health and efficiency.

4. A wage scheme, the operation of which can not be easily understood by the wage earners, or, if understood, appears to them inequitable, fails as an incentive.

5. A wage scheme which is badly adjusted may lead directly to limitation of output.

6. A scale of wages which renders it possible for the wage earners to obtain too easily all the money which their social aspirations demand fails to provide an adequate incentive.

7. Hours of labor which give but little chance of spending the wages earned diminish the incentive to earn more money.

8. Workers, especially those newly introduced to industrial life, require protection against their own eagerness.

FURTHER CONSIDERATIONS.

22. *Necessity for rest pauses.*—No wage system known to the committee takes any special account of the physiological fact that the natural inclination to work is followed by a desire for rest. Incentives, used to stimulate the inclination to work, must lose their effect as this inclination gives way to the desire to rest; and what is required is not to increase or diminish the incentive but to maintain the inclination to work. In previous memoranda¹ attention has been drawn to the advantage of rest pauses during long spells of work; and a further example has come under observation which indicates the natural tendency of workers under favorable con-

¹ See Bul. 221 of U. S. Bureau of Labor Statistics—Memorandum No. 12, Output in relation to hours of work, par. 31, p. 46; and Memorandum No. 7, Industrial fatigue and its causes, par. 6, p. 50.

ditions to alternate work with rest: A group of workers, men and women, paid on a time wage were found employed from 6 a. m. to 6 p. m. with two half-hour meal intervals at the process of emptying and filling a series of presses. Each press, after being filled, has to be left under hydraulic pressure for 35 minutes, during which time other presses in the series are emptied and filled. The management calculated the number of presses to each series, which would allow the work to be done in 35 minutes at a reasonable pace; but the workers on their own initiative have adopted a different method. They work with a rapidity so organized that the series of presses is emptied and filled in less than 25 minutes, after which they rest for 10 or 12 minutes until the time comes to begin again. The work entails the expenditure of a fair amount of physical energy; and it was interesting to watch these operatives swing into their labor in order to obtain their rest pause.

As an extreme instance, what has now become a classic case may be referred to: Mr. F. Taylor¹ found good, average pig iron handlers, loading pigs of iron, weighing about 92 pounds each, into railway wagons at an average pace of 12½ long tons per man per day. He decided that for such work a first-class workman should only be under load for 43 per cent of his time, and be entirely free from load for 57 per cent; and worked out the working and resting periods. A man was persuaded to work under the scheme:

Schmidt started to work, and all day long and at regular intervals, was told by the man who stood over him with a watch, "Now pick up a pig and walk. Now sit down and rest. Now walk. Now rest," etc. He worked when he was told to work, and rested when he was told to rest, and at 5.30 in the afternoon had his 47½ tons loaded in the car. And he practically never failed to work at this pace and do the task that was set him during the three years that the writer was at Bethlehem.

That Schmidt was no exceptional man is shown by the fact that gradually the whole gang of workers were taught to load iron in this way at about the same pace, that is, four times more quickly.

The value to be got industrially from well-planned rest pauses is only slowly coming to be appreciated; though for long sustained athletic efforts it has long been recognized. The point for present consideration is whether advantage can not be taken of a wage system to insure that adequate rest pauses are taken. The committee are satisfied that short rest pauses do not interrupt the rapidity of the work; for observations have disclosed that as the initial morning stiffness passes off output rapidly increases, but that in the afternoon, after the pause for the midday meal hour, the rapidity of output recommences at the level of the last hour of the morning shift.

¹Taylor, Fred W. "Principles of Scientific Management," 1911. Harper & Bros., New York.

They would, therefore, be inclined to regard favorably any plan whereby rest pauses could be used as an incentive to work.

An imaginary example may be used to explain the method associated with a flat piece rate. Take a light repetition calling for a rapid use of the small muscles of the hands and fingers. The working hours are taken at eight, i. e., 480 minutes, and the average pace at which a number of articles, say 200, are submitted to the process is presumed to be 43 minutes. Then if a rest pause of 5 minutes were introduced after each spell of 43 minutes, 200 articles being then made, there would be 10 rest periods during an 8-hour day. If, however, a rapid worker dealt with his 200 articles in 35 minutes, he would then get a 5-minute rest pause, 40 minutes in all; and if he continued to work at this pace would earn 12 rest pauses in the 8-hour period. A very slow worker on the other hand might only deal with 200 articles in 55 minutes, when he would get 5 minutes pause, 60 minutes in all; and working at this pace would only earn 8 rest pauses in the day. If a worker's daily earnings computed in this way are plotted on a diagram it will be found that the curve of wages has a similar shape to that furnished by the premium-bonus system, but the result is reached by a very different route. The premium-bonus system curtails output by reducing the wages' incentive; the worker is allowed to work as hard as he pleases, but if he does more than a certain amount he will receive a very small extra reward. The present system curtails output by progressively decreasing the amount of time the worker is allowed to work. In effect, if the unit (200 articles of the illustration) is produced in "m" minutes, the worker can only produce $\frac{480}{m+5}$ units in an 8-hour shift, that is to say if he could turn out his 200 articles in a moment of time, he would still be unable to produce more than 95 units, that is 19,200 articles, in the shift. Consequently, it may be said that the system is in no way superior to the premium-bonus system, that with a scale devised in this way a limiting point will be learned, and that output will be kept down to such a point. The answer is that if a limit is established, as may very well be the case, the quick workers will reap an advantage by having the time saved as definite rest periods instead of furtive "slacking." Further, the system might be improved by dividing the wages into two parts—(a) a piece rate computed as above, and (b) a time rate for the compulsory rest pauses, the rate being progressively increased with the number of pauses earned. The pauses need not necessarily be employed in doing nothing; sedentary workers employed at light work would benefit most from some form of exercise which calls the legs into action, and they might be set to tidy up their work place, or carry the articles treated to the next department, or fetch

the next lot of articles to be treated, or indeed at any other occupation timed to occupy the rest pause, which gives exercise but does not entail use of the small hand muscles. Workers, on the other hand, employed standing at heavy physical labor would benefit most during the rest pauses by sitting down. Experience teaches that in practice workers always take rest pauses,¹ and what is here advocated is only the organization of such pauses so that they can be brought into harmony with the wage scheme and recognized as stepping stones in the daily progress of output. This method of distributing the day's work into a number of tasks is in itself an incentive to quick work; constant repetition of a process many times every day tends to produce monotony; but this is avoided by breaking the work up into a number of stages with a direct incentive to complete each stage, while the pleasure which comes from something done is steadily repeated.²

Objections, however, of substance may be made to this arrangement. In the first place rest is made proportional to output, whereas it should be proportional to effort according to the theoretical basis of the scheme. Output is not a complete measure of effort when comparison is made between different persons under the same conditions or in the same person under different conditions; nor, indeed, is any method known whereby effort could be adequately measured in practice. While, therefore, the plan might operate favorably for the average worker under average conditions, it would clearly be prejudicial to those who for one reason or another had little output to show after considerable effort; and in this way inefficient, weak, or sickly workers would actually get less rest than the skillful and robust, though needing it much more. Still, both would obtain some rest. In the second place managers of factories, wherein there are many and varied processes carried on, might, not unreasonably, object that the suggested plan is of such a complicated character that it would not be easy to carry out without an undue amount of supervision; only direct experiment can test the validity of this objection. And they may consider that discipline would be interfered with if each group of workers came and left at different times of day. The difficulty, however, would be overcome if well-considered rest pauses were introduced; these rest pauses would be longer for the more arduous processes, and shorter for the less arduous processes; and by careful adjustment the optimum number of hours, with rest pauses interposed, could be arranged for each process to coincide with the times fixed for the factory as a whole to start and stop.

¹ See Memorandum No. 12, Output in relation to hours of work, par. 27, published in Bul. 224 of the U. S. Bureau of Labor Statistics, p. 48.

² A concrete instance of introducing rest pauses totaling 15 minutes in every hour at a light repetition work, the output of which became three times that previously obtained, is given on pp. 127-129 of "Fatigue Study," by F. Gilbreth, 1916, G. Routledge & Sons, Ltd.

The scheme outlined should not conflict with the practical necessity which has been demonstrated¹ of employing workers at processes which call for different degrees of physical and mental effort for different lengths of time if maximum output is to be attained; the greater the effort, the shorter should be the hours.

But in a standardized industry, such as the manufacture of munitions of war has now become, much work consists of tending machines, the speed of which largely controls the rapidity of output; and this speed is a direct stimulus to the worker to strive to keep the pace, with, as a result, danger to health and to safety, which may cause physical and mental exhaustion. The interpolation of rest pauses, definitely paid for, would go far to remove the injurious influence of this speeding up.

23. *Necessity for instruction.*—When the task has been determined and the wages fixed, there still remains, closely associated with incentive to work, the necessity for teaching workers how to perform the task and so earn the wages.

The committee think it strange that while soldiers are sedulously instructed both in drill movements, which are indirectly, and in rifle and bayonet exercises, which are directly of value to them in carrying out their duties in the field, munition workers, not less important contributors to our national defense, have to depend upon casual and haphazard information, or may be referred to technical schools which, however excellent, can no more replace factory instruction than can drilling in the park training in the field; and have noted that, though in the athletic world instructors exist to teach boxers how to balance themselves and use their arms, and cricket professionals are constantly at work improving the efficiency of batsmen and bowlers, and coaches are a necessity to teach a boat's crew collectively and individually how and when to move their bodies and hands, yet in the industrial world the value of teaching operatives how to earn their livelihood is hardly yet recognized. In America much has recently been done, in association with what is known as "scientific management," to eliminate useless movements and lessen physical effort, but, somewhat unfortunately, the subject has got wrapped up with "time studies" used for fixing piece rates, and there is, in consequence, a tendency for it to be looked on with disfavor by wage earners, while the real value of teaching is being lost sight of. The committee feel no doubt that just as the athlete obtains further incentive to skill by seeking information as to his faults from a trained teacher, so should operatives be able to turn for instruction as to wasteful and nonproductive practices unconsciously developed, and as to methods of improving their work with less effort, and that such teachers would be able to give useful advice to the management as to

¹ See Memorandum No. 12, Output in relation to hours of work, pars. 25 and 26, published in Bul. 221 of the U. S. Bureau of Labor Statistics, p. 43.

the most suitable speed for running machinery and as to the best moment to choose for rest pauses. The ideal foreman should be such a teacher, but foremen who consider such duties part of their daily work are seldom found.

APPENDIX.¹

1. This appendix describes some of the different systems of wage payments which are adapted in connection with piecework. No attempt is made to judge the systems on economic, ethical, or physiological grounds, but merely to reduce the working of each to comparable terms. At some points algebraical equations have been introduced, as such expressions will make the argument clearer to some readers; but those who dislike this form of mental shorthand can pass over the equations without loss of continuity for arithmetical examples are given in each case.

2. In munition works the large majority of the employees are engaged in repetitive work, and the different systems will only be considered in relation to such work; that is to say, the systems will be expressed in terms of total earnings for a day of arbitrary and constant length, viz, 10 hours when varying numbers of articles are produced by different individuals.

3. Many forms of piece rates are in use; to understand them the basis on which they rest must be considered. Every industrial establishment in which they are employed has two forms of expenditure:

- (1) The expenditure which represents—
 - (a) Interest upon capital sunk in land, buildings, and manufacturing plant;
 - (b) Taxes, depreciation, and insurance;
 - (c) The wages paid to managers, clerks, skilled experts such as chemists and mechanics, foremen and general laborers, who are all paid by time; and
 - (d) Such items as the cost of driving shafting and of lighting the premises.

All this group of expenditure (provided the whole of the plant is utilized, and that the number of employees is kept constant) is fixed whatever the output of the factory, and is known as overhead charges; and

(2) Expenditure upon wages paid by the piece, upon the cost of raw material manipulated, and upon the cost of power consumed by the machinery when in action (a relatively small item); all the items in this group vary directly with the output.

4. If such an establishment has a 10-hour working-day and a calculated output of 100 articles, the price charged for these articles

¹ The committee desire to thank Capt. M. Greenwood, R. A. M. C., statistician to the Lister Institute, for assistance in preparing this appendix.

must be the sum of the expenditure per diem on overhead charges and the piece wages paid for making 100 articles, together with an item added for profits. If now by speeding up production 120 articles are produced in the 10 hours instead of 100, and the selling price is not altered, the cost of production will only be higher, as compared with that of the original hundred in respect of the cost of the extra raw material, the extra piece wages, and the extra power used and wear and tear of machinery. In other words, the additional 20 articles add nothing to any of the items under (1); and the firm can therefore afford to pay a higher rate of wages for their production and still make greater profits. Or again, since the price of 10 articles carries the overhead charges for one hour, if 12 articles are made in that time a higher rate can be paid for the two extra articles. Based on these considerations, the simplest form of piece rate would be a plain piece rate of so much per piece until the incubus of overhead charges has been lifted, and then a rise which may take the form of a definite sum, or bonus, for completion of the task, or of a higher piece rate for further articles made.

5. This form is simple and easily understood, but in practice only the more rapid workers would attain the high piece rate, and it fails to be an incentive to many of the workers. In order to provide for this, the progressive piece rates for the manufacture of the first installment of articles which are to carry the overhead charges, say 90 articles, might be introduced. Thus, say the expenditure which can be set aside for piece wages has been fixed at one penny [2 cents] for each article, the scale may be on the following plan:

For the first	10 articles	6 pence	[12.2 cents].
For the second	10 articles	7 pence	[14.2 cents].
For the third	10 articles	8 pence	[16.2 cents].
For the fourth	10 articles	9 pence	[18.3 cents].
For the fifth	10 articles	10 pence	[20.3 cents].
For the sixth	10 articles	11 pence	[22.3 cents].
For the seventh	10 articles	12 pence	[24.3 cents].
For the eighth	10 articles	13 pence	[26.4 cents].
For the ninth	10 articles	14 pence	[28.4 cents].

For 90 articles 90 pence [\$1.83].

Such a scale would provide an incentive for even slow workers to climb by a higher rate of production to a higher rate of pay; and a sudden rise from, say, 10 pence [20.3 cents] for every 10 articles until 90 are made, to 16 or 17 pence [32.5 or 34.5 cents] for every 10 articles over 90 is avoided.

6. The only economic difficulty in such a progressive scale seems to be that if the progression is too rapid and the capacity of workers has been underestimated, the workers may climb to a piece rate

which absorbs the sum profitable to pay, even when overhead charges have no longer to be considered; and it would be to the employer's interest to slow down production or "cut" the piece rate. In order to guard against such a state of things arising, systems have been devised in which the "bonus" varies with the selling price of the product; and progressive piece rates have been introduced in which the increment is not regular, but is slightly less at each advance, and is so arranged that it can never exceed the amount of overhead charges; thus presume that overhead charges are distributed over 90 articles at one penny [2 cents] per article; and piece wages are also at one penny [2 cents] per article; after the first 90 are made at this price the firm can afford to pay piece rates up to twopence [4 cents] per article, but not above. The advancing piece rates in this case would be so arranged by decreasing increments that twopence [4 cents] per article can not be exceeded.

7. These remarks are introduced to enable the reader to grasp the general conditions of the problem which ought to be solved by an ideal wages system. The plans may next be considered which have actually been tried, exclusive of those which to a greater or less extent aim at the realization of a cooperative ideal by taking selling price or profits into consideration.

SYSTEMS OF PIECE RATES.

8. (1) *Straight piece rates without a minimum wage.*—This is the simplest conceivable case. Let us suppose that the piece rate is one penny [2 cents] per article. Then, if in 10 hours the man produces 0 article he receives nothing; if he produces 10 articles, he receives 10 pence [20.3 cents]; if he produces 100 articles, 100 pence [\$2.03], and so on. The wages curve is a straight line; or expressed otherwise, $Y = mX$, where Y is the wages, m the price per piece, and X the number of pieces produced in standard time.

9. (2) *Piece rates with a minimum wage.*—In practice system 1 is not usually adopted, but a minimum wage is generally paid to all workers, however little they produce, and the piece-rate system only comes into operation after a certain minimum number of articles has been exceeded.

The following deductions can be made at once:

(1) If the piece rate be fixed at the rate per article found by dividing the minimum wage by the number of articles beyond which piece-rate payment comes into force, then the more the worker produces the lower will be the price paid per article of his production, until he has produced the standard number.

(2) Equal increments of production bring equal increments of earnings beyond the point corresponding to the standard, but not from zero.

These deductions will appear to most readers self-evident, but as they are of fundamental importance it is well to give some illustrations. Let us suppose that the minimum wage for 10 hours is 50 pence [\$1.01], and that piece payments begin when 100 articles have been made and are calculated at the corresponding rate, viz, 100 articles for 50 pence [\$1.01], or $\frac{1}{2}$ penny [1 cent] an article. Then the man who only produces one article is paid 50 pence [\$1.01] for it; if he produces two articles he still receives 50 pence [\$1.01], or 25 pence [50.7 cents] for each article, and so on, his rate per article steadily decreasing to a minimum of $\frac{1}{2}$ penny [1 cent] per article, and thereafter remaining constant, which is deduction (1).

The same illustration shows the truth of deduction (2), since for every additional article produced from 1 up to 100 the man receives no addition to his wages, while for every addition beyond 100 he receives an identical increment, viz, $\frac{1}{2}$ penny [1 cent] per article.

10. (3) *Piece rates with a minimum wage, the piece rate being less than the standard piece rate.*—These systems cover the great majority of the “premium,” or “bonus,” or “premium bonus” systems; indeed, with certain modifications to be noted, which are only modifications of detail, not of principle, the systems of Halsey, Emerson, Weir, and Gantt all belong to this class.

The order followed in the previous paragraph will be reversed, and a particular illustration given before the general principle is stated.

Suppose that, as before, 50 pence [\$1.01] are the minimum wage for 10 hours and 100 articles the standard production. Then the position of a man under the present system is exactly as under 2 until he has reached a production of 100 articles. Now, suppose that further production is not paid for at the rate of $\frac{1}{2}$ penny [1 cent] an article, which is the rate paid the man who produced the standard number in the standard time, viz., 100 articles in 10 hours, the 10 hours' pay being 50 pence [\$1.01], but at half this rate, viz, at $\frac{1}{4}$ penny [$\frac{1}{2}$ cent] an article. Then, for every extra article beyond 100 he will receive an extra $\frac{1}{4}$ penny [$\frac{1}{2}$ cent], so that deduction (2) of last paragraph still holds. But deduction (1) is no longer true; the price paid for each article in his output continues to diminish after the standard production has been reached down to a rate of $\frac{1}{4}$ penny [$\frac{1}{2}$ cent] an article. The concluding words of deduction (1) “until he has produced the standard number” must be omitted. If, for instance, he produces 200 articles he will be paid 50 pence [\$1.01], plus 100 times $\frac{1}{4}$ penny [$\frac{1}{2}$ cent], or 75 pence [\$1.52] in all, which is at the rate of 0.375 penny [0.8 cent] per article for his whole output. Had he produced 300 articles he would have received 50 pence [\$1.01], plus 200 times $\frac{1}{4}$ penny [$\frac{1}{2}$ cent], or 100 pence [\$2.03], in all a

rate per article of 0.3333 penny [0.7 cent]. The rate paid per article steadily diminishes, but, and this is of the essence of the matter, it does not diminish indefinitely; it can never be less than $\frac{1}{2}$ penny [$\frac{1}{2}$ cent] per article. Suppose he produces some incredibly large number, say a million articles more than the standard number of 100. His receipts will be 50 pence [\$1.01] plus a million farthings [\$5,075], that is 250,050 pence [\$5,076.02], which gives, dividing by 1,000,100 (the number of articles produced), a piece rate of 0.25002 penny [0.5 cent] per article. This can be seen at once if we express the facts in algebraical symbols. Let Y represent the price paid per article of the man's total production, W the minimum wage, K the number of articles beyond which a piece rate is paid, and p that rate; also let X be the man's output in excess of K , so that $K + X$ is his total output. Then we have—

$$Y = \frac{W + pX}{K + X}.$$

Now, when X is very large indeed, W and K become insignificant in comparison with pX and X , so that the expression reduces to p multiplied by X and divided by X , i. e., it becomes equal to p , which in our illustration was a farthing. The reader will note that the curve is a rectangular hyperbola, $Y = p$ being an asymptote.

System 3 therefore differs from system 2 in that the piece rate diminishes down to a finite minimum. On the other hand, the total earnings increase indefinitely, for the total earnings are $W + pX$, and the only difference between the curves representing the total earnings of case 2 and case 3 is that in case 2 p is equal to W/K , while in case 3 it is less than W/K . In geometrical language this means that both curves of total earnings are straight lines rising from W as an origin, but the rise is less steep (in our illustration just half as steep) in case 3 as in case 2.

These very simple propositions must be thoroughly understood; failure to grasp them has caused a vast amount of confusion in the statements made respecting premium systems.

These results may be summarized by saying that systems of type 3 enable the employee to increase his total earnings from the point of reaching the standard by equal increments of money for equal increments of production, and that there is no theoretical limit to the amount he may earn. If he produced an infinite number of articles he would receive an infinite sum in wages. On the other hand, the employer pays the employees who have passed the standard progressively less per unit of production, but he never pays less per unit than a certain finite amount. From his point of view the law is one of increasing average returns.

Again, looking at the same facts from a slightly different point of view, there is no amount of production increases beyond which will return the employee no finite increase of reward. The significance of this fact will appear later.

11. It has been said that this system comprises the majority of bonus systems. It will be sufficient to demonstrate this by an examination in detail of one such system, viz., that of Mr. F. A. Halsey. Mr. Halsey described his plan in detail in a paper entitled "The premium plan of paying for labor," published in the first volume of the Economic Studies of the American Economic Association, which appeared in 1896 (supplement pp. 75, etc.). Mr. Halsey and others have, of course, issued many subsequent papers dealing with the subject, but none of these, so far as is known, affect the principle which alone is now under consideration. An analysis of the table annexed, which is extracted from Mr. Halsey's paper, will afford all the information required.

This table (see below) is expressed in terms of one particular task, and to bring it into line with the general plan it must be reconstructed. It will be assumed, then, that the task standardized for 10 hours consists, as before, of making 100 articles. It follows, then, that the man who could produce the 100 articles in 9 hours would have produced 1,000 divided by 9, or 111.11 articles in 10 hours, and similarly for the other values. But these amounts do not increase by equal increments, so that the table expressed in terms of earnings for different amounts produced is not easily understood. It is seen at once, however, that if the man can produce the 100 articles in 5 hours; that is, if he produced 200 articles in 10 hours, his wages would be not \$6, but \$4, or increased by a third instead of by 100 per cent. This suggests that the system is probably system 3, with p equal to one-third of W/K , and we shall show that such is the case.

TABLE 1.

Time consumed.	Wages, per piece. ¹	Premium.	Total cost of work.	Earnings, per hour.
<i>Hours.</i>				
10.....	\$3.00.....	.....	\$3.00	\$0.30
9.....	2.70.....	\$0.10	2.80	.311
8.....	2.40.....	.20	2.60	.325
7.....	2.10.....	.30	2.40	.343
6.....	1.80.....	.40	2.20	.366
5.....	1.50.....	.50	2.00	.400

¹ This heading does not mean *per piece* in the sense of our text; it is really *time wage earned at standard rate of \$3 per hour*.

PRODUCTION.

Let H be the number of hours required by the man to produce the standard task of K articles.

Then he receives for K articles:

$\frac{HW}{10} + (10-H)P$, where W is the minimum day wage and P is the premium. His

piece rate is $\frac{HW}{10} + (10-H)P$, but the faster his production, the smaller the number of hours required to produce K articles, so that his piece rate diminishes from $\frac{W}{K}$ when H=10 to

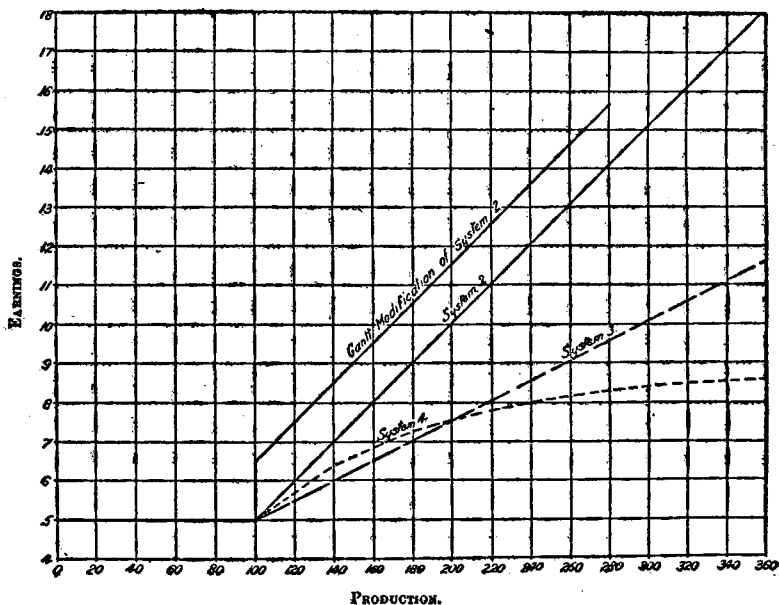
$$\frac{10P}{K} \text{ when } H=0. \quad \frac{W}{K} \text{ is } \frac{300}{100}=3 \text{ cents.}$$

$$\frac{10P}{K} \text{ is } \frac{100}{100}=1 \text{ cent, i. e., one-third of } \frac{W}{K}.$$

The total earnings are as before, given by a straight line.

$$Y=W+.33 \frac{W}{K} X.$$

CHART TO ILLUSTRATE SYSTEMS.



The reader can satisfy himself that this is correct by comparing the results with the last column of Mr. Halsey's table, e. g., if 111.11 articles are produced in 10 hours—

X=11.11 and Y=300+11=311 cents for 10 hours, or .311 dollars for one hour.

In other words, the table quoted from Halsey's paper is a typical example of system 3, the piece rate for output beyond the standard being one-third the rate paid to the standard producer instead of one-half as in the former illustration.

12. There are many modifications of this system; for instance, that of Emerson. These modifications consist in changing the earn-

ings below the standard. In the case we have described the diagram expressing total earnings as a function of output is a horizontal straight line for all outputs up to the standard and then a straight line inclined at an angle to the horizontal. Now, by introducing the premium method below the standard, for instance, by crediting the producer of something less than the standard output with a certain premium which is larger the nearer he approaches the standard, the horizontal line of total wages for producers of less than standard quantities can be altered. But if there is a minimum day wage and if the piece rate for production in excess of the standard is less than the piece rate for the standard calculated as before and is constant the two main features of system 3 will be reproduced. An application of this test is all that is necessary to determine whether any given wage system falls into the class. We shall apply it to the Emerson system as described by Prof. Hoxie (*Scientific Management and Labor*, p. 72). Here for each 1 per cent increase in production above the standard the worker receives 1 per cent increase of wages in terms of a minimum wage. The standard producer receives 120 per cent of the minimum. Suppose 100 articles in 10 hours to be the standard and 3s. [73 cents] the day wage, then the producer of 50 articles receives 3s. [73 cents]; the producer of 100, 3.6 [87.5 cents]; and 200, $3.6+3.0=6.6$ [$\$0.88+\$0.73=\$1.61$]; piece rates of .06, .036, and .033 [1.5 cents, 0.9 cent, and 0.8 cent], respectively.

The piece rate for producers beyond the standard is $\frac{3.6+n \times .01D}{100+n}$

(n =production beyond 100, and D =day wage), which becomes .01 D when n is infinite, i. e., it diminishes down to .030.

The Gantt system (Hoxie op. cit., p. 68), on the other hand, is an example of class 2, with discontinuity. All workers who fall below the standard receive a day wage. The standard producer receives a sudden increase of 30 per cent and the producers beyond the standard receive the same piece rate as the standard producer.

The curve is a horizontal line for all outputs below the standard, then the line rises at right angles to a point 30 per cent of the previous distance between the horizontal line and base line above the former, and from this point the piece rate line of system 2 commences. (See chart.)

Before leaving these systems it should be noted that the objection urged against them, viz, that equal increments of work do not earn equal rewards must be true of any conceivable wage system provided that a minimum time wage is enforced, and is quite as true of system 2 as of system 3 (geometrically, of course, system 2 is only a particular case of system 3). Conversely the arguments in their favor (*a*) that it is reasonable to share the profits between the employer and the employee, and (*b*) that they obviate the necessity, from the em-

ployer's point of view, of cutting rates, are hardly sound. Argument (a) is only true if the employer make no profit at all from the worker, who produced the standard quantity or less. Argument (b) is only true if the piece rate paid for production above the standard is so small that the inclination of the straight line rising from the horizontal is inappreciable, in which case there is no sensible pecuniary inducement to the worker to produce more than the standard, and he can hardly be expected to do so. All that the system secures is that the workers' increase in earnings with increase of output shall be slower than if system 2 were adopted. On the other hand, system 4, to which we now come, does, indeed, completely secure the employer against ever having to pay more than a certain sum in wages, however great the output.

13. (4) *Piece-rate system with minimum wage, the piece rate diminishing without any limit.*—This system which, very unfortunately, has been called the premium-bonus system, is a method of keeping the total wage cost down to a certain amount, however great the production, and at the same time of securing the worker a minimum wage for his day's work. The reader, with a slight knowledge of algebra, will recognize that these objects can be very easily attained. Thus, if we decide that no man shall earn less than W pence for his day's work and that no man shall earn more than twice W pence, however much he does, we can pay him wages calculated from the following formula: $Y = W(2 - 1/x)$, where x is the number of times the standard amount he actually produces and only values of x greater than 1 are employed. If he produces exactly the standard amount he will earn W. If he produces twice the standard amount he will earn one and a half times W, and if he produces an indefinitely large amount he will earn twice W, and can never earn more than twice W. This, which, be it remembered, is not the curve of piece rates but the curve of total earnings, is a rectangular hyperbola with $Y = 2W$ for horizontal asymptote.

The system was devised by Mr. Rowan and we quote his table (American Machinist, 1902, Vol. XXV, p. 49):

Wage rate, \$0.30 per hour.

TABLE 2.

Hours allowed.	Hours taken.	Time wages on job.	Premium earned on job.	Total cost.	Work-man's rate per hour.
100	100	\$30.00	.....	\$30.00	\$0.30
100	90	27.00	\$2.70	29.70	.33
100	80	24.00	4.80	28.80	.36
100	70	21.00	6.30	27.30	.39
100	60	18.00	7.20	25.20	.42
100	50	15.00	7.50	22.50	.45
100	40	12.00	7.50	19.20	.48
100	30	9.00	6.30	15.30	.51
100	20	6.00	4.80	10.80	.54
100	10	3.00	2.70	5.70	.57
100	1	.30	.297	.597	.597

It will now be shown that this table can be expressed by the formula given above. From the table we see that if a job standardized for 100 hours is completed in, say, 80 hours the workman receives

$$80 \times \text{hourly wage of } .30, \text{ plus } \frac{100-80}{100} \times 80 \times \text{hourly wage} = 24 + 4.8 = \$28.8.$$

In symbols:

$$\text{Amount earned in } t' \text{ hours} = t'h + \frac{(t-t')}{t} ht' = t'h \left(2 - \frac{t'}{t} \right) \quad (1),$$

Where t is standard time, t' actual time and h hourly rate. But if the standard task is taken as unity, the man who can complete it in t' hours will do $\frac{t}{t'}$ times the standard in t hours.

This is x of the formula on p. 120, par. 13. Multiply (1) by $\frac{t}{t'}$, and substitute $\frac{1}{x}$ for $\frac{t'}{t}$ in the bracket, and we have

$$\text{Amount earned in } t \text{ hours} = ht \left(2 - \frac{1}{x} \right) \quad (2);$$

but

$$ht = \text{wage for } t \text{ hours} = W,$$

so (2) becomes

$$y = W \left(2 - \frac{1}{x} \right),$$

which was to be proved, y being the amount earned.

This is σ of the formula on p 120, par. 13. Multiply (1) by and substitute. If the standard output is 100 articles, the piece rate paid to a man who produces 100 σ articles in time t is

$$W \frac{\left(2 - \frac{1}{x} \right)}{100\sigma},$$

which diminishes from $\frac{W}{100}$ to zero as x increases.

14. Certain consequences follow from the above investigation. From the nature of the curve of earnings, there is a considerable pecuniary inducement to exceed the standard to a moderate extent, greater indeed than by system 3, but the inducement rapidly diminishes and becomes practically insignificant. These points are brought out by Table 3. System 4 offers a greater temptation than system 3 to do 50 per cent better than the standard. On the other hand, while an increase from three times to three and a half times the standard output is rewarded by an increase of one shilling and three pence [30.4 cents] under system 3 it only earns a trifle more than 2½d. [5 cents] under system 4. Consequently in the case of purely repetitive work, the system is admirably calculated to give rise to artificial limitation of output, unless the standard production is fixed so high that very few workers are able to do more than, say, 50 per cent better than "bogie."

This appendix is not, of course, concerned with anything beyond a description of the systems, but it is fair to remark that the method under notice was not apparently devised in a factory engaged upon work of a mainly repetitive character. Thus, it has been remarked (American Machinist, XXVI, October 17, 1903):—"The work done

in the Rowan Works is the building of marine engines, in which, of course, there is little repetition work—a fact which accounts for the emphasis which Mr. Rowan always places on the importance of the rate-fixing department.”

TABLE 3.

Working of systems 2 to 4.—In the case where the standard production is 100 articles in 10 hours, and the day standard wage 5s. [\$1.22], piece rates 0.05 [1.2 cents] for system 2, and 0.025 [0.6 cent] for system 3.

Production.	Total earnings (shillings).		
	System 2.	System 3.	System 4.
100	5. 0 [\$1. 22]	5. 00 [\$1. 22]	5. 00 [\$1. 22]
150	7. 5 [\$1. 82]	6. 25 [\$1. 52]	6. 67 [\$1. 62]
200	10. 0 [\$2. 43]	7. 50 [\$1. 82]	7. 50 [\$1. 82]
250	12. 5 [\$3. 04]	8. 75 [\$2. 13]	8. 00 [\$1. 95]
300	15. 0 [\$3. 65]	10. 00 [\$2. 43]	8. 33 [\$2. 03]
350	17. 5 [\$4. 26]	11. 25 [\$2. 74]	8. 57 [\$2. 09]

SUMMARY.

15. The various methods which have been described (all of which, excepting the first, are known to be employed in different munition factories), can be conveniently contrasted as follows:

A. From the point of view of the operative:

(1) Following a law of constant rate of remuneration. (System 1.)

(2) Following a law of diminishing rate of remuneration.

(a) Rate of remuneration diminishing to the rate corresponding to the earnings of “bogie,” and return constant from that point. (System 2.)

(b) Rate of remuneration diminishing down to a rate which is some finite fraction of the rate earned by “bogie.” (System 3.)

(c) Rate of remuneration diminishing without any limit. (System 4.)

B. From the point of view of pecuniary incentive to production: None, except the Gantt modification of system (2),¹ offers any incentive to the worker who is only just able to equal “bogie.” Systems (2) and (3) provide a constant incentive to the workers who can pass “bogie” to continue their efforts. System (4) provides a greater incentive than system (3), as illustrated, to workers to surpass “bogie” by a moderate amount, but as the production increases further the incentive falls behind that provided by system (3) and rapidly becomes infinitesimal.

¹ The special feature of the Gantt system is carried further in the systems of Taylor, a new and higher rate being introduced discontinuously as the worker reaches various stages of increased production. These methods are not known to be used in any factories studied by the committee, and the reader is referred to the work of Hoxie, cited in the text, for further information.

REPORT ON THE HEALTH AND PHYSICAL CONDITION OF MALE MUNITION WORKERS.

BY CAPT. T. H. AGNEW, R. A. M. C.

SCOPE OF INQUIRY.

1. In arranging for these inquiries the committee were actuated by a desire to obtain medical evidence as to the nature and extent of the ailments and defects from which the workers were suffering, the amount of fatigue existing among them, and the means of alleviation which might be adopted.

The inquiry extended over a period of six months, from the middle of February to the middle of August, 1916. During the first half of this period I had the assistance of Mr. Heath, of the factory department of the home office, to whom I am indebted for some of the details elicited in the conduct of this inquiry. I desire also to place on record my obligations to the management and the men of the factories visited. Everywhere the inquiry was facilitated by the readiness of the examinees to answer questions, both general and particular, and by the anxiety of the management to remove, so far as possible, any cause of difficulty or hindrance.

2. Eight factories were selected for the examination, the works being situated in four of the principal industrial areas of England. The class of munition work upon which the operatives were engaged varied within wide limits. The principal processes followed were anti-aircraft gun making, limber mounting, big-gun manufacturing, shell stamping, fuse and gaine making, bullet and cartridge case making, exploder bag filling, gunpowder pellet making, cartridge filling. Next came the inspection of the processes of rifle and auto-machine gun manufacture, such as stamping parts, gunstock turning and polishing, barrel rifling and sight testing, steel smelting, gas producing, forging naval guns, naval shell making, steel rolling by both hot and cold processes, field-gun shell pressing, aeroplane building, and ambulance construction.

3. In all, 3,052 workers were examined—1,543 men and 1,509 boys—distributed as follows:

- In factory 1, 532 men and 88 boys.
- In factory 1 (return visit), no men and 900 boys.
- In factory 2, 376 men and 124 boys.
- In factory 3, 137 men and 73 boys.

In factory 4, 61 men and 29 boys.

In factory 5, 152 men and 97 boys.

In factory 6, 240 men and 91 boys.

In factory 7, 45 men and 15 boys.

In factory 8, no men and 92 boys.

4. The men chosen were 41 years of age and upward and the boys 18 years of age and under. The reasons for this selection were: (a) That any baneful influence which unhygienic surroundings and long hours might exert would probably be mostly manifested during youth or middle age—during youth because growth is proceeding and the reaction to environment may be expected to be more acute—during middle age because these workers have already been submitted to many years of industrial life; (b) at the present time so many of the physically fit have been withdrawn from industrial to military service that the residue between the ages of 18 and 41 years might reasonably be expected to be below the normal standard.

5. Before commencing the examination of the workers a general survey of the workshops was made in order to ascertain the nature of the process or processes conducted, the amount of strain to be endured, and the number of men engaged. After this information had been obtained concerning every workroom in the factory a representative group of men and boys was chosen for examination. The reasons for making the inquiry were explained clearly to the shop managers, to the men, and to the boys alike. Appreciation of the purpose of the committee's inquiry was shown by the readiness to submit to examination and to answer questions, and often to add information quite irrelevant but occasionally useful to the nature of the inquiry. The scope of the examination of each worker was limited by the necessity for interfering, as little as possible, with output, and generally occupied about 12 minutes. The scheme adopted in every case was a careful examination of the radial pulse recorded by a "watch count;" the heart and lungs were next examined, apex beat and chest expansion being noted. The measurement of blood pressure and of chest expansion had unfortunately to be eliminated owing to lack of time. Next in order of examination were the nose, mouth, teeth, and pharynx, particular attention being paid to the latter in the case of juveniles. Questions upon the digestive system were answered clearly and freely. Sometimes information relevant to the general nervous system was given with hesitation, but in the main the questions were understood and replied to readily. The condition of the eyesight only called for close observation in a minority of those examined, because (i) the majority of the processes were unlikely to cause eyestrain, (ii) a very large number of the men examined had had their vision carefully tested before being taken on for work, and (iii) in those cases where strain was made

upon the eyes defects had already been adjusted by spectacles, or, where suspected, the eyes had been examined by an ophthalmic specialist; in all cases the desire to be equal to the work and to earn as much money as possible were the reasons for this precaution. All operatives were examined for flat foot or any other pedal deformity likely to cause inconvenience. In all those processes necessitating long standing the legs were examined for the presence of varicose veins.

In order that the data elicited during these inquiries should be as reliable as possible, the examinees were classified solely upon the result of their medical examination, and the considerations of their hours of labor and the conditions of work upon which they were engaged were not referred to until compiling the reports upon each factory.

6. As a method of eliciting the effects of labor and environment on health, this procedure is open to obvious criticism. Men who are sick or dead are not found at work, and any complete survey would include the condition of those who are temporarily absent as well as of those who have permanently retired from the particular sphere under investigation. There are, however, good grounds for thinking that conditions of work which cumulatively result in severe illness and death may be presumed to leave in the factory indications of their operation in the form of milder examples of illness of the same kind or of similar origin, and that to some extent at any rate this index would be quantitative. This relation, however, is doubtless influenced by the process of selection which goes on more or less continuously, whereby those who are unfit become eliminated altogether or segregated to particular kinds of work. The extent and intensity of this selection will necessarily vary with the fluctuations between industrial demand and the supply of labor, and it is with a shortage of labor, such as now exists, that we should expect selection to be at its minimum and the health standard therefore at its worst. These difficulties can not be solved with the present data; we can only bear them constantly in mind in interpreting the results of an inquiry such as the present.

CLASSIFICATION OF OCCUPATIONS.

7. For purposes of analysis the work done by each man and boy has been assigned to one of four categories, and the figures set out in tables 1 and 2 under the various headings show clearly the numbers of individuals engaged upon various classes of work. The groups are arranged partly according to weight of work, partly according to the conditions of heat, noise, etc. In factories 1, 2, 3, 5, and 6 the very heavy and heavy processes were most frequently followed.

While at some of these the men were more fully engaged upon very heavy work, others were occupied in processes which involved both very heavy and heavy labor, but for the purposes of classification in the tables they have been grouped according to the work upon which they were found engaged.

(a) The *very heavy group* includes such processes as steel making, naval gun forging, smithy work where hammers of 18 pounds weight and upward were used, the forging of 12-inch and 15-inch naval and field shells. Smiths wielding hammers of 25 or 30 pounds weight and dealing with very heavy materials in the smithies have been also included in this category because their work is continuous and involves the expenditure of great energy and exposure in most cases to excessive heat.

(b) *Heavy group*.—Among the men occupied in the heavy trades have been included smiths wielding hammers of a less weight than those referred to above; laborers in steel yards, because some of these men in the course of their work lift very heavy weights, but have the advantage of following their occupation chiefly in the open air; men wheeling large quantities of metal, bricklayers, ordinary laborers, forgers engaged upon the lighter class of work, men making the small shells such as the 4-inch and below, gas producers, navvies, men engaged in stamping shops, have been included in this category because the temperature to which they are ordinarily exposed, though high, is not nearly so high as in the processes referred to as "very heavy." There is occasionally some overlapping, as I have already mentioned.

(c) *Medium group*.—Between the former processes and the medium and light processes there is a distinct difference. Occasionally some difficulty arose with reference to the class into which an examinee should be put. Often this was settled by the fact that a workshop was very noisy, though the work upon which the individual was engaged was light and decided his inclusion in the medium group. Those processes classed medium included automatic machine minding, the majority of shell turning processes, gun stock turning and polishing, barrel rifling, fuse and gaine turning, the various processes of limber mounting, and gun sighting for anti-aircraft work. In the majority of these cases the conditions under which these processes were carried out were such as not to add materially to the weight of work. Among the boys a large number has been classified in the medium group owing partly to the weight of their work and partly to the excessive noise in the factory. Many of these boys had been engaged for a comparatively short time, and though the work was apparently easy, yet at the same time the noise, in my opinion, would influence very considerably their conditions

at the end of a working-day. This particularly refers to the boys in the bullet and cartridge making factories from among whom large numbers were chosen for examination.

(d) *Light group*.—In the light processes, for boys particularly, little or no effort was called for. The majority were seated at their work and the common processes were gunpowder pellet making, exploder bag filling, breaking down gages and fuses, and cartridge filling. These occupations were all very easy and called for no physical effort. The men included in this category are those who are occupied in such work as sweeping up shops, acting as shop foremen, viewers of shell work, leading hands whose time is spent in walking about, and supervisors.

8. Similarly the standard of health and physical conditions of each examinee has been summarized as being:

- A, good;
- B, slightly below normal;
- C, much below normal; or
- D, bad;

and this grouping is used throughout this report.

GENERAL RESULTS OBTAINED.

9. The whole series of 3,052 men and boys examined give the following summary result:

- Class A—Men, 1,198, or 78 per cent; boys, 1,374, or 91 per cent.
- Class B—Men, 264, or 17 per cent; boys, 119, or 8 per cent.
- Class C—Men, 75, or 5 per cent; boys, 13, or 1 per cent.
- Class D—Men, 6, or 0.4 per cent; boys, 3, or 0.2 per cent.
- Total—Men, 1,543; boys, 1,509.

It is evident that there is no very gross degree of ill health prevalent among those at work; the figures suggest a fairly satisfactory position, though the absence of any standard of comparison renders accurate evaluation impossible. It should be noted that the main facts can not be substantially changed by any reasonable assumption about absentees from illness at the time of the inquiry (see par. 12).

RELATION OF GENERAL HEALTH TO LENGTH OF EMPLOYMENT, HOURS, AND NATURE OF WORK.

10. The data regarding health, length of employment, hours of labor, and nature of work have been summarized in tables 1 and 2. These tables are complex, and it is necessary to analyze their contents.

In the first place I suspected that the men and boys employed before the war—that is to say, those who were already in munition

factories upward of two years ago—could not properly be regarded as in the same class as those engaged since. These prewar employees are a product of a long period of industrial selection and entered the trade at a time when the supply of labor was not so restricted as it became after the outbreak of war. Hence a larger proportion of physically fit men might be expected among them, the weaklings or poorer ones, I should say, falling out through dismissal or through some other form of elimination. This presumption is verified by the fact that the percentage of men placed by me in class A is greater in the case of the prewar men (80 per cent) than for those men engaged since (74 per cent).

The three remaining groups, all composed of men and boys who were engaged after the outbreak of war, and therefore during a period when selective elimination became difficult or almost impossible, are comparable one with another as regards the remaining factors. Three variables are involved, namely, (1) length of hours, (2) general health, (3) length of time employed; and what the committee particularly wished to know is whether (1) and (2) are associated.

In Tables 3 to 6¹ the material is arranged with the object of bringing into comparison general health and length of hours. The fourfold arrangement has been adopted for convenience of comparison and is justified by the facts that the characters classified are continuous and the numbers in the extreme classes (very long hours and fitness below B, for instance) are small. The comparison shows that the percentage in class A is less among those working longer hours; that is, 70 hours or over for men and 60 hours or over for boys. In three of the tables the difference is more than twice the probable error, and the combined improbability that all four tables should merely, as a result of random sampling, give the observed deviations is considerable; indeed, the odds against it are about 99 to 1. The long hours, therefore, appear definitely prejudicial to physical well being, but it is necessary to be sure that this deduction is not deceptive, and that it is not due to the intervention of the third variable, namely, length of employment. Thus, it might happen that a larger proportion of the employees who had been engaged for longer periods, say over 12 months, worked shorter hours, and that they were by a process of selective elimination physically fitter, quite independently of the fact of working shorter hours. In this way a spurious association between short hours and physical fitness might arise.

¹ I am deeply indebted to Capt. Greenwood for the elaboration and arrangement of Tables 3 to 22.

Tables 7 to 14 were prepared to test this objection. Taking them seriatim we note:

(i) There is very little difference between the percentages of A in the case of men on very heavy and heavy work when the classification by length of employment is adopted, and a similar remark applies to men on medium and light labor. In both cases, however, the hours are shorter for the men longer employed.

(ii) In the case of boys on light and medium labor, the boys more recently engaged are significantly fitter (the measure being as usual the percentage of A), but in this case the hours are significantly shorter. This case can be instructively compared with that of the men. The corresponding table for boys on very heavy and heavy labor records no differences which are significant.

These tables, therefore, in no way weaken the impression derived from Tables 3 to 6, namely, that there is a real relation between unfitnes and long hours. Additional evidence pointing the same way is furnished by Tables 15 to 18. Each of these is derived from samples of men or of boys of the same grade of experience, and in each case the percentage of A is greater among the employees on shorter hours. Any one of these tables taken alone would not warrant the conclusion suggested, but their concurrent testimony is of great importance.

Passing now to the prewar employees, Tables 19 to 22 should be examined. The number of prewar boys is small to support averages which would merit discussion, but the men provide a very instructive comparison with those dealt with above. In the case of light and medium work there is no appreciable difference between the general physical condition of those working longer or shorter hours. But in the case of heavy and very heavy labor there is a substantial difference in the opposite direction to that found in all the post-war tables, and those working the longer hours are seen to be actually the healthier body of men. The result is what might be expected if the hypothesis of industrial selection is true. In prewar days the less fit were forced through selective elimination to join the ranks of the unemployed or became unemployable when labor was plentiful and cheap; the demands of the employer for labor were easily met and no particular thought was given to those who suffered through physical disability, the result of long hours or heavy work, or both combined. But to-day, when labor of almost any class is valuable, the seriousness of this question has become apparent.

130 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

TABLE 1.—NUMBER OF MEN EXAMINED IN CERTAIN MUNITION FACTORIES—DURA WORK, STANDARD

[General health: A—good, B—slightly below normal, C—much below normal.

Duration of employment.	Net average hours worked weekly.	Very heavy process.					Heavy.				
		A.	B.	C.	D.	Total.	A.	B.	C.	D.	Total.
Under 6 months..	Under 60..	2	2			4	6	4			10
		18.8	18.8			36.4	8.3	5.6			13.9
	60-70.....	5	1			6	27	6			33
		45.4	9.1			54.5	37.5	8.3			45.8
	70-80.....						13	5	1		19
6 months and under 12.	80-90.....	1				1	13.1	6.9	1.4		21.4
		9.1				9.1	12.6	1.4		15.9	
		8	3			11	55	16	1		72
		72.7	27.3			100.0	76.4	22.2	1.4		100.0
	Under 60..		1			1	21	2			23
60-70.....	6	8.3			6.3	13.9	1.8			20.7	
70-80.....	50.0				6	18	5	1		24	
80-90.....	4	1			5	16.2	4.5	0.9		21.6	
12 months, or since commencement of war.		33.3	8.3			41.7	28.8	11.7	5.4	0.9	46.8
							11	1			12
		10	2			12	82	21	7	1	111
		83.3	16.7			100.0	73.9	18.9	6.3	0.9	100.0
	Under 60..	8				8	24	1	1		26
60-70.....	23.5				23.5	24.7		1.0		26.8	
70-80.....	15	4			19	18	6	6		20	
80-90.....	44.1	11.8			55.9	18.6	6.2	6.2		30.9	
Before the war...		6	1			7	15	13	1	1	30
		17.7	2.9			20.6	15.5	13.4	1.0	1.0	30.9
							11				11
		29	5			34	68	20	8	1	97
		85.3	14.7			100.0	70.1	20.6	8.3	1.0	100.0
Before the war...	Under 60..	62	16			78	121	22	7	1	151
		30.7	7.9			38.6	31.1	5.7	1.3	0.3	38.9
	60-70.....	57	13			70	70	18	14		102
		28.2	6.4			34.6	18.0	4.6	3.6		26.2
	70-80.....	50	2	1	1	54	87	11			98
		24.8	1.0	0.5	0.5	26.7	22.4	2.8			25.2
	80-90.....						35				35
							9.0				9.0
	90.....						1				1
	100.....						2				2
Before the war...							5				5
		169	31	1	1	202	316	51	21	1	389
		83.7	15.5	0.5	0.5	100.0	81.3	13.1	5.4	0.3	100.0
Before the war...		216	41	1	1	259	521	108	37	3	669
		83.4	15.8	0.4	0.4	100.0	77.9	16.1	5.6	0.4	100.0

HEALTH OF MALE MUNITION WORKERS.

TON OF EMPLOYMENT, NET AVERAGE HOURS WORKED WEEKLY, HEAVINESS OF OF PHYSIQUE.

D--bad. The italic figures below the actual totals indicate percentages.]

Medium.					Light.					Net average hours worked weekly.	Duration of employment.	
A.	B.	C.	D.	Total.	A.	B.	C.	D.	Total.			
	1			1	18	1				19	Under 60.	Under 6 months.
	<i>3.1</i>			<i>3.1</i>	<i>51.4</i>	<i>2.9</i>				<i>54.3</i>		
7	5	4		16	8	1				9		
<i>21.9</i>	<i>15.8</i>	<i>12.5</i>		<i>50.0</i>	<i>22.9</i>	<i>2.9</i>				<i>25.7</i>		
7	7			14	5	2				7		
<i>21.9</i>	<i>21.9</i>			<i>43.8</i>	<i>14.3</i>	<i>5.7</i>				<i>20.0</i>		
1				1						1		
<i>3.1</i>				<i>3.1</i>								
15	13	4		32	31	4				35	Under 60.	6 months and under 12.
<i>46.0</i>	<i>40.0</i>	<i>12.5</i>		<i>100.0</i>	<i>88.6</i>	<i>11.4</i>				<i>100.0</i>		
3	3			6	20	5				25		
<i>9.1</i>	<i>9.1</i>			<i>18.2</i>	<i>30.5</i>	<i>7.7</i>				<i>38.5</i>		
11	1	1		13	19	1				20		
<i>33.3</i>	<i>3.0</i>	<i>3.0</i>		<i>39.4</i>	<i>22.9</i>	<i>1.5</i>				<i>30.8</i>		
8	2	1		11	13	1	1			19		
<i>24.2</i>	<i>6.1</i>	<i>3.0</i>		<i>33.3</i>	<i>20.0</i>	<i>7.7</i>	<i>1.5</i>			<i>29.2</i>		
3				3		1				1		
<i>9.1</i>				<i>9.1</i>		<i>1.5</i>				<i>1.5</i>		
25	6	2		33	52	12	1			65	Under 60.	12 months, or since commencement of war.
<i>75.7</i>	<i>18.2</i>	<i>6.1</i>		<i>100.0</i>	<i>80.0</i>	<i>18.5</i>	<i>1.5</i>			<i>100.0</i>		
3	3	1		7	37	7	4			48		
<i>6.5</i>	<i>6.5</i>	<i>2.2</i>		<i>15.2</i>	<i>50.0</i>	<i>9.6</i>	<i>5.4</i>			<i>64.9</i>		
15	2	2	1	20	15	3	1			19		
<i>32.6</i>	<i>4.3</i>	<i>4.3</i>	<i>2.2</i>	<i>43.5</i>	<i>20.3</i>	<i>4.1</i>	<i>1.4</i>			<i>25.7</i>		
16	2			18		5				6		
<i>34.8</i>	<i>4.3</i>			<i>39.1</i>		<i>6.8</i>	<i>1.3</i>			<i>8.1</i>		
1				1	1					1		
<i>2.2</i>				<i>2.2</i>	<i>1.3</i>					<i>1.3</i>		
35	7	3	1	46	53	15	6			74	Under 60.	Before the war.
<i>76.1</i>	<i>16.8</i>	<i>6.5</i>	<i>2.2</i>	<i>100.0</i>	<i>71.6</i>	<i>20.3</i>	<i>8.1</i>			<i>100.0</i>		
11	2	2	1	16	48	8	7			63		
<i>8.2</i>	<i>1.5</i>	<i>1.5</i>	<i>0.7</i>	<i>11.9</i>	<i>24.5</i>	<i>4.1</i>	<i>5.6</i>			<i>32.2</i>		
26	3			24	48	11	3			62		
<i>19.4</i>	<i>6.0</i>			<i>25.4</i>	<i>24.5</i>	<i>5.6</i>	<i>1.5</i>			<i>31.6</i>		
59	9	2		70	44	20	6			70		
<i>44.0</i>	<i>6.7</i>	<i>1.5</i>		<i>52.2</i>	<i>22.4</i>	<i>10.2</i>	<i>3.1</i>			<i>35.7</i>		
12				12			1			1		
<i>9.0</i>				<i>9.0</i>			<i>0.5</i>			<i>0.5</i>		
2				2								
<i>1.5</i>				<i>1.5</i>								
110	19	4	1	134	140	39	17			196	Under 60.	Before the war.
<i>82.1</i>	<i>14.2</i>	<i>3.0</i>	<i>0.7</i>	<i>100.0</i>	<i>71.4</i>	<i>19.9</i>	<i>8.7</i>			<i>100.0</i>		
185	45	13	2	245	276	70	24			370		
<i>75.5</i>	<i>18.4</i>	<i>5.3</i>	<i>0.8</i>	<i>100.0</i>	<i>74.9</i>	<i>18.9</i>	<i>6.5</i>			<i>100.0</i>		

132 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

TABLE 2.—NUMBER OF BOYS (UNDER 18 YEARS) EXAMINED IN CERTAIN MUNITION
HEAVINESS OF WORK,

[General health: A—good. B—slightly below normal. C—much below normal.

Duration of employment.	Net average hours worked weekly.	Very heavy process.			Heavy.				
		A.	B.	Total.	A.	B.	C.	D.	Total.
Under 6 months.	Under 50.								
	Under 60.	5		5	42	1			43
	60-70.	83.3		83.3	67.8	1.6			69.4
	70-80.	1		1	14	2			16
		16.7		16.7	22.6	3.2			25.8
6 months and under 12.	Under 50.								
	Under 60.	6		6	58	4			62
	60-70.	100.0		100.0	83.5	6.6			100.0
	70-80.								
	80-90.								
12 months, or since commencement of war.	Under 50.								
	Under 60.	5		5	45	3			48
	60-70.	100.0		100.0	63.4	4.2			67.6
	70-80.				18				18
	80-90.				25.4				25.4
Before the war...	Under 50.								
	Under 60.	2		2	27	3			30
	60-70.	50.0		50.0	77.2	8.6			85.7
	70-80.	1		1	4	1			5
		25.0		25.0	11.4	2.9			14.3
	Under 50.								
	Under 60.	4		4	31	4			35
	60-70.	100.0		100.0	88.6	11.4			100.0
	70-80.								
		17	1	18	229	18	1		248
	94.4	5.6	100.0	88.3	7.3	0.4		100.0	

HEALTH OF MALE MUNITION WORKERS. 133

FACTORIES—DURATION OF EMPLOYMENT, NET AVERAGE HOURS WORKED WEEKLY, STANDARD OF PHYSIQUE.

D—bad. The italic figures below the actual totals indicate percentages.]

Medium.					Light.					Net average hours worked weekly.	Duration of employment.	
A.	B.	C.	D.	Total.	A.	B.	C.	D.	Total.			
						3				3	Under 50.	Under 6 months.
						<i>1.0</i>				<i>1.0</i>		
11	1			12	68	2	1	1	72	72	Under 60.	
<i>4.8</i>	<i>0.4</i>			<i>5.3</i>	<i>21.7</i>	<i>0.6</i>	<i>0.3</i>	<i>0.3</i>	<i>23.0</i>	<i>23.0</i>	60-70	
190	13	3	1	207	228	10			238	238	70-80	
<i>83.7</i>	<i>5.8</i>	<i>1.3</i>	<i>0.4</i>	<i>91.3</i>	<i>72.8</i>	<i>3.2</i>			<i>76.0</i>	<i>76.0</i>		
5.0	3			8								
<i>2.2</i>	<i>1.3</i>			<i>3.5</i>								
206	17	3	1	227	299	12	1	1	313	313		
<i>80.8</i>	<i>7.5</i>	<i>1.3</i>	<i>0.4</i>	<i>100.0</i>	<i>95.6</i>	<i>3.8</i>	<i>0.3</i>	<i>0.3</i>	<i>100.0</i>	<i>100.0</i>		
1				1	1				1	1	Under 50.	6 months and under 12.
<i>0.5</i>				<i>0.5</i>	<i>0.7</i>				<i>0.7</i>	<i>0.7</i>		
11	1			12	39	2			41	41	Under 60.	
<i>5.0</i>	<i>0.5</i>			<i>5.5</i>	<i>27.3</i>	<i>1.4</i>			<i>23.7</i>	<i>23.7</i>	60-70	
175	21	2		198	32	7	2		101	101	70-80	
<i>80.3</i>	<i>9.8</i>	<i>0.9</i>		<i>90.8</i>	<i>64.3</i>	<i>4.9</i>	<i>1.4</i>		<i>70.6</i>	<i>70.6</i>		
6	1			7								
<i>2.8</i>	<i>0.5</i>			<i>3.3</i>								
193	23	2		218	132	9	2		143	143		
<i>88.5</i>	<i>10.8</i>	<i>0.9</i>		<i>100.0</i>	<i>62.3</i>	<i>6.3</i>	<i>1.4</i>		<i>100.0</i>	<i>100.0</i>		
4	1			5	11	2	1	1	15	15	Under 60.	12 months, or since commencement of war.
<i>2.0</i>	<i>0.5</i>			<i>2.4</i>	<i>16.7</i>	<i>3.0</i>	<i>1.5</i>	<i>1.5</i>	<i>22.7</i>	<i>22.7</i>		
171	27	2		200	46	4			50	50	60-70	
<i>83.4</i>	<i>13.2</i>	<i>1.0</i>		<i>97.6</i>	<i>69.7</i>	<i>6.1</i>			<i>75.8</i>	<i>75.8</i>	70-80	
						1			1	1		
						<i>1.5</i>			<i>1.5</i>	<i>1.5</i>		
175	28	2		205	57	7	1	1	66	66		
<i>85.4</i>	<i>13.7</i>	<i>1.0</i>		<i>100.0</i>	<i>86.4</i>	<i>10.6</i>	<i>1.5</i>	<i>1.5</i>	<i>100.0</i>	<i>100.0</i>		
1				1							Under 50.	Before the war.
<i>2.5</i>				<i>2.5</i>								
5				5	6				6	6	Under 60.	
<i>12.5</i>				<i>12.5</i>	<i>19.4</i>				<i>19.4</i>	<i>19.4</i>	60-70	
30	3			33	23	1	1		25	25	70-80	
<i>75.0</i>	<i>7.5</i>			<i>82.5</i>	<i>74.2</i>	<i>3.2</i>	<i>3.2</i>		<i>80.6</i>	<i>80.6</i>		
1				1								
<i>2.5</i>				<i>2.5</i>								
37	3			40	29	1	1		31	31		
<i>82.5</i>	<i>7.5</i>			<i>100.0</i>	<i>93.6</i>	<i>3.2</i>	<i>3.2</i>		<i>100.0</i>	<i>100.0</i>		
611	71	7	1	690	517	29	5	2	553	553		
<i>88.6</i>	<i>10.3</i>	<i>1.0</i>	<i>0.1</i>	<i>100.0</i>	<i>83.5</i>	<i>6.2</i>	<i>1.0</i>	<i>0.4</i>	<i>100.0</i>	<i>100.0</i>		

134 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

MEN ENGAGED SINCE THE OUTBREAK OF WAR. BOYS ENGAGED SINCE THE OUTBREAK OF WAR.

TABLE 3.—Very heavy and heavy labor.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 70.....	150	40	190
Over 70.....	102	45	147
All hours.....	252	85	337

Percentage of A's in "under 70" group, 73.95.
 Percentage of A's in "over 70" group, 69.39.
 Difference—9.56±3.22.

TABLE 4.—Medium and light labor.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 70.....	156	47	203
Over 70.....	55	27	82
All hours.....	211	74	285

Percentage of A's in "under 70" group, 76.8.
 Percentage of A's in "over 70" group, 67.1.
 Difference—9.7±3.87.

TABLE 7.—Very heavy and heavy labor.

Period of employment.	General health.		
	A	B+C+D	All groups.
Under 12 months.....	155	51	206
Over 12 months.....	97	34	131
All periods.....	252	85	337

Percentage of A's in "under 12 months" group, 75.2.
 Percentage of A's in "over 12 months" group, 74.0.
 Difference—1.2±3.30.

TABLE 8.—Very heavy and heavy labor.

Period of employment.	Hours of labor.		
	Under 70 hours.	Over 70 hours.	All hours.
Under 12 months.....	107	99	206
Over 12 months.....	83	48	131
All periods.....	190	147	337

Percentage of men working "under 70 hours and under 12 months," 51.9.
 Percentage of men working "under 70 hours and over 12 months," 63.4.

Difference—11.5±3.74

TABLE 5.—Very heavy and heavy labor.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 60.....	156	9	165
Over 60.....	55	7	62
All hours.....	211	16	227

Percentage of A's in "under 60" group, 94.55.
 Percentage of A's in "over 60" group, 88.71.
 Difference—5.86±2.57.

TABLE 6.—Medium and light labor.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 60.....	149	13	162
Over 60.....	913	97	1,010
All hours.....	1,062	110	1,172

Percentage of A's in "under 60" group, 91.98.
 Percentage of A's in "over 60" group, 80.49.
 Difference—11.5±1.67.

TABLE 11.—Very heavy and heavy labor.

Period of employment.	General health.		
	A	B+C+D	All groups.
Under 12 months.....	135	9	144
Over 12 months.....	76	7	83
All periods.....	211	16	227

Percentage of A's in "under 12 months" group, 83.8.
 Percentage of A's in "over 12 months" group, 81.6.
 Difference—2.2±2.38.

TABLE 12.—Very heavy and heavy labor.

Period of employment.	Hours of labor.		
	Under 60 hours.	Over 60 hours.	All hours.
Under 12 months.....	101	43	144
Over 12 months.....	64	19	83
All periods.....	165	62	227

Percentage of boys working "under 60 hours and under 12 months," 70.1.
 Percentage of boys working "under 60 hours and over 12 months," 77.1.

Difference—7.0±4.14

MEN ENGAGED SINCE THE OUTBREAK OF WAR—Concluded. BOYS ENGAGED SINCE THE OUTBREAK OF WAR—Concluded.

TABLE 9.—Medium and light labor.

Period of employment.	General health.		
	A	B+C+D	All groups.
Under 12 months.....	123	42	165
Over 12 months.....	88	32	120
All periods.....	211	74	285

Percentage of A's in "under 12 months" group, 74.5.
Percentage of A's in "over 12 months" group, 73.3.
Difference—1.2±3.55.

TABLE 10.—Medium and light labor.

Period of employment.	Hours of labor.		
	Under 70 hours.	Over 70 hours.	All hours.
Under 12 months.....	109	56	165
Over 12 months.....	94	28	120
All periods.....	203	82	285

Percentage of men working "under 70 hours and under 12 months," 66.1.
Percentage of men working "under 70 hours and over 12 months," 78.3.
Difference+12.2±3.66.

TABLE 15.—Heavy labor. Length of employment, 6 to 12 months.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Over 70 hours.....	30	8	47
Under 70 hours.....	43	21	64
All hours.....	82	29	111

Percentage of A's in "under 70 hours" group, 83.0.
Percentage of A's in "over 70 hours" group, 67.2.
Difference—15.8±5.09.

TABLE 16.—Heavy labor. Length of employment, 12 months to 8 years.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 70 hours.....	42	14	56
Over 70 hours.....	26	15	41
All hours.....	68	29	97

Percentage of A's in "under 70 hours" group, 75.0.
Percentage of A's in "over 70 hours" group, 63.4.
Difference—11.6±6.35.

TABLE 13.—Medium and light labor.

Period of employment.	General health.		
	A	B+C+D	All groups.
Under 12 months.....	830	71	901
Over 12 months.....	232	39	271
All periods.....	1,062	110	1,172

Percentage of A's in "under 12 months" group, 92.1.
Percentage of A's in "over 12 months" group, 85.6.
Difference—6.5±1.36.

TABLE 14.—Medium and light labor.

Period of employment.	Hours of labor.		
	Under 60 hours.	Over 60 hours.	All hours.
Under 12 months.....	142	769	911
Over 12 months.....	20	251	271
All periods.....	162	1,020	1,172

Percentage of boys working "under 60 hours and under 12 months," 15.8.
Percentage of boys working "under 60 hours and over 12 months," 7.4.
Difference—8.4±1.61.

TABLE 17.—Medium and light labor. Length of employment, under 6 months.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 60 hours.....	82	5	87
Over 60 hours.....	428	30	458
All hours.....	510	35	545

Percentage of A's in "under 60 hours" group, 94.2.
Percentage of A's in "over 60 hours" group, 83.4.
Difference—10.9±1.93.

TABLE 18.—Medium and light labor. Length of employment, over 6 months.

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 60.....	52	8	55
Over 60.....	273	33	306
All hours.....	325	36	361

Percentage of A's in "under 60 hours" group, 94.5.
Percentage of A's in "over 60 hours" group, 89.2.
Difference—5.3±2.96.

136 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

MEN ENGAGED BEFORE THE WAR.

TABLE 19.—*Very heavy and heavy labor.*

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 70.....	310	91	401
Over 70.....	175	15	190
All hours.....	485	106	591

Percentage of A's in "under 70" group, 77.31.
 Percentage of A's in "over 70" group, 89.74.
 Difference—12.43±2.28.

TABLE 20.—*Medium and light labor.*

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 70.....	133	42	175
Over 70.....	117	38	155
All hours.....	250	80	330

Percentage of A's in "under 70" group, 76.00.
 Percentage of A's in "over 70" group, 75.48.
 Difference—0.52±3.19.

BOYS ENGAGED BEFORE THE WAR.

TABLE 21.—*Very heavy and heavy labor.*

Hours of labor.	General health.		
	A	B+C+D	All groups.
Under 60.....	29	3	32
Over 60.....	6	1	7
All hours.....	35	4	39

Percentage of A's in "under 60" group, 90.63.
 Percentage of A's in "over 60" group, 85.71.
 Difference—4.92±8.54.

TABLE 22.—*Medium and light labor.*

Hours of labor.	General health.		
	A.	B+C+D.	All groups.
Under 60.....	12	.....	12
Over 60.....	54	5	59
All hours.....	66	5	71

Percentage of A's in "under 60" group, 100.00.
 Percentage of A's in "over 60" group, 91.53.
 Difference—8.48±5.46.

It is then probably permissible to draw from the data the conclusion that long hours seem to exercise a prejudicial effect upon average general health. The exact intensity of this effect can not, of course, be measured by data of this kind, but if we combine all the results for postwar men it appears that 22.1 per cent of the men working less than 70 hours are in a physical class below A and 31.4 per cent of those working 70 or more hours. Of the boys 6.7 per cent and 10.6 per cent, respectively, are the percentages among those working less than 60 hours and for those working 60 hours or more. This difference is a serious one. If one examines the relations between health and nature of work, it appears that the heavier grades of work are associated on the whole with a higher health standard. Taking all the men together, the proportion of A men is 83 per cent, 78 per cent, 76 per cent, and 75 per cent in the very heavy, heavy, medium, and light occupations, respectively, and this relation holds for both prewar and postwar workers. The heavier work may actually be healthier, though the suggestion of selection is strong.

The influence of change of occupation is interesting. Out of the total number examined, adult and juvenile, who had been employed not less than six months, it was found that 887 persons had vacated other occupations to go into munition factories. Twenty-nine of this

number reported themselves as feeling better, the result of increased wages, regular hours, and improved factory environment in contrast to the conditions of their former avocations, such as underground offices or workshops and exposure to dust in tea packing, flour mills, and other industries. The majority, 741, reported that they felt just the same, while 117 complained of feeling worse. The previous occupations included barmen, silversmiths, auctioneers, commercial travelers, farmers, bakers, butchers, grocers, stablemen, dental mechanics, coach makers, goldbeaters, valets, tailors, bricklayers, shoemakers, horsehair cleaners, shop assistants, and clerks, among many others. Further interest is lent to this part of the inquiry on account of the determination of many of these workers to turn their backs on their former occupations, and especially in reference to barmen, who in every case reported a very marked improvement in health, which was ascribed to greater regularity of meal hours and abstinence from "nipping," with consequent improved appetite.

MEDICAL DEFECTS FOUND.

11. Table 23 shows the predominant physical disabilities of the workers, adult and juvenile; some of them contribute, perhaps in a slight measure, to fatigue, or are the result of overwork. In the earlier part of this inquiry, I did not recognize sufficiently the value of every particle of evidence bearing upon the question of general health and overwork, so that some of the items do not appear throughout the list. In other cases where percentages are small, they have been marked down because at the time of examination the evidences were so clearly marked in the examinees.

In Factory 1 (work of all grades of severity) men were examined at a season of the year when the weather was very bad. Most of them were working long hours and many of them had to travel long distances to and from their work. The nervous symptoms were marked, especially in the case of the boys. Among the latter the percentage record showed less than the truth, as a note was made only in those cases who were suffering severely. Sleepiness on the night shift showed large percentages which were due, particularly among the boys, to the evils of night shifts. Without discussing the reasons for and against night shifts, the fact remained that the figures, as they stand, admit of very little argument. The workers were genuinely tired, and I frequently found that the boys never became accustomed to the conditions of a night shift owing to the frequency of the change over; in other words, when a boy at the end of a week of day work is just recovering from the effects of night shift he is back again on to night work. Restlessness, as recorded here, was very severe, and was due, in all cases, so it was reported,

to the struggles for trams and trains and the long journeys homeward after the day's toil. Headache, in the case of the men, was very largely due to digestive disturbances, but in the case of the boys was the result of shop conditions, loss of sleep, long hours of work, and long journeys to and from the factory. Muscular pains were noted at this time only in the case of those who were suffering severely. The figures for the teeth do not need discussion. In the case of eyesight, the percentage of spectacles recorded for this and other factories includes, for the most part, those men who, either in the gaslight or for the purposes of reading, were forced to wear spectacles owing to the changes which take place in the eyes about middle life. The majority of processes upon which the men examined were engaged did not call for the use of spectacles. Under the head of "corrected," the figures represent men or boys who had defective sight, had had their defects corrected, and were ordered to wear spectacles continuously. Skin rashes resulting from exposure to oils used as lubricants at this factory equal 9 per cent, and were due, in a very large measure, so I was informed, to want of proper cleanliness—in my opinion the direct result of imperfect facilities for washing.

In Factory 2 (work mostly very heavy, heavy, and medium) digestive and respiratory troubles were high, the respiratory troubles because at the season of the year at which this factory was visited the weather was extremely bad. The percentages for nervous symptoms are low. There was no record of particular men being unduly tired either at the end of the day or on rising in the morning. This had been largely brought about by the reduction of hours which had taken place on three or four occasions. Sleepiness on the night shift was not very common, particularly among the boys. The majority of boys in this factory came from good homes, and showed a striking contrast after the conditions reported in Factory 1. Headache was common among the boys, and was due to the noise of the machinery and the smell of oil rather than to loss of sleep. Digestive disturbances were similarly caused. It was ascertained, in the course of this inquiry, that most of the boys at this factory slept alone (see par. 24). Muscular pains are more numerous than in Factory 1, but that was due, very largely, to closer inquiry and greater appreciation of their value for this report. In any case they are caused by standing for long periods at machines or benches. Nasal catarrh was severe. The condition of the teeth calls for note—the majority of the boys had very good teeth, but oral sepsis was considerable and, in many cases, severe.

In Factory 3 (work mostly very heavy and heavy) the digestive disturbances among the men were high, probably owing to the prevalence of very bad teeth. Respiratory troubles were also high, be-

cause the weather was very cold and the majority of the men were engaged in hot and heavy trades. The percentage of nervous affections was small. Overwork as measured by a tiredness either at the end of the day or on rising in the morning was not noted. A large number of boys in this factory complained of sleepiness on the night shift. The percentage of men suffering from restlessness on going to bed was small, and was due almost entirely to the discomfort of varicose veins aggravated by their heavy work and their exposure to furnace fires, etc. The percentage of men suffering from headache was high. Footache and muscular pains together form a high percentage in both men and boys. The importance of these symptoms is obvious, and their contribution to strain from fatigue is very considerable and must be regarded as an index of the workers' health conditions. Enlarged tonsils were very prevalent among the boys, and I have no doubt caused the boys to resist more feebly the strain of their work. For the most part the teeth of the boys were good, but there was a sad neglect of oral cleanliness.

In Factory 4 (work heavy and medium) digestive troubles were numerous amongst the men as well as amongst the boys. Many of the boys in this and succeeding factories 5 and 6, where steel is made, suffered severely from digestive troubles owing to the irregularity with which they take their meals, many of them having to "work through" on account of the "heats." Respiratory troubles were not so high, because the weather had improved considerably. A definite record of the nervous conditions of the men and of the boys was difficult to obtain here owing to the fact that the employees were afraid of the information being conveyed to the management, though it was distinctly pointed out to them that any information they chose to give was confidential. On the night shift 20 per cent of the boys suffered from marked sleepiness and weariness, due in large measure to the monotony of the work, the peculiar character of the work, and the juvenility of the workers; 11 per cent of the men suffered from restlessness on retiring to bed, due to the weariness produced by long hours of work. Foot ache, muscular pains, and swelling feet were very prevalent. In this factory the men and the boys were very poor specimens compared with those examined in the preceding works. This was due entirely to the peculiarities of the industry. As usual, oral sepsis existed, but to a greater extent than in any other factory visited; 9.8 per cent of the men engaged here suffered from deafness, the cause for which could not be ascertained.

In factory 5 (work mostly very heavy and heavy) the percentages for digestive troubles are high, due to a variety of causes, chief amongst which are the condition of the teeth and the irregularity of meal hours, owing to the nature of the work. The number of employees, both adult and juvenile, complaining of weariness at vari-

ous periods of the week is about average. On the night shift a very large percentage of the boys complain of sleepiness. At the time of the examination, those amongst whom this complaint was made were quite young and doing very heavy work on a 12-hour night shift, exposed to excessively high temperatures in stamping and shell shops, and with very little opportunity for sufficient rest owing to many causes, chief of which, perhaps, was the domestic conditions of their homes. Headache was prevalent. The percentage of foot ache amongst these boys was not so high as in the preceding factory, but was severe. Muscular pains were frequent and occurred generally amongst the boys just over 14 years of age. Enlarged tonsils again were very prevalent. The teeth here were, among the majority, very good, but again sadly neglected. Defective eyesight, both amongst boys and men, was not numerous. Among the men, headache of a frontal character was common. Foot ache and muscular pains were very prevalent and in many cases very severe, brought about by reason of their heavy work and exposure to high temperatures.

In Factory 6 (work mostly very heavy and heavy) the percentages of workers suffering from digestive troubles are again high. Many men complain of weariness at the week end, ascribed by them to their work and also to shop conditions, which would, in my opinion, contribute very largely to such an end. The sand about the foundry floors is hot, and in the establishments under review all the men working in the foundries complain. The factory is old and the shop arrangements, generally speaking, are not good. The fettlers particularly were affected by weariness both night and morning, but men engaged in other branches of industry fall within this category. There is no record for boys with reference to sleepiness on the night shift because the majority of boys examined did not work on night shift. Headache among the men was frequent and severe; among the boys the percentage was very low. Flat foot, foot ache, swelling feet, and muscular pains were severe and frequent. Among the boys these defects did not show such a high percentage as among similar boys in other factories of the same town. Enlarged tonsils were again very frequent. Deafness among boys and men is referred to, the deafness occurring chiefly among those engaged in foundries.

Factory 7 (work heavy and medium) had been running for about six months prior to the examination conducted on behalf of your committee. It is in a town quite unaccustomed to the conditions common to munition workers. The weather at the time of the examination was very good. Respiratory troubles are referred to as being found among 13 per cent of the workers. One-third of the men complained of being thoroughly tired at the end of the day; 13 per cent of the boys reported similarly. The work was heavy, chiefly

pressing 6-inch shells, and the unaccustomed conditions of the work account very materially for these figures. On the night shift 11 per cent of the men and 20 per cent of the boys complained of being very sleepy. During the afternoon 7 per cent of the men complained of sleepiness and weariness due to exposure to high temperatures and the heavy work; 9 per cent of the men complained of restlessness at night, reporting that they felt too tired after their day's work to sleep when they get into bed. Foot ache was very prevalent among the men; muscular pains were complained of by 31 per cent. Among the boys swelling feet were not uncommon, and inquiry elicited the information that the swelling had only made its appearance since they had worked close to the shell furnaces. Enlarged tonsils were frequent, the eyesight was good, and the teeth very moderately good.

Factory 8 (work medium and light) was a modern factory employing a large number of men. For the purposes of the inquiry I examined all the boys available, with the results set out in the table. The number complaining of tiredness was rather small and due, in the majority of cases, to the fact that the boys had very recently left school and joined the factory. The general condition of the boys was excellent, and the home conditions, broadly speaking, were very good. There was not much incentive to be out later than 10 o'clock in this particular town, owing to the lighting regulations. There were complaints of sleepiness in the afternoons in hot weather. This was ascribed to the warmth of the workshop and the peculiarly soporific atmosphere of the district. Headache was frequent. Flat foot, foot ache, and muscular pains were not severe and were not frequent. Nasal catarrh and enlarged tonsils were common. The cleanliness of the mouth was marked.

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TABLE 23.—A TABLE OF PHYSICAL DEFECTS TO SHOW THE COMPARISON BETWEEN SEASON OF THE YEAR WHEN

	Factory 1. February-March.		Factory 2. March-April.		Factory 3. April-May.	
	Men, 532.	Boys, 88.	Men, 376.	Boys, 124.	Men, 137.	Boys, 73.
General health grouping:	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
A.....	74.5	69.3	76.0	90.3	85.4	93.1
B.....	17.7	26.2	17.6	6.6	12.4	6.9
C.....	7.1	4.5	5.1	1.6	2.2	
D.....	.7		.2	1.6		
Digestive.....	3.4		26.0		42.3	6.9
Constipation.....	1.5			1.6	6.5	6.2
Circulatory.....	2.0	1.1	1.3		2.8	
Respiratory.....	5.5		45.5	16.1	51.0	34.2
Nervous.....	10.5	13.6	4.5	2.5	3.6	
Tired, end of day.....			1.1			
Tired, week end.....			.5			
Tired, rising.....						
Easily fatigued.....	18.5	13.6	.2	.2		
Sleepiness:						
Night shift.....	25.0	41.0	2.7	1.4	.7	15.5
Afternoons.....						
Restless.....	10.7	10.2	2.1	.8	3.0	1.4
Headaches:						
Frontal.....	16.7	33.0	15.9	22.5	18.2	22.0
Temporal.....	2.0		2.9	1.6	.7	1.4
Occipital.....	1.3		1.3	.8	1.4	
Migraine.....	.2		.2			
Anemia.....	.2	3.4	.2	.6	.7	2.8
Fainting.....	.6		.5			
Giddiness.....			.2	3.2	.7	1.4
Varicose veins.....	8.0		9.2	1.6	3.6	1.4
Hemorrhoids.....	4.0		6.9		4.4	
Flat foot.....	1.3	1.1	.2	2.4		
Foot ache.....					6.5	31.5
Swelling feet.....	3.5	1.1	8.5		4.4	2.8
Muscular pains.....	18.0	3.4	32.0	12.0	29.0	8.2
Hernia:						
Double.....	8.3		7.9		4.4	
Ventral.....			1.1			
Umbilical.....			.2		.7	
Nasal catarrh.....	50.0	30.0	71.0	55.6	97.0	90.4
Enlarged tonsils.....	.2	9.0	1.1	5.6		37.0
Cleft palate.....			.2			
Teeth:						
Good.....	55.4	82.0		92.0		91.8
Moderately good.....			47.5	.8	25.6	
Very bad.....	32.0	14.0	35.4	6.4	52.6	8.2
None.....	2.0		7.6		10.9	
False.....	9.0	4.0	9.5	.8	10.9	
Epsps.....			61.7	29.8	71.5	51.0
Eyestrain:						
Good.....	90.4	93.2	89.8	97.5	95.0	93.6
Defective.....	5.6		10.2	2.5	5.0	1.4
Corrected.....			3.2	2.5		
Spectacles.....	38.0		25.5	2.5	46.0	
Cataract.....			.1		2.0	
Glass eye.....	1.3		.2		.6	
Deaf.....			.2			1.4
Oil rash.....		9.0				
Enlarged thyroid.....						
Otitis media.....						

THE FACTORIES AND ALSO SHOWING VARIOUS EFFECTS OF "FATIGUE," AND THE THE INQUIRY WAS CONDUCTED.

Factory 4. May.		Factory 5. May.		Factory 6. May-June.		Factory 7. June-July.		Factory 8. July.	Factory 1. July-August.
Men, 61.	Boys, 29.	Men, 152.	Boys, 97.	Men, 246.	Boys, 91.	Men, 45.	Boys, 15.	Boys, 92.	Boys, 900.
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
75.4	75.8	87.5	88.4	76.6	93.5	73.3	86.7	98.9	92.0
21.2	17.2	12.0	10.3	17.5	5.4	24.5	13.2	1.1	6.7
2.8	7.0		1.3	5.5	1.1	2.2			4
		.5		.4					
34.5	13.7	40.7	18.5	41.2	15.3	20.0		4.4	4.0
5.0			2.1					1.1	2.6
6.6	3.4	1.9		.8	1.1			1.1	.7
39.3	3.4	36.8	7.2	33.7	2.2	13.3		1.1	.6
1.6				.4					.2
	2.4		5.2	3.0		33.3	13.3	7.6	14.5
		11.2	6.2	30.5	6.5	33.3	13.3	11.0	15.2
			1.3	33.7	12.0	4.5		5.5	20.0
		2.0		2.7	2.2				1.5
	20.7	.6	24.7	2.1		11.1	20.0		51.0
						6.6		17.7	
11.0		3.3		6.2	2.2	8.8			3.0
26.2	26.7	19.7	26.8	25.0	6.2	8.8		17.5	15.0
3.2	2.4	3.2	2.6	1.3	4.4			4.3	1.6
2.2		2.0		.4	3.3			1.1	1.1
		2.0	3.1	.4	2.2				.9
				.4					2.2
				.8					
				.8					.1
2.2		4.5		6.0		8.8			
9.8		6.5		2.1	2.2			1.1	.1
				.4					
21.3	38.0	46.0	18.5	45.0	7.7	24.4	6.6	6.5	14.5
8.2		8.5	2.6	3.8	2.2	4.4	13.3	1.1	
36.0	24.1	39.5	15.4	32.5	9.8	31.1	6.6	7.6	17.0
6.0		7.2		6.2		8.8			
3.2									
		.6							
93.2	92.4	92.1	99.6	96.2	98.5	97.5	53.3	24.0	82.5
	34.5		35.0		83.8		13.3	24.0	19.2
									.1
24.6		20.3	92.8	10.5	96.8	13.5	86.6	66.3	75.6
14.7	82.8	18.5	4.1	26.6	11.0	22.2	6.6	25.0	24.1
47.2	17.2	39.5	3.1	43.7	2.2	46.6	6.8	3.3	2.3
6.5		16.3		10.0		11.1			
7.6		5.3		6.2		6.6		5.4	
82.0	65.5	77.5	63.1	55.5	46.3	77.7	53.3	17.4	
92.5	89.7	92.2	97.9	88.0	94.5	97.7	100.0	98.9	97.8
7.5	10.3	7.8	2.1	12.0	6.5	2.3		1.1	2.2
	3.4							1.1	
42.6		65.5		53.0		42.2			
.8									
			1.3	8.3	2.2	4.5		1.1	.3
9.8									.8
									.2
									.1

¹ If hot weather.

At the time of the return visit to factory 1 the weather was exceedingly good. The percentages of boys complaining of tiredness at varying periods of the week are interesting. In some cases it was undoubtedly due to the prevalence of late hours, but not in all cases. In my opinion the majority of boys so complaining did so because they were tired as the result of really hard work, frequently combined with the difficulties of a long railway or tram journey. Sleepiness on the night shift claims 51 per cent of the workers. It may be said that this was largely due to the neglect of opportunities for sleep during the day. It might be suggested that though the boy is tired and goes to bed immediately he leaves the night shift he not infrequently gets up early in the afternoon so as to obtain some social amusement before going to work. In my opinion this may account for a small percentage of the sleepiness that I found among these boys, but I do not feel satisfied on the point. The boys in this factory work alternate day and night shifts of 12 hours, in many cases stand for hours when traveling to and from their homes, and very frequently when they reach home have to wait some little time for a meal before they get to bed. Generally, I found that where the domestic conditions were good, and there was little doubt about the authenticity of the statements with reference to hours of sleep, the boys still complained of sleepiness. It is contrary to the laws of nature for young children—for such many of these are—to be able to turn night into day without feeling an effect. Among the boys examined in the various departments of this factory on this occasion many complained of foot ache and muscular pains though they were not exposed to temperatures other than the ordinary temperature of a workshop. Nasal catarrh was very prevalent, enlarged tonsils also. The teeth were, for the most part, good, but there was a great lack of oral cleanliness.

CONSIDERATIONS ARISING FROM THE NATURE OF THE WORK.

12. (a) In the very heavy trades nearly all the men complained of feeling thoroughly tired and weary at the end of their day's work where the shift was more than eight hours. The rarity of the 8-hour shift in these trades struck me as remarkable (see below). In the few instances where I examined men working for such periods, they nearly always reported that they felt at the end of the shift almost as well as when starting work. Amongst the steel smelters and the other very heavy trades, an effort is made by the workmen to overcome the defects of the 12-hour shift. They arrange between themselves to shorten the day shift and lengthen the night shift. As these are alternate, the men so engaged have the opportunity of enjoying more recreation and rest every other week. In all very heavy trades which I have investigated, the exposure to heat is considerable, and renders physical effort more exhausting.

In two factories where steel was made by the open-hearth method, the men so engaged gave one the impression of being a good sample, due very largely, in my opinion, to the excellence of the general arrangements, which permitted them to get modern plants at such works and the opportunity for getting away from the immediate vicinity of the furnaces, while still near enough to regulate them. At one factory where the shop conditions are undoubtedly very bad, owing to lack of ventilation, old-fashioned methods of charging the furnaces, and the general proximity of the furnaces to each other, the men gave the impression of showing signs of being weary and tired. They were sallow complexioned, looked more tired, and certainly had not the physique of men similarly engaged in the better workshops. The temperature of this steel shop at the time of my visit was 138° F., the temperature of the teemings varying from 1,800 to 2,300° C. I had the opportunity of reviewing the men on the day shift as well as those who worked on the night shift, and they all complained of the imperfect ventilation and the want of proper machinery with which to charge the furnaces. The forgesmen engaged on the heavy ingots used for making big guns appeared strong, well-nourished, powerful men. At the time of this examination their hours were long, and it was only owing to the intermittent character of their work that they were able to stand up against the strain they were enduring. The shop manager said that in his opinion the men had worked magnificently, but would not be able to continue at the same pressure in spite of the intermittent conditions. This class of work causes the men to become very thirsty. For an onlooker, unaccustomed to industrial conditions such as these, the greatest sympathy for the workers is excited because the effort called for is tremendous, and the way these men perspire as a result of their heavy work and exposure to the furnaces is astonishing. Beer is the usual refreshment. A few of the workers are abstainers from alcohol in any form. These latter are usually the most reliable men. When the supply of drink was restricted by the closing of the public houses in the district, a great improvement in the health and the timekeeping of the workmen was noticed and was admitted by the men. No satisfactory substitute for beer, so far as is at present known, has been introduced. The use of such substitutes as oatmeal water and barley water is stated to cause skin eruptions and boils.

The work, though very hard, is usually intermittent with long periods of comparative rest. The weather greatly influences the capacity of the men for work; wind blowing the air over the hot furnaces into their faces adds considerably to their difficulties; really cold weather soon affects the older men by producing chest troubles and rheumatic conditions, though the younger and newer hands work with much greater comfort.

(b) In the heavy trades, almost with one consent the men tell you that at the end of the day they have had as much as they can possibly stand. In many instances these men, in order to do their work satisfactorily, absent themselves for a couple of days for rest purposes. I am assured by the firms that so long as the departmental managers know that these men are absent justifiably, no notice is taken. The effect upon the boys was commencing to show itself. Many, though little more than 14, were working 12-hour shifts, and doing heavy work. In the stamping shop, with an outside temperature of 78° F., the inside temperature close to the gateway was 90° F. In a smith shop the temperature was much higher, but varied according to one's proximity to the furnaces. The boys in these shops manipulate heavy pieces of steel at a temperature of about 900° F. They struck me as being considerably overworked; they looked dull and spiritless, and conversation with them gave the impression that they were languid. In fact, all the boys in this group were working, in my opinion, far too hard.

TABLE 24A.—LOSS OF TIME, THROUGH ILLNESS OR ACCIDENT, BY MEN (41 YEARS OR OVER) EXAMINED IN CERTAIN MUNITION FACTORIES; CAUSE, STANDARD OF HEALTH, NUMBER AFFECTED. TOTAL TIME LOST.

[Standards of general health: A=good; B=slightly below normal; C=much below normal; D=bad.]

Cause.	Group A (1,198 examined).			Group B (263 examined).			Group C (76 examined).			Group D (6 examined).			All groups (1,543 examined).		
	Men affected.			Men affected.			Men affected.			Men affected.			Men affected.		
	Number.	Percentage of number examined.	Time lost.	Number.	Percentage of number examined.	Time lost.	Number.	Percentage of number examined.	Time lost.	Number.	Percentage of number examined.	Time lost.	Number.	Percentage of number examined.	Time lost.
Illness.....	301	25.8	Days. 4,910	105	40	Days. 3,396	41	53.9	Days. 1,929	3	50.0	Days. 105	450	29.2	Days. 10,340
A.—Special:															
Digestive.....	33	3.2	685	17	6.5	508	6	7.9	44	2	33.3	56	63	4.1	1,293
Respiratory....	143	12.4	1,514	29	11.0	516	13	17.1	596	.....	.....	.....	190	12.3	2,626
Circulatory....	1	.1	35	4	1.5	140	5	6.6	292	.....	.....	.....	10	.6	467
Nervous—															
Definite....	5	.4	110	2	.8	35	2	2.6	63	.....	.....	.....	9	.6	208
Indefinite..	17	1.4	163	9	3.4	159	.....	.....	.....	1	16.7	49	27	1.8	376
Urinary.....	2	.2	63	1	.4	105	.....	.....	.....	.....	.....	.....	3	.2	168
Ocular.....	1	.1	7	2	.8	234	.....	.....	.....	.....	.....	.....	3	.2	261
B.—General:															
R h e u m a-															
tism.....	55	4.6	1,729	29	11.0	1,229	15	19.7	934	.....	.....	.....	99	6.4	3,892
Microbic and															
other infec-	32	2.7	459	11	4.2	443	.....	.....	.....	.....	.....	.....	43	2.8	902
tions.....	2	.2	140	1	.4	7	.....	.....	.....	.....	.....	.....	3	.2	147
Miscellaneous.															
Accident.....	88	7.4	2,310	9	3.4	131	4	5.2	183	.....	.....	.....	101	6.6	2,624
Injury to—															
Head.....	6	.5	175	.....	.....	.....	1	1.3	42	.....	.....	.....	7	.5	217
Eye.....	1	.1	42	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.1	42
Arm.....	3	.3	82	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.2	83
Hand.....	29	2.4	558	8	1.1	56	1	1.3	42	.....	.....	.....	33	2.1	656
Body.....	9	.8	119	3	1.1	56	.....	.....	.....	.....	.....	.....	12	.8	175
Leg.....	11	.9	699	1	.4	4	.....	.....	.....	.....	.....	.....	12	.8	703
Foot.....	19	1.6	512	.....	.....	.....	.....	.....	.....	.....	.....	.....	19	1.2	512
Miscellaneous.	10	.8	123	2	.8	15	2	2.6	99	.....	.....	.....	14	.9	237
	389	32.7	7,220	114	43.4	3,527	45	59.1	2,112	3	50.0	105	551	35.8	12,964

TABLE 24B.—LOSS OF TIME THROUGH ILLNESS OR ACCIDENT, BY BOYS (UNDER 18 YEARS) EXAMINED IN CERTAIN MUNITION FACTORIES; CAUSE, STANDARD OF HEALTH, NUMBER AFFECTED, TOTAL TIME LOST.

[Standards of general health: A=good; B=slightly below normal; C=much below normal; D=bad.]

Cause.	Group A (1,374 examined).			Group B (119 examined).			Group C (13 examined).			Group D (3 examined).			All groups (1,509 examined).		
	Boys affected.		Time lost.	Boys affected.		Time lost.	Boys affected.		Time lost.	Boys affected.		Time lost.	Boys affected.		Time lost.
	Number.	Percentage of number examined.		Number.	Percentage of number examined.		Number.	Percentage of number examined.		Number.	Percentage of number examined.		Number.	Percentage of number examined.	
Illness.....	266	19.3	Days. 2,952	38	31.9	Days. 525	9	69.3	Days. 219	1	33.3	Days. 2	314	20.9	Days. 3,698
A.—Special:															
Digestive.....	76	5.5	655	6	5.0	41	1	7.7	6				83	5.5	702
Respiratory....	49	3.6	629	10	8.4	121	1	7.7	7	1	33.3	2	61	4.0	758
Circulatory....							1	7.7	21				1	1	21
Nervous—															
Definite....	21	1.5	107	5	4.2	71							26	1.7	178
Indefinite..	37	2.7	149	6	5.0	44	2	15.4	11				45	3.0	204
Urinary.....	1	.1	84										1	.1	84
Ocular.....															
B.—General:															
Rheumatism....	7	.5	128	4	3.4	140	2	15.4	112				13	.9	380
Microbic and other infections.....	40	2.9	749	4	3.4	64							44	2.9	813
Miscellaneous.	35	2.5	452	3	2.5	44	2	15.4	62				40	2.7	558
Accident.....	134	9.7	2,855	16	13.4	391							150	9.9	3,236
Injury to—															
Head.....	14	1.0	221										14	.9	221
Eye.....	4	.3	37	1	.8	120							5	.3	157
Arm.....	16	1.2	225	2	1.7	32							18	1.2	257
Hand.....	60	4.4	1,256	8	6.7	181							68	4.5	1,437
Body.....	6	.4	179										6	.4	179
Leg.....	14	1.0	660	2	1.7	17							16	1.1	677
Foot.....	13	.9	178	2	1.7	24							15	1.0	202
Miscellaneous.	7	.5	99	1	.8	7							8	.5	108
	400	29.0	5,807	54	45.3	906	9	69.3	219	1	33.3	2	464	30.8	6,934

(c) The physical fatigue of the medium and light occupations is not such that it produces a feeling of weariness and overwork of itself. Monotony and long hours added to weight of work are the chief causes. Among the men the complaints concerning weight of work were not so frequent as concerning length of hours. Several of the men I examined complained about the continuous work without a break. Among the boys engaged in the occupations under discussion complaints were made that they felt the long hours—in many instances with added difficulties of getting to and from home—but they said that owing to much better wages they thought they would be able to continue for at least some time. On the other hand many of the boys expressed themselves as desirous of returning to their old occupations, even though for lower wages. In these trades, both for men

and boys, the effect of work and long hours is shown by the weariness and generally "fed-up" condition of the workers.

With reference to the table (23) dealing with the defects of the men engaged in the various factories there is no one defect that points conclusively to overwork or strain, but many of the symptoms taken collectively indicate severe strain, and I would suggest that sleepiness on the night shift, headache, footache, and muscular pains are probably the most common signs of overwork. The nervous symptoms added to these go far to complete the picture. The effect of noise upon the individual and its contribution to feelings of overtiredness and exhaustion must be considerable. In many of the workshops visited, though the work was not heavy, the noise was such that the result of lengthened periods in these factories was almost as severe as exposure to high temperature coupled with hard work.

HOURS OF LABOR.

13. The hours of labor were found to vary considerably. In some cases for boys under 14 years of age they were limited to 48, but in others boys of 18 were found to be working an average of over 80 hours per week, and it was ascertained that they had worked 90 and even 100 hours per week. In the case of men, the net average hours ranged from 53 to 108 hours per week. The latter hours, I am glad to say, were not prevalent, but they are recorded in Tables 1 and 2. Hours of labor must be considered in relation to the distance many of the workers have to travel to and from their work. While engaged for 12 hours per day in the factory, they spend in a large number of cases from $2\frac{1}{2}$ to 4 hours traveling to and from their homes. One boy, for example, travels 38 miles to and from his work, and spends 4 hours in the transit. Another boy, aged 15, travels 26 miles to and from his work and spends 4 hours in the transit. Another boy, aged 17, travels 25 miles to his work and spends 4 hours in the transit. These hours, added to the working hours, leave very little time for meals at home, recreation, or sleep. Similar instances for men could be given.

My general impression is that hours tend to be too long for the proper preservation of health and efficiency. Large numbers of boys are working a net average of $68\frac{1}{2}$ hours per week. Under certain conditions the effect upon their health is not so deleterious as in others, but, whatever the conditions, where more than one hour has to be spent in going to and from the factories, in my opinion, $68\frac{1}{2}$ hours are too many. Many of these boys are just over 14 years old, and they spend considerably more than two hours per day in traveling, thus having very little time for recreation or for rest. The natural bent of most of us is to revolt against a yoke of any kind in modern times. This is just what happens. The boys have found

from experience that they can not comfortably work over 60 hours per week, and as evidence of this—in one shop, where 600 boys worked, 500 of them on a Saturday afternoon did not return to work.

The same state of affairs, with a few exceptions, is found up and down the country. On the night shifts, boys do not tolerate well long hours, and in one factory a very large percentage of the boys complained of sleepiness and disinclination for work. It has to be borne in mind that the average age of the boys examined would certainly not exceed 15 years, and it makes one consider very seriously the future of the rising generation. One factory was chosen for the specific purpose of examining the differences that existed where night work was not done, and where a modern installation added to the comfort of the workers. At this particular factory 5 o'clock was the nominal knocking-off time; from 5 to 8 a small number of the workers, both adult and juvenile, worked overtime, but in the main most of the workers left the factory at 5 o'clock. Some of the boys work occasionally until 4 o'clock on Saturday afternoons, but most of them had Saturday afternoon and all Sunday free. They were a clean, well-dressed, well-nourished, intelligent lot of boys. The hours for all the boys examined would average about 62 per week. Their wages were low, but in spite of this fact they all managed before leaving home to have tea, bread, and butter, and frequently an egg, though many of them had to leave at 5 a. m. to reach their work at 6 o'clock. To show the advantages of restricted hours and good factory conditions, these boys in their spare time indulged in boating, swimming, cricket, football, and golf, caddying and cycling. Anyone going around this particular factory would have been struck by their healthy and intelligent appearance. On the other hand, many of the boys I examined at other factories are showing definite signs of the wear and tear to which they are subjected. Pale, anemic, dull, and expressionless, their conditions would excite great commiseration. Conditions outside the factory contribute their share, and if this war is to continue for a long time and these boys remain subject to conditions such as described, the effect upon their general health will be difficult to remedy. Many of these boys, by reason of badly managed homes, are very indifferently fed, and I found in the course of my inquiry, boys coming to work who arose at 4.45 in the morning to travel many miles in order to reach their work at 7 o'clock, and that without food. These conditions can not possibly be allowed to exist, and call for the severest condemnation.

In another munition town, steelyard laborers were found working as much as 108 hours per week. The work was very heavy, but the saving clause was the fact that they were pursuing their occupations in the open air.

The conclusions I have arrived at are that where the work is heavy and the factory conditions are bad it is imperative that the hours

of labor should be restricted for both men and boys. At the present time there is, or there may be, a shortage of labor, but in order to safeguard against a further shortage in the immediate future it will be wise to limit hours.

LOSS OF TIME THROUGH SICKNESS OR ACCIDENT.

14. Appended is a table (24) of the amount of time lost, as stated by the workers themselves, through nonpreventable causes by the men and the boys. Among the 1,543 men the time lost during 12 months from all causes is 12,964 days, of which 20 per cent was due to accidents and 80 per cent to illness. The comparison of the various groups is interesting.

Of the men in health group A, 25 per cent lost some time through sickness, the average days lost per man are 4, and the average days lost by the men who lost any time are 16; for the B, C, and D groups together the corresponding figures are 43 per cent, 16, and 30. The accidents on the other hand are not more frequent among the less healthy, 7 per cent of the A men being involved with an average loss of 26 days, and 4 per cent of the others with an average of 24 days. It was shown above (par. 10) the proportion of physically unfit increased with the length of hours of work in the case of the post-war employees, and it should follow that the amount of time lost through sickness should also vary with the same factor. As far as the data are available for the necessary analysis, however, it does not appear that there is a direct relation between length of shift and lost time. The conditions grouped as "rheumatism" account for 38 per cent of the time lost for sickness, and for 22 per cent of the 950 men who lost any time, the figures for respiratory diseases, including "colds," being 25 per cent and 42 per cent. The remaining third of the time lost is distributed among a variety of afflictions of which digestive disturbances are the most frequent.

Among the boys, 53 per cent of the lost time is due to illness, 47 per cent to accidents. The less healthy boys (B, C, and D groups) lost twice as much time as the healthy, 36 per cent of the former losing some time against 19 per cent of the latter, the average days lost per boy being 5 and 2, respectively. On the whole the boys lost through illness only about a third of the time lost by the men. The accidents are equally distributed among the health groups. Digestive and respiratory disturbances, with various infectious conditions, account for about two-thirds of the total illness.

CONSIDERATIONS ARISING FROM VARIOUS FEATURES IN THE ENVIRONMENT.

15. *Wages.*—For the most part I found that wages were adequate to provide good food for the workers, and in this direction the general rise in wages has been beneficial. Many of the small boys dwelt

on this subject at great length, informing me that since they had gone into the munition factories and taken home good wages they had been much better fed. In some cases, however, the wages earned were certainly not sufficient to furnish satisfactory home conditions for the workers and their families, and in others, though high wages were earned, often by several members of the family, the overcrowding at home was considerable. It is hardly my province to discuss further this most controversial and complex question of wages, though in all its ramifications it has clear bearings of an indirect kind on the health of workers.

16. *Nutrition.*—Output in regard to quality, amount, and speed is largely dependent upon the food of the workers. The conditions of factory work often make it impossible for the worker to have his principal meal at home, and frequently the facilities for obtaining refreshments in the neighborhood are insufficient. Only four of the factories I visited had made this valuable addition to their establishment. All the arrangements at the first factory were perfect. The space allocated was ample for those employed, and a large number of the workers, both male and female, took their meals at the canteen, while others patronized the various refreshment rooms close to the works, or returned to their own homes. The kitchen equipment was model in every detail, and the cleanliness of the whole place was delightful. The service was most expeditious, 300 dinners being served in seven minutes. The method of keeping the meals hot was very good, a special dish cover having been devised by one of the employees and proving most efficient. Any food brought by the workers was heated or cooked free of cost, and boiling water was also supplied free. Trolleys containing food, such as Bovril, soup, sandwiches, pork pies, mineral waters, and coffee, were taken around all the shops at 11 a. m., 4 p. m., and 3 a. m. The canteen was open for both day and night shifts. In the second works canteens were numerous, but could in no way compare with the above. The lighting and ventilation were not good, and on many occasions the temperature of the dining room was so high as to be oppressive. There was a great lack of tidiness, and the service was poor. In various areas of these very large works were numerous coffee stalls, managed by voluntary workers; and my experience was that the quality, cleanliness, and general arrangements were much better than those at the canteens. At the third factory, a dining room is provided, but there is no provision for serving dinners; food brought in can be either warmed or cooked. Confectionery, chocolate, tea, coffee, and boiling water are provided. In the fourth factory, the canteen arrangements were fairly good, about 50 men per day availing themselves of the advantages offered. The quality of the food was good, it was provided at first cost, and prepared under good conditions. A

specimen meal included liver and bacon, peas, potatoes, and fried bread pudding for 7d. [14.2 cents]. Tea, coffee, cocoa, and other light refreshments are provided at very small cost. At one large steel works employing more than 10,000 men no canteen was then provided, though an attempt had been made to overcome this defect by two coffee stalls, where light refreshments are on sale at stated hours of the day. In this factory there was, throughout the workshops, an excellent provision of warm cabinets, which were well maintained and whitewashed every fortnight. In another factory, in the same town, employing almost as many operatives, there was no provision of any kind.

Provision of forms with backs would add very materially to the comfort of the workers frequenting these canteens. I personally have not come across such provision anywhere.

As an example of the way the worker to-day lives I may give here the results of my analysis for two groups of workers taken at random. Of 592 men, 14 of the men did not eat meat or fish per day at any meal, some because of their dislike for these articles of diet, the remainder because their wages and their responsibilities did not permit; 271 men consumed one meat or fish meal per day, 239 partook of two such meals, while 64 had three. Consuming four meat meals a day there were 4 men. Out of this number 151 went home to dinner at midday. Of 1,280 boys, 14 did not get meat or fish, partly because of bad domestic arrangements and partly because they disliked the diet; 312 of them have one meat or fish meal a day, 526 of them eat meat or fish twice daily, and 425 of them had three meat meals, while 3 of them enjoyed the luxury of four such meals. Out of this number only 136 go home to dinner at midday.

17. *Ventilation*.—Broadly speaking, the factories visited were well ventilated. In some cases frequent complaints were made about drafts coming through the broken windows and partly open gateways. In the machine shop of one factory, though the rooms were very large, the air appeared to be stagnant and smelt stale, but this was due to the fact that the workmen would insist on keeping the windows closed. The assurances of those who appreciated a fresh atmosphere were to the effect that some arrangement was necessary whereby the workmen could not tamper with the method adopted. In the older portions of these rooms good ventilation was maintained by a system of fans, more especially in those shops where dust was prevalent. The exception to the general rule was found where steel was smelted in a practically closed-in shop. The atmosphere of this place was stifling, and in the summer time the temperature, when taken 6 feet above the level of the floor, was 136° F. My experience of the machine shops visited is that some improvement

which will not create drafts is necessary, for in all these shops the air is stagnant or appeared to me to be so. In every trade with exposure to heat the better the ventilation the greater is the comfort of the workers engaged upon the various processes.

18. *Lighting.*—Owing to air raids, the lighting of the factories at night has been somewhat interfered with, but speaking generally the arrangements are good. Whether by gas or electric light I found it adequate in every case. The placing or shading of lamps so that the light from them did not fall directly on the eyes of the operative when engaged on his work was almost universal. These particulars were obtained by visiting various factories at different hours of the night shift. The natural lighting in almost every case would be good if the windows were cleaned regularly, but owing to the anti-air-raids darkening regulations the windows were not cleaned regularly, or if cleaned regularly the transmission of daylight is interfered with by blinds which have become dislodged or have got out of order and hang loosely about the windows. The advantage of whitewashing the walls and keeping the ceilings clean was shown by contrast with some of the workshops where these processes are sadly neglected.

19. *Washing accommodation.*—Except in danger buildings and throughout factory 2, washing accommodation is extremely defective. Even in those departments where factory legislation insists upon washing accommodation for workers handling lead and other similarly dangerous materials, the accommodation appeared to me not only insufficient but badly maintained. Complaints were made about the want of such facilities. In most of these factories where men are engaged in very dirty work, and even where basins with water laid on were installed, towels were not provided. Soft soap is given to the men engaged upon dirty, oily work, since it is difficult to clean thoroughly the hands without hot water and soap after being employed upon such work. The pleasure of changing into clean and dry clothing after a heavy day's work is considerable. Its influence would react upon the worker, who feels that he may go into crowded thoroughfares of large towns without being tabooed by a better-dressed and cleaner crowd. The argument may be advanced that the workers do not avail themselves of such opportunities as are provided. From personal experience I had the opportunity of appreciating the desire for washing by both men and boys. This occurred in a cartridge shop in factory 1. The weather was warm, the work dirty, and whenever a boy or a man had the opportunity he availed himself of the washing basin. From them I learned that they could have done with three times as much accommodation as was provided. No doubt in some cases prejudice to

cleanliness might have to be overcome, but the result of my inquiries and observation has been that if the facilities were given, full use would be made of them. The boy workers are much keener about washing, and it is unfortunate that they should be brought up in industrial surroundings which prevent them from following up closely their present taste for cleanliness. The present day juvenile operative is not without his appreciation of regular cleanliness, but factory arrangements as I found them will assuredly create a condition of "laissez faire."

20. *Locker and wardrobe accommodation.*—Generally speaking, this is lacking; the workers arriving on wet days hang up their clothes in any corner which they can find, with the result that, on leaving, the apparel is almost as wet and sodden as on entry. The lack of drying rooms for such clothing is evident. In factory 2 an excellent system of cloakrooms has been installed, and it was so arranged that steam could be passed through the hanging pipes to which the hooks had been fixed. In some branches of industry it is necessary for the workers, owing to exposure to excessive heat and the risk of their clothes catching fire, to saturate them with water. Large numbers of men, for example, in factories 3, 5, and 6 are, for the most part, wearing clothes which are wet almost all day long. Some of them change their things before leaving, but others are forced, partly through lack of accommodation, and partly owing to custom, to go home as they are. In one factory some slight provision in the way of huts is made for these workers, but the clothes taken off at the end of the shift are in a damp and unwholesome condition on their arrival at work the following day. Apart from the pleasure of changing into dry clothing, the risks to health are considerable.

21. *Sanitary accommodation.*—In almost all cases this was fairly good. In one or two instances, however, it was certainly insufficient and was not maintained as well as it should have been.

22. *Ambulance arrangements.*—In factories 1, 2, and 5 arrangements are made for dealing with accidents on the premises. The equipment at factory 1 is excellent in every way, and it does not call for any description here.

In factory 2 a large dispensary, contained in a private house adjacent to the works, is staffed by three trained nurses. The general arrangements are good. There is an ample supply of antiseptic dressings and a fair equipment of the necessary instruments with which to render first-class "First aid." There is a trained nurse always on duty. In the event of any serious accident the works doctor, who lives within easy distance, is summoned.

In factory 5 the provision of surgery accommodation and ambulance room is good. There are two ambulance rooms in two distinct

areas of the works, replete with all conveniences. Each contains two couches, a large number of splints, crutches, stretchers, etc., and each has its attendant in charge. The attendant has had a large amount of experience in these works for the past four years and is a certified ambulance man. Two medical men living within five minutes' journey are in touch by telephone with the works. At nighttime, though no ambulance man is in attendance at the surgery, every workshop is fitted with a complete first-aid installation, and from each works' office there is telephone communication to the central building, whereby if a serious accident happens necessitating medical attendance one of the two doctors above referred to can be summoned immediately.

In the remaining factories visited there was no adequate provision for dealing with even minor accidents. Some of the workers are ambulance men, but the condition of the equipment which I saw, where there was any, was disgraceful. It generally consisted of a bandage, a bit of lint or wood—usually very dirty—and some useless sticking plaster. The provision of proper material, carefully stored and easily reached, requires immediate attention.

23. *Welfare work.*—In making these inspections I had ample opportunities of observing the working of the arrangements which have been made for "welfare supervision." The welfare worker should be in close touch with all matters affecting the welfare of the boys from a hygienic standpoint. In my opinion, too little attention has been paid to this aspect of the matter, and the first consideration should be the health of the operatives, male and female, adult and juvenile. Some elementary knowledge of hygiene should therefore be regarded as an indispensable qualification for a welfare worker.

24. *Housing conditions*, while not strictly a part of this inquiry, come within its scope because of their influence upon the work. There was considerable difficulty in obtaining clear evidence upon this point. Many of the workers are well housed, living in property which they have purchased, and taking a marked pride in its proper upkeep. Others, not so fortunate or not so provident, live under very bad conditions. In one town, for example, I saw three-roomed houses of the back-to-back type built around small courts, entered by narrow passages or by tunnels under houses facing the street, with rents from 3c. 9d. to 4s. 6d. [\$0.91 to \$1.10] per week. [Large numbers of such houses are close to several of the works visited.] It was found that many of the workers were living in one room only, but the variety of conditions under which they live is too great for brief description. Tables 25 and 26 summarize some interesting facts relating to sleeping accommodation.

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TABLE 25.—AN ANALYSIS OF THE HOME CONDITIONS OF 392 ADULT MALES CONCERNING SLEEPING ACCOMMODATION.

Beds in room.	Number of persons, including workers, occupying each bedroom.					
	1	2	3	4	5	6
1	{ 42 10.7 per cent.	{ 252 64.3 per cent.	{ 19 4.8 per cent.	{ 1 0.32 per cent.	}	
2	{ 12 3.1 per cent.		{ 43 11 per cent.	{ 11 2.8 per cent.	{ 7 1.8 per cent.	{ 1 0.3 per cent.
3	}		}		{ 1 0.3 per cent. (4 beds).	

¹ This man earned £2 per week and had a large family.

TABLE 26.—AN ANALYSIS OF THE HOME CONDITIONS OF 188 BOYS CONCERNING SLEEPING ACCOMMODATION.

Beds in room.	Number of persons, including workers, occupying each bedroom.					
	1	2	3	4	5	6
1	{ 29 15.4 per cent.	{ 72 38.3 per cent.	{ 17 9 per cent.	{ 2 1.1 per cent.	}	
2	{ 4 2.1 per cent.		{ 27 14.4 per cent.	{ 20 10.6 per cent.	{ 12 6.4 per cent.	{ 1 0.5 per cent.
3	}		{ 2 1.1 per cent.		{ 2 1.1 per cent.	}

¹ This boy earned 14s. a week and three others were also working and earning money.

TABLE 27.—SHOWING THE ACTUAL HOURS OF SLEEP OBTAINED.

	Under 6 hours.	6 to 7 hours.	7 to 8 hours.	8 hours and more.
590 men.....	52=9 per cent.	173=29 per cent. ...	243=41 per cent. ...	122=21 per cent.
1,282 boys.....	1=0.1 per cent.	144=11 per cent. ...	495=39 per cent. ...	642=50 per cent.

TABLE 28.—MEN.

Shifts.	When sleeping.	Number of workers.						Hours of sleep.		
		Sleeping.						Rough total.	Average hours per person.	
		Under 5 hours.	5, but under 6 hours.	6, but under 7 hours.	7, but under 8 hours.	8 hours and over.	Total.			
Day workers (not working on night shift). Day and night workers, changing weekly.	Sleep obtained during the night.	{ 3 2 per cent.	{ 6 4.1 per cent.	{ 36 24.3 per cent.	{ 71 48 per cent.	{ 32 21.6 per cent.	} 148	1,085	7.3	
	Sleep obtained during—									
	Night.....	{ 10 4.1 per cent.	{ 9 3.7 per cent.	{ 59 24.2 per cent.	{ 116 47.5 per cent.	{ 50 20.5 per cent.				} 244	1,723	7.6
Day.....	{ 23 9.4 per cent.	{ 30 12.3 per cent.	{ 76 31.2 per cent.	{ 83 34 per cent.	{ 32 13.1 per cent.	} 244	1,657	6.7		

TABLE 29.—BOYS.

Shifts.	When sleeping.	Number of workers.						Hours of sleep.	
		Sleeping—						Rough total.	Average hours per person.
		Under 5 hours.	5 but under 6.	6 but under 7.	7 but under 8.	8 and over.	Total.		
Day workers (not working on the night shift). Day and night workers changing weekly.	Sleep obtained during the night.			5 10.4 per cent.	22 45.8 per cent.	21 43.8 per cent.	48	376	7.8
	Sleep obtained during—								
	Night.....		1 0.7 per cent.	22 15.7 per cent.	63 45.0 per cent.	54 38.07 per cent.	140	1,080	7.7
	Day.....	1 0.7 per cent.	2 1.4 per cent.	9 6.4 per cent.	40 28.6 per cent.	83 62.9 per cent.	140	1,122	8

25. *Sleep.*—The necessity for a sufficient amount of sleep has been and is constantly referred to in questions concerning industry and overwork. Table 27 summarizes the results of my inquiries in a long series of men and boys, and shows that on the whole the amount of sleep obtained is fairly adequate. In a second series (Tables 28 and 29) I have examined the relative times of sleep on day work and night work for 392 men and 188 boys. The boy workers were found generally to enjoy longer sleep when they slept during the day, one of the chief reasons being that the boy is not on tenterhooks about being up in proper time for reaching his work. When sleeping during the day he generally remains in bed till the last moment and then is "called" by his mother or some other occupant of the house, being allowed sufficient time to partake of a meal comfortably and get to his work. When sleeping during the night it is obvious that the risks of being late through not being called are very much greater.

Most of the men enjoy more sleep when it is obtained during the night. During the day many domestic duties prevent them from going to bed. When they are on the night shift, and even though they have the chance of remaining in bed, they frequently get up and have their meals at the usual meal times, partly for the pleasure of being with their children and partly to save their wives trouble; in the case of single men they may have to conform to the régime of the household in which they find themselves.

RECOMMENDATIONS.

26. The chief points which in my opinion require attention are:

(a) Reduction of excessive hours, especially when bad transit makes a substantial addition to the effective working-day and in the case of boys.

- (b) Provision and improvement of canteens.
- (c) Provision of adequate washing accommodations in all works, with baths for workers in the hot and heavy trades.
- (d) Improvement in first-aid equipment.
- (e) Hygienic qualifications of welfare workers.

T. H. AGNEW.

APPENDIX.

1. Since completing the detailed inquiry which forms the basis of the foregoing report, I have visited four other districts in which steel manufacture is carried on in order to compare the conditions of work and the health of the employees with those whom I had previously examined. A similar examination was conducted of about 700 workers, and the details, classified according to the plan previously used, gave results so similar to those already set out that further exposition is unnecessary. I think, therefore, that a satisfactory appreciation of the general health of the workpeople has been obtained.

2. In the first district nine works were visited, and a large number of men and boys examined. In all cases it was found that their general health was very good, and I found no evidence of undue fatigue. There were no complaints of sleepiness, restlessness, swelling feet or muscular pains; respiratory, circulatory, and digestive disturbances were practically absent. In fact, all the men and boys reported that they felt very well. The teeth, however, were bad, and the general state of the mouth showed great lack of regular attention.

I am of opinion that this satisfactory state of affairs is due to the superiority of the conditions under which work is carried on, and I attach chief importance to the general prevalence of eight-hour shifts. The eight-hour day was introduced into this district about 16 years since and has now been adopted in almost all the steel works; the opinion of the men on the question of hours is very definite, and they would under no circumstances return to 12-hour shifts. Apart from the question of hours the environment is in general of a superior kind; the workshops are well placed in open areas, very well arranged, the ventilation free, and the whole clean and orderly. Wages are good and food is excellent.

In some respects, however, there is great need of reform. The appalling condition of the sanitary accommodation calls for immediate action. In some cases the provision is insufficient, and almost everywhere the condition of such conveniences as are provided is so revolting that it is impossible to describe. They are also commonly situated in almost inaccessible places, the approach to which is particularly dangerous at night. The provision of ambulances, first-aid outfits, and surgery appliances is exceedingly scanty. There is no

washing accommodation. Canteens are not provided and appear to be unnecessary, as nearly all the men live close to the works.

3. In a second neighboring district I visited five large works. The general conditions are much the same as in the first district, except that a 12-hour day is general. The boys and men generally were in good health, though their physique compared unfavorably with that of the employees in the first district. The sanitary accommodation was again very bad, and there were no arrangements for washing. The ambulance arrangements require much improvement.

4. In a third district, in which I investigated six steel and iron works during November and December, the conditions varied a good deal from place to place. The work is mostly arranged in 12-hour shifts, the shops are large and well ventilated, and transit is good. There are some first-rate ambulance arrangements, but on the whole this wants much more attention; canteens are infrequent and washing accommodation absent, the standard of personal cleanliness among the workers being a low one. With rare exceptions the sanitary accommodation is revolting and urgently requires reform. Wages are good and the standard of living high. Public drunkenness was much in excess of anything I have seen elsewhere; and of 165 workers who were examined in detail only 54 per cent reached the A standard; there were no clear signs of fatigue from overwork.

5. In a fourth district, an armament center, I visited three large works engaged in steel manufacture and the rolling of boiler plates. The work was both very heavy and heavy, the exposure to high and varying temperatures was considerable, and at this particular season of the year the variations of heat and cold were extreme. The period of employment before breakfast was longer than in the works visited previously, the breakfast hour commencing at 9 a. m., after three hours' work. At two of the works under consideration the employees go home to every meal, but at the third only those living close to the factory avail themselves of this opportunity. The average length of shift is 12 hours for the tonnage men. The shifts change over weekly, and usually at Sunday midnight.

The shops were remarkably free from dust or fumes and the ventilation, lighting, and general cleanliness were good. In the rolling mills noise was considerable, and frequently it was difficult to hear a "shouting" voice.

The sanitary accommodation was at one works very good and conveniently situated, having been reconstructed during the past two or three years; it was kept in a clean and orderly condition, a special man being detailed for this duty. At a second factory the accommodation was scanty, inconveniently situated, dark, and was

not kept in a clean and orderly condition. At the third the structural arrangements were falling to pieces and the interiors were filthy and revolting, but I was informed that at last the directors have had plans prepared in view of a complete reconstruction.

Washing accommodation was not provided in any of the works. Cloakroom accommodation in the form of cabins or of shelters was good in all the smelting departments, but I did not see similar provision in the rolling mills.

In two of the works the workers gave the impression of living well, and this was confirmed by their own statements on the subject. At one factory particularly the men were a fine set, many of whom were total abstainers, while the remainder were, without doubt, very temperate. In the third works the standard of health was not good; the prevalence of alcoholic habits has an influence not only upon the appetites of the men, but also upon the character of the food. From this factory very few men go home to breakfast or dinner, which latter meal usually consists of merely a sandwich and a cup of tea or other "refreshment," but it was reported that a full meal was partaken of when home was reached in the evening. At this works there are cabins—clean, well lighted, and containing a stove, where workers can make tea or coffee and eat their meals. Canteens where hot meals are provided have not been established at any of these factories.

The "first-aid" arrangements were everywhere poor, although in all three works excellent ambulance rooms were provided; but they were poorly stocked with dressings, and such as were inspected were untidily kept and soiled. The rooms for this purpose were well arranged, centrally situated, and well provided with the necessary tables, couches, stretchers, and basins, but they gave me the impression of being sadly neglected. In one works the ambulance room was rarely used and the dressings were done in a "store," where the lotion bottles were kept close to a sink full of tea leaves and dirty crockery.

The general health of the workers was good, particularly in shops fitted with modern plant. There were no evidences of undue fatigue, and respiratory and digestive troubles were not prevalent. The chief causes of complaint arose from conditions commonly classified as "rheumatic," which claimed a large percentage of those examined.

INQUIRY INTO THE HEALTH OF WOMEN ENGAGED IN MUNITION FACTORIES.

THE NATURE OF THE INQUIRY

1. In accordance with the instructions of the Health of Munition Workers Committee, an inquiry was conducted by ourselves and other selected women medical officers¹ and women inspectors,² whose services were lent for the purpose, into conditions affecting the health of women workers in certain munition factories. The inquiry took place between December, 1915, and July, 1916, and included a survey of factory environment, hours of work, transit, domestic circumstances, etc., together with the effect on the health of the workers as revealed by a medical examination. The medical inspection was necessarily brief and usually occupied 10 to 15 minutes. Generally speaking, the doctors' inquiry was held in a surgery or rest room, but on some occasions less suitable premises had to be used in order that the medical examination might take place near the factory shops to avoid delay and consequent interference with output. In a few instances the noise of machinery or the absence of sufficient privacy prevented a thorough examination of the chest, but it was at least possible to ascertain whether the women were suffering from symptoms indicative of slight or marked fatigue as the result of their factory work.

SELECTION OF WORKERS.

2. Groups of workers were chosen to include representatives of the various processes carried on in the factories. An attempt was made to select those who had been in employment for at least three months, and to avoid unfairness workers were chosen at random, e. g., every third or fourth girl at a bench. The total number of women workers examined was 1,326. The examination was confidential and entirely voluntary as far as the workers were concerned. In practically all cases they showed every willingness to answer questions and to submit to the medical examination.

NUMBER OF FACTORIES VISITED.

3. Reports were received of visits to 11 factories in England and Scotland, which were selected with a view to obtaining a general survey of typical conditions. In every case the management of the

¹ The medical officers who took part in one or more inquiries were Dr. Ada Whitlock (Home Office), Dr. Beatrice Webb, Dr. Ethel M. Stacy, Dr. L. M. Chesney, Dr. Mabel Campbell, and Dr. Ethel Williams.

² The women inspectors who assisted in one or more inquiries were Miss Hilda Martindale, Miss H. C. Escreet, and Miss Irene Whitworth (Home Office), Miss E. M. Gardner and Miss E. G. Woodgate (National Health Insurance), and Miss E. G. Colles (Board of Education).

firm were most courteous and did all in their power to facilitate the investigation.

Factory No. 1,	105 workers examined.
Factory No. 2,	82 workers examined.
Factory No. 3,	149 workers examined.
Factory No. 4,	210 workers examined.
Factory No. 5,	130 workers examined.
Factory No. 6,	70 workers examined.
Factory No. 7,	100 workers examined.
Factory No. 8,	170 workers examined.
Factory No. 9,	156 workers examined.
Factory No. 10,	40 workers examined.
Factory No. 11,	114 workers examined.
Total,	1,326.

GENERAL CONDITIONS OF EMPLOYMENT.

4. The types of work in which the women were engaged included the manufacture of shells, bullets, cartridges, and fuses, and covered a wide range of processes, including employment in danger buildings. No workers in TNT, etc., were examined. Much of the labor was unskilled or semiskilled, so that workers were not infrequently changed from one operation to another with little difference to output. The following extract from one of the reports indicates the type of work carried out:

Feeding of automatic machines.—If 100 per cent be taken as the maximum which can be obtained from any machine, it is obvious that this can only be done under ideal conditions. These conditions are never present even in a highly organized concern; the material, the machine, and the minder vary in changing proportions. It is customary to allow a percentage for the machine, for time spent in setting and grinding tools, etc. A further percentage must be allowed for the degree of skill of the worker, and thus, with a reasonably steady flow of material, some idea of the result to be obtained can be aimed at. In fixing these percentages account must be taken of the human factors in machine manipulation, the tool setter and the minder.

The tool setter's art consists in making the machine run smoothly; if it is necessary for tools to be removed for grinding, he must remove and replace them as expeditiously as possible. It is obvious that the percentage to be allowed will depend to a great extent on the skill of the tool setter. In the factory under consideration the machines are untried, the trained men are limited, and each has a gang of learners under him.

Very little skill is required from the machine minder and in this factory almost all are being taught the work from the beginning. In order to attain anything like proficiency, dexterity is necessary and experience tells. It was stated on all sides that it is difficult to lay down any hard and fast rule; one individual may pick up the work at once and "earn her money" the first day, while another may take longer and never attain any great speed. The human element enters even into the feeding of nickel "cups" into the revolving disk of a machine which is to "draw them through" to a stage nearer their finish as "envelopes"; it is possible to miss holes as the disk revolves through tiredness or inattention. It is even possible to introduce variability

into the treading of a metal slide full of cartridge cases which descend into a "tapering" machine; the slide must be kept full, the cases must be fed in with their heads in the same way, they must lie evenly side by side in the slide, or the very delicately constituted machines which deal with them will be thrown out of gear and require the spending of much skilled time and attention before again being able to work.

Lathe work requires slightly more concentration than the automatic machines and is, in the workers' language, slightly more "tedious."

Power and hand-press work require considerable concentration, as the nervous strain is not slight. Risk of accident is always present, and experience is necessary in order to overcome the timidity attendant on this. Though the risk is greater on a power press, the worker's variability is equally great, if not greater, on a hand press, where muscular action enters into account as well as mental strain.

Examining.—Examining is said to be the most "tedious" of the operations; it is the one which requires most thought as well as close attention. The examiner's work lies in the application of her own intelligence to the object in hand. She has no artificial aid of gauge, machine, or scales to help her. She must think, however slowly she does it, and her experience will tell not so much in the direction of manual dexterity, though this is of great assistance, as of quickened intelligence.

Light bench work, some involving contact with lead, some not.—This work requires no skill at all; it merely consists in dropping lead pellets into nickel "envelopes," as the outer shell of the bullet is called.

Bullet weighing and case and bullet gauging can also be performed without experience and to some extent mechanically, though here, as in the above and other operations, experience tells. The worker is only concerned to watch the scales or the gauge and keep them in use, and her variability depends on how constantly she does it.

HOURS OF WORK.

5. The long hours of work were frequently complained of by the workers, and in some cases the hours worked were undoubtedly excessive, as, for example, in factory No. 4, where women were employed 77 hours weekly and 15.5 per cent of the workers showed evidence of marked fatigue. At factory No. 8 the hours were also long in most departments. The following table shows the hours worked in a large shop in this factory:

Shifts.	Meal hours.	Longest spell without break.	Hours worked per week (excluding meals).
Day shift:			
Sunday-Friday, 7-7.....	¹ [8.30-8.45] 12-1 4-4.30 8.30-9	3½ hours...	68½
Saturday, 7-1.....	8.30-9	4 hours.....	
Night shift:			
Sunday-Friday, 7-7.....	10-11 2-2.30	3 hours....	63
Saturday, nil. (Shifts changed weekly.)	¹ [5-5.15]		

¹ "Unofficial" mealtimes. The workers do not leave their machines.

The report states: "The workers did not, as a rule, object to night work, but there is a strong feeling among them, which is practically unanimous, that the hours should be shortened. They have made up their minds that work should stop not later than 6 o'clock, and that they should have one day off in the week—Saturday being the day usually suggested. The chief argument brought forward in favor of this alteration is that from 6 to 7 p. m. very little work is done. Most workers have 'earned their bonus' by that time and they will not start on a fresh lot of work. They sometimes 'help along the lines,' i. e., help any workers who have not earned their bonus, or they spin out the cleaning of their machines which could be done in a very few minutes, or they 'stand and rest at their machines,' not being allowed to sit down. The reason generally given is that they are 'properly tired-out' by 6 o'clock and 'would not be fit for work next day if they did more than that.'"

At factory No. 3 the following hours were worked:

Hours worked.	Meal hours.	Longest spell without meals.	Hours worked per week.
SCHEME A.			
Day:			
Sunday, 8.30-5.....	Sunday, 12.30-1.30.....	} 4 hours....	67
Monday-Friday, 6-5.30.....	Monday-Saturday, 8.15-8.45, 12.30-1.30.....		
Saturday, 6-5.....			
Night:			
Sunday, 5.45-5.45.....	} Sunday-Friday, 9.30-10.30, 2.45-3.15....	} 4½ hours....	63
Monday-Friday, 5.45-5.45.....			
Saturday, nil.			
SCHEME B.			
Day:			
Sunday, 8.30-5.....	Sunday, 11.30-12.30.....	} 4½ hours....	69
Monday-Friday, 7-7.....	Monday-Friday, 11.30-12.30, 4.30-5.....		
Saturday, 7-5.....	Saturday, 11.30-12.30.....		
Night:			
Sunday, 7-7.....	} Sunday-Friday, 10.30-11.30, 3.30-4.....	} 4 hours....	63
Monday-Friday, 7-7.....			
Saturday, nil.			

Here "several workers stated that they found the hours very long, and that the night work was more tiring than day work, but few strong representations were made on these points, and often the contrary was stated. On the other hand, there was strong and widespread feeling against Sunday work, both day and night, more especially Sunday night. In spite of the extra shilling given for Sunday work a strong desire to have this day free was expressed by a considerable number of workers." Indeed, Sunday work was generally found to be unpopular.

At factory No. 1 it was found that output was greater when 8-hour shifts were worked. At this factory the periods of unbroken work were sometimes as long as five hours; in these cases, owing to difficulty in transit, workers were sometimes six or seven hours without food, and stated that "on reaching home they were too tired to eat."

This arrangement was particularly unsatisfactory in view of the number of young workers under 18 who were employed.

LOST TIME.

6. Inquiries were made of the workers as to lost time and their reasons for remaining away from work. It was not easy to obtain reliable data. At factory No. 8 "no records of lost time have been obtained from the firm in respect of the workers interviewed, but from their statements it appears that this must have been considerable. There are a few very regular workers who take a pride in not losing time, and there are others who 'can't afford to stay away'; but there are many who have been away a good deal on account of illness, and who, apart from actual illness, take a day or a night off for a rest when they are feeling tired or run down. Some make a practice of taking a day off once a week or once a fortnight, and maintain they work better in consequence." In regard to factory No. 3, it was stated that "with few exceptions the amount of time lost through illness or other reasons is remarkably little considering the long hours worked and the long period for which they have been worked. There are about a dozen cases of illness lasting three weeks and upward, but apart from these, periods of absence were short and few according to the workers' statements. An odd day or a 'breakfast time' was taken occasionally when the worker was feeling 'tired out.' Records of time lost during the last four months by 74 of the workers interviewed have been supplied by the firm, giving the total number of whole days lost as 121 (i. e., 1.6 per worker), and the number of 'quarters' lost as 60 (i. e., 0.8 per worker)." On the whole, the timekeeping was good, and the women only absented themselves on reasonable grounds.

POSTURE.

7. At certain factories an unnecessary amount of standing seemed to be enforced. In some cases this was due to insufficient seats, but in many cases it was stated that foremen did not allow girls to sit even while their machines were being repaired. At factory No. 2 "girls in one hut who work standing and have considerable intervals when they are kept waiting for work complained that they had no seats which they could use during the intervals."

At factory No. 1, "in the head-turning department where the work is heavy, the workers complained of the refusal of the foreman to have them supplied with stools. They all stated that they could work better sitting than standing, and many complained of faintness and exhaustion caused by the continuous standing. In consequence of their protests eight stools had been provided to be shared among 14 people, but no more could be obtained. Before we left the factory the fore-

man undertook that each of these workers should be supplied with a stool as quickly as possible."

At factory No. 8, "many complaints were received that workers who usually stand at their work were not allowed to sit down at all during working hours—even when their machines were being repaired or they were kept waiting for work. Apparently the foremen are afraid that if they sit down at all they will be reluctant to get up and start work again when the machine is repaired." At another factory "complaints were made by some of the workers in the head-turning department that they had no stools and were never allowed to sit down even when waiting for work or for repairs to their machines. As each worker is in charge of two machines they state that they must stand while actually working, but would be glad of the opportunity of sitting down in the intervals of waiting for work, etc. In the heading department and the hand cut-off department (cases), workers expressed a wish for stools and said that their work could be done equally well sitting or standing. In the finish press (bullet) department and the final view (case) department, complaints were made that the number of stools provided was insufficient and that some workers had to stand in consequence.

At one factory general muscular pains were found to occur in 26 per cent of the workers examined, and a number of the elderly women complained of the fatigue of standing all day; at a reexamination of these workers six months later seats had been provided and complaints of fatigue and backache, etc., had markedly diminished.

NUTRITION.

8. A satisfactory standard of nutrition is of the highest importance in maintaining a proper level of physical efficiency. This is dependent indirectly on many factors, such as domestic conditions, fresh air and exercise, wages, convenience of transit, etc., but the most urgent requirement is the provision of proper meals at suitable hours. The association between a satisfactory diet and good physical health was usually clearly observed. For example, at factory No. 11 it was noted that the women who as a whole were exceptionally robust ate particularly solid and suitable meals; in addition they worked under good hygienic conditions, and for the most part lived near their work, factors which contributed to an excellent standard of general health. At factory No. 9 the meals were also adequate and substantial in the great majority of cases, a typical dietary being as follows:—

On rising—Tea; toast or biscuit.
 9 a. m.—Porridge; ham and egg; toast or bread; tea.
 11 a. m.—Fruit.
 1 p. m.—Soup; meat and potatoes; sometimes pudding; tea.
 3.45 p. m.—Biscuit or cake.
 6 or 7 p. m.—Plain tea, sometimes fish or egg.

In contrast to these examples, in the case of factories 1 and 2 there were difficulties of transit, the factory environment was not always convenient, and unduly long intervals often elapsed without food; neither factory had a welfare supervisor. The proportion of workers showing marked fatigue was high. The report on one of these factories runs:

"The arrangements for meals at the factory appear to be far from satisfactory. A dining room is provided with pipes for heating up food previously cooked, but with no other cooking facilities and practically no attendance. The girls describe the room as dark and cheerless, and many prefer to eat their meals in the workroom or cloakroom. The arrangements for night workers are particularly bad. Hot water is obtainable for making tea, but nothing can be warmed up at all, and the workers unanimously expressed the opinion that their work and health would benefit if they could have something hot in the 2 to 2.30 a. m. interval when they are feeling cold and tired." In another case "for 7 shops employing nearly 3,500 women by day and 2,590 by night there are 2 canteens run by caterers with accommodation for 750 at one and 300 at the other. In addition, a third canteen is shortly to be opened which will provide for another 500; i. e., there will be canteen accommodation for 1,550. As all the workers have their chief meals simultaneously and as night shifts are continuous this is quite inadequate. Moreover, the second canteen is hardly patronized at all; the reason given for this is that the workers do not like it—it is too far to come to during the night in the dark. The girls from shop A have to come out from an exit some distance down the road. The firm have one mess room for the use of girls in shop B; here the food is well cooked and the workers much appreciate it; there is room for all employed by day or night. There are facilities for warming brought food in shops A and C." In this case also the amount of fatigue observed was considerable.

In factory No. 3, the workers were in good health as a rule, while "the canteen arrangements appear to be fairly good and to be appreciated by the workers. The food provided is of good quality and variety and is sold at a moderate price. Soup can be had for 1 d. [2 cents], meat and vegetables for 4d. [8.1 cents], and other dishes at corresponding prices. Many workers bring their own food to be cooked or warmed up. The workers appear on the whole to be well fed. Most of them before starting in the morning have a cup of tea, with nothing or very little to eat, and have their main breakfast at the factory."

9. Speaking generally, it was satisfactory to note that the workers realized their need for nourishing and substantial food, and were in fact eating much better meals than many of them were accustomed

to before the war. This had certainly had considerable influence in enabling them to stand the strain of long hours, etc., as well as they have done.

TRANSIT.

10. The arrangements for transit showed much variation. In cases where the workers lived near the factories, e. g., factories Nos. 9, 10, and 11, they were not only spared the fatigue entailed by a journey in a crowded train or tram before and after work, but they were able to take many meals at home and had increased time for exercise and recreation; this certainly had a distinct effect for good on their health. In other cases the difficulties of transit were acute, as is instanced by the following examples: "The length of time spent in traveling is a noticeable feature in connection with this factory. This is partly due to the fact that a number of workers come in daily from outlying districts, but it is also largely attributable to the exceedingly bad car-service, about which there was universal complaint. In the morning workers often have to allow twice the time that would ordinarily be taken to travel the distance to the factory, and even then they are frequently late. It is said to be not uncommon to wait 20 or 30 minutes before being able to get on a car, and then a worker considers herself lucky if she finds standing room." (Factory No. 9.)

In another case the medical officer remarked: "It is noteworthy that a comparatively large number of workers live at some distance from their work—in 57 cases out of 149 the journey occupied at least 30 minutes each way. Frequently car journeys took 45 minutes, and many complained that cars were both late and crowded. The fatigue of standing in a crowded car after a struggle to gain admission adds considerably to the severity of the day's work, and many of these girls complained of muscular pains in the feet or back. Expense of transit sometimes proved a difficulty—one or two workers walked to save fares, including a widow aged 53 years, whose journey took one hour each way." (Factory No. 3.)

At another factory "many workers stated that the trams were irregular and crowded, and that they often had to wait a considerable time—sometimes half an hour or more—in consequence. There were many complaints also as to the overcrowding on the brakes provided by the firm to convey workers to and from the tram terminus (25-30 minutes' walk from the factory), many saying that they preferred walking to joining in the struggle for a seat." (Factory No. 1.)

PERSONAL HYGIENE.

11. At most of the factories the facilities for washing were unduly limited, cloakroom accommodations was scanty, and sanitary conveniences were not always adequate in number. The absence of

reasonably good arrangements for cleanliness, etc., can not fail to exercise some detrimental effect on the health.

The report on factory No 2, for example, states: "The washing accommodation is worse than the sanitary accommodation. There are only three basins with cold water (no soap or towels) for the whole of the fuse department—300 women and girls, of whom only about 18 actually handle mercury, but all get dirty and want provision made for washing. The girls who lacquer complain most bitterly. In the 'A' department 52 women handle cordite and gunpowder, but there are no washing facilities. The 66 girls in the emergency shop are equally strong in their statements that they need washing accommodation, but have none."

Another report states: "The washing conveniences, which seemed hardly sufficient, comprised basins with cold water laid on. Very few towels were provided, and the workers purchased their own soap."

Again: "In the bullet department there are only nine basins with cold water and nailbrushes provided for 130 girls, 30 of whom handle lead. Soap can nominally be obtained from the forewoman, and towels, conspicuous by their absence, are supposed to be provided biweekly to each of two sets of basins. Complaints are made by foremen that towels, etc., are stolen and the workers complain of lack of accommodation. Very little washing is done, I think, although the girls' hands get black." In another case "washing facilities are quite inadequate, workers in some departments being unable to wash their hands at all before meals, though at most processes they become very dirty. Many state that they clean their hands with oil, though they are not supposed to use oil for this purpose; others wash their hands in the water running from their machines. Even those who handle lead do not always wash their hands before meals; these latter state that five minutes is allowed for washing, and that hot water is provided but no soap or towels."

Washing facilities in the factories have, no doubt, been improved since the reports were made. Another difficulty experienced by the workers is in obtaining hot baths. Many use the public baths, but these are not always convenient, and may be crowded.

MEDICAL INQUIRY.

12. As the result of the medical examination, the workers have been classified in three groups:

A denotes apparent good health.

B denotes those showing signs of fatigue or ill-health.

C denotes those showing marked fatigue or ill-health.

170 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

The results were as follows:

England.	Number of workers examined.	A (healthy).		B (slight fatigue).		C (marked fatigue).	
		Number.	Percentage.	Number.	Percentage.	Number.	Percentage.
Factory No. 1....	105	62	59.0	31	30.0	12	11.0
Factory No. 2....	82	50	61.0	22	26.8	10	12.2
Factory No. 3....	149	98	65.8	44	29.5	7	4.7
Factory No. 4....	210	129	61.4	69	32.9	12	5.7
Factory No. 5....	130	65	50.0	50	38.5	15	11.5
Factory No. 6....	70	37	52.9	25	35.7	8	11.4
Factory No. 7....	100	38	38.0	49	49.0	13	13.0
Factory No. 8....	170	68	40.0	52	48.2	20	11.8
Factory No. 9....	156	107	68.6	40	25.6	9	5.8
Factory No. 10....	40	26	65.0	11	27.5	3	7.5
Factory No. 11....	114	83	72.8	28	24.6	3	2.6
Total.....	1,326	763	57.5	451	34.0	112	8.5

AILMENTS.

13. As the medical examination was conducted by several medical officers, allowance must be made for the personal factor in considering their findings. A table¹ is attached giving percentages of the most common defects found at each factory. The ailments most frequently observed included indigestion, constipation, headache, anemia, and muscular pains. These are all frequently met with among women workers and can not be attributed specially to munition work. The great difficulty in estimating their precise importance was the lack of any control investigation or data. In some cases the ailment had undoubtedly been caused or accentuated by the conditions of factory work; in other cases it had existed before beginning munition work; in others, again, the workers expressed themselves in better health than formerly.

Indigestion in many forms was noted, but occurred less frequently than had been anticipated. Pain after food was fairly common, but was often explained by an unsuitable choice of food, particularly on the night shift. The amount of tea consumed is large, but the tea seemed practically always to be freshly made and was drunk at once so that ill effects were probably not produced as a rule.

Constipation was more marked than appears from the table.¹ Most workers seemed to take aperients fairly regularly and in consequence of this habit may often have reported themselves as not constipated. In one factory the practice of taking aperients was most noticeable; nearly all the workers and especially the younger ones, took salts, usually with their morning tea, two or three times a week, before beginning work. Lack of appetite was most frequent on the night shift, a considerable number stating that they could not eat substantial meals in the night. Many had no desire for a proper breakfast. The teeth were often carious and septic, but no constant association between indigestion and defective teeth was observed.

¹ See pp. 178 to 181.

Headache was often an accompaniment of anemia or constipation and in other cases was doubtless due to eyestrain. In two cases where a second medical examination was conducted six months after the previous one it was found that 10 to 15 per cent of the workers had obtained dental treatment in accordance with medical advice and the amount of headache was appreciably lessened.

Anemia was particularly common where arrangements for meals were not satisfactory and difficulties of transit existed. It was usually relatively slight in degree, and no case of really severe chlorosis was discovered. Some workers were classed as "C" in whom anemia accompanied by a marked hemic murmur was noted.

Muscular pains, foot ache, etc., often due to prolonged standing, were common, especially in the case of workers who had not become accustomed to the work or had not a good enough general physique to withstand the fatigue. Few cases of marked flat foot were noted, and the foot ache usually disappeared to a great extent, though the feet and ankles of girls obliged to stand during the whole shift were apt to become swollen toward the end of the day or on the night shift.

A small amount of *organic disease* was detected, usually either early phthisis or heart disease. A few of these women were obviously unfit to continue their work in the existing conditions, but others, especially the heart cases, had not apparently suffered in health.

Disorders of menstruation occurred in a certain proportion of workers, and in some cases these had increased with factory life, usually either in young workers unaccustomed to standing or in older women with climacteric symptoms. Here, again, the effect of the conditions of employment was less marked than had been anticipated. The provision of a rest room, conveniently situated, and in charge of women attendants or a nurse, is most desirable. At one factory the girls did not care to avail themselves of the ambulance room, as it was in charge of a male attendant and was also visited by men workers for the treatment of minor injuries.

SPECIAL POINTS OF INTEREST.

14. Some special points of interest which emerged from the findings at certain factories are worth recording:

- (a) Effect of factory life on married women.
- (b) Length of service in relation to strain.
- (c) Relation of age of workers to fatigue shown.
- (d) Eye-strain in relation to factory employment.

(a) *Effect of factory life on married women* was observed in two medical examinations carried out at Factory No. 4 within six months:

of each other. In the first case 210 workers were examined, and in the second 116 of the same women were seen again.

The married women reexamined at the factory included 31 per cent who mentioned difficulties in home conditions or suffered from the strain of night work, as they often obtained too little sleep during the day. Chronic rheumatism occurred in 12 per cent. Ten women had remained quite healthy; these included young women either without children or who undertook no household duties, and a proportion of elderly women of over 40 years of age, of the charwoman type, who were especially strong and wiry. Several mentioned the improvement which had resulted from their being given work at which they could sit instead of having to stand; and some had ceased night work.

Married women interviewed in their homes had left the factory for reasons of health in 26 per cent, or on account of low wages and long hours in a similar proportion (26 per cent). Some had secured work in other factories in the district where no Sunday labor was required. An additional 15 per cent had left on account of pregnancy, and 15 per cent had ceased going out to work either for health reasons or for home affairs. One case could not be traced, and one worker had left on account of chronic rheumatism.

The numbers under consideration are too small to afford definite conclusions, but in reviewing these cases the general impression was obtained that the long shifts and night work, in addition to home duties and worries (often associated with insufficient sleep), formed too heavy a burden for the average married woman.

(b) *Length of service in relation to strain.*

[Factory No. 3: 134 workers reviewed.]

	3-5 months.	6-9 months.	9-12 months.	12 months and over.
Number of workers considered (total 134).....	15	43	37	39
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Percentage of healthy workers.....	33	9	19	38
Digestive disturbances.....	33	29	28	20
Headache.....	20	42	49	28
Faintness.....	7	29	32	13
Anemia.....	27	16	24	33
Muscular pains.....	27	9	19	21
Sleeplessness.....	13	9	19	20

Muscular pains occurred in 26.6 per cent of workers between three to six months and were at first probably largely due to general bodily fatigue, unfamiliarity with machinery, etc. They appeared to pass off as the girls became accustomed to the work and from six to nine months were present in only 9 per cent. The condition continued throughout factory life in an increasing degree and was found among 20.5 per cent of workers who had been more than one year in the factory. In such cases it seems due to fatigue resulting from the nature of the work, possibly accentuated by difficulties of transit or general causes.

Headache and faintness were slight in the first few months of work, but steadily increased between 6 and 9 months and 9 and 12 months, when the maximum was reached, the figures being 48.9 per cent headache and 32.4 per cent faintness. From this point came a decline, and the figures over 12 months' work strongest workers, and it is worthy of note that 38.4 per cent of workers over one year's standing were found to be free from any physical defects.

Anemia was fairly marked between 3 and 6 months, possibly owing to new conditions of life. The healthiest period seemed to be from 6 to 9 months, when the percentage was 16, but the figures steadily rose as factory life continued, reaching 33 per cent in workers of 12 months and upward.

Sleeplessness was most marked between 9 and 12 months, especially in those on night duty. After this the habit of sleep was again established except in the case of a few elderly workers of many years' standing, where possibly factory work was not the main cause of the condition.

The numbers are too small to form anything but a rough guide, but tend to show that for the first six months of factory life the work is usually fairly well borne and the effects of night duty show little ill result. In the six-twelve months' interval the strain begins to produce effects on the weaker members of the factory, and an increased amount of headache, dizziness, and sleeplessness is experienced, especially on night work. The data concern, of course, only those found at work, and are no criterion of what effect may be produced upon those—and their number is not inconsiderable—who for various reasons give up industrial employment after a short trial.

(c) *Relation of age of workers to fatigue shown.*—Examination of 210 women and girls at factory No. 4. It should be noted that the hours of work at this factory were then exceptionally long.¹

A table follows showing the relation of the age of the workers to the amount of fatigue experienced. It will be seen that 44 per cent of the workers aged 14 were suffering from slight or marked fatigue when medically examined, although the majority had been employed under four months and some of them for a much shorter period. Among the workers aged 16 to 20 about 55 per cent found the long hours tiring. The heaviest proportion of those suffering marked fatigue occurred in the age group 30 to 40, but here it should be remembered that these numbers include a proportion of married women in whose case conditions of home work aggravated the strain of factory life.

A decline in signs of fatigue is noticed in the age group 40 and upward, among whom were several elderly women of a wiry type.

¹The report states: "Young persons of 14-18 years have been employed the 77 hours a week continuously, i. e., Monday-Friday, 7 a. m.-9 p. m.; Saturdays, 7 a. m.-5 p. m.; and Sunday, 9 a. m.-4 p. m. Meal times amounting to 1½ hours were required by the order, but only 1½ hours have been given in many departments, one break being omitted and a continuous spell of 7 hours being worked."

Age.	Number of workers examined.	Fatigue.		
		No obvious signs.	Slight.	Marked.
		Per cent.	Per cent.	Per cent.
14.....	25	56	28	16
15.....	15	73	20	7
16-20.....	65	45	43	12
20-30.....	63	49	40	11
30-40.....	80	40	30	30
40 and over.....	12	58	25	16
Total.....	210			

A second medical inspection of 116 of these workers six months later revealed that on the whole the young workers (aged 14 or 15), showed improvement in health since the previous examination. Of 39 girls, 20 were quite healthy, 7 showed slight signs of fatigue, and 12 were no longer at the factory. Those who had left had usually been removed by their parents on account of long hours or dislike of night work. The ventilation of the main shop had been improved and defects due to faulty temperature were no longer marked; on the other hand, the July inquiry showed a rise of 10 per cent in the number of cases suffering from marked fatigue (possibly in part due to unsuitable arrangements for feeding).

(d) *Eyestrain in relation to factory employment.*—This point was considered during the examination of 156 workers in factory No. 9. In contrasting the eye conditions found in different shops in this factory it will be seen that most defects occurred in the fuse department where fine processes were in operation involving close attention and considerable likelihood of eyestrain. In the work of machining shells only 18.7 per cent of eye defects were noted, but in the fuse department the proportion of eye defects reached 64 per cent.

The following table gives the results of inquiry as revealed by the workers' statements or by the more obvious signs of eyestrain:

	Machining shells.	Inspecting shells and fuses.	Fuse department.	Total.
Number of workers examined.....	32	23	101	156
Glasses previously worn.....	9	1	11	15
Glasses obtained since working in factory.....			8	8
Glasses obtained but not worn.....		1	4	5
Probably need glasses.....	2	3	10	15
Complaining of eye fatigue.....		2	19	21
Apparent eye strain.....	3	5	10	18
Conjunctivitis.....		2	11	13
Blepharitis.....	1	1	2	4
	9	15	75	99

It will be noted that in the fuse department 8 per cent of the workers were obliged to obtain glasses since starting factory work, 19 per

cent complained of eyestrain, of whom 12 per cent found sight difficult on the night shift, and 2 per cent found the eyestrain increasing in severity. Besides these, 10 per cent appeared to have latent eyestrain as shown by severe headache, blepharitis, etc., and probably required to have their eyes tested. Conjunctivitis was present in 11 per cent. Many workers complained of the artificial light falling directly on their eyes, and others said that the reflection of the brass work of the fuses was dazzling. The artificial lighting in the factory was by electric lights placed over the benches. Owing to difficulty in train service it was not possible to visit the factory during the night shift in order to watch the effect on the girls, or to observe if shades could be adjusted without undue interference with the work, but this point appeared to need consideration.

On the other hand, it must be remembered that cases of eyestrain or frequent headaches may not be due entirely to factory conditions. Several girls had been warned at school by the school medical officer that their sight was defective, and had neglected to obtain glasses. Five workers had obtained glasses but did not wear them; in one instance the previous occupation of dressmaking was probably responsible for the initial eyestrain, and in another case a girl who had previously been a domestic servant now visited the cinema three times a week although suffering from marked eyestrain. It is also probable that some of the employees were still feeling the effects of overtime and seven days' weekly work, which had recently been discontinued, and some visual improvement might be expected on subsequent examinations.

SUMMARY.

15. It is unfortunately impossible to compare the findings based on the reports from the factories visited with the results of investigations carried out in nonmunition factories in time of peace, but they have in themselves considerable interest, and though the numbers are not large they at least show the general physical condition of the women workers in the earlier period of women's labor in munition factories. Factory conditions which were then unsatisfactory have probably been remedied in most cases, means of transit have been improved, canteens provided, welfare supervisors and nurses appointed, unduly long hours reduced, etc., so that the descriptions quoted from the reports do not necessarily hold good now; they serve, however, to indicate the circumstances in which the work was carried out and the discomforts which had to be faced by the women.

The medical findings are on the whole satisfactory. Most of the inspectors had expected to discover far more fatigue directly attributable to the conditions of work, and were agreeably surprised at the general physical condition of the workers. Several suggestions

may be put forward as explaining the relative absence of marked fatigue.

In the first place, those who felt fatigue most may have left the factories, and so failed to come under review; indeed, in the re-examination referred to above, only 116 out of the original 210 were present six months later.

In the second place, the dietary was in most cases more ample and suitable than the workers had been used to previously. Wages were higher and more money was spent on food. The women were beginning to realize that they could not do their work unless they had substantial meals, although there was still too great a tendency at the canteens to select pastry, chips, etc., instead of a proper dinner of meat, vegetables, and pudding. Food brought from home was often excellent in quantity and quality.

16. Again, although the hours of work were long, they were not usually increased by domestic work at home. Girls in lodgings or living at home were able to pay sufficiently well to be excused from housework, though, indeed, there was usually no time in which this could be performed. A reason sometimes given for not desiring an 8-hour instead of a 12-hour shift was the fact that in the former case the girl would be required to do her share of housework which she escaped with the longer hours. Married women, however, especially when they had young children, frequently found the strain of house and factory work too fatiguing. Further, the factory work, though often monotonous and tedious, was not as a rule particularly exacting and the workers were not putting forth their whole energy all the time. If they had, there would certainly have been far more fatigue observable. The excitement of doing "war work" and making munitions added a zest and interest to the work which tended to lessen the fatigue experienced, and the courage, perseverance, and patriotic spirit exhibited was largely induced by the knowledge that the special efforts made had a common object, namely, to assist the men at the front.

17. Night work proved less exhausting than had been feared (except in the case of married women with children). A fair proportion of girls preferred it to the day shift partly perhaps because of the higher wages earned and partly because they then gained a little time for recreation or shopping; most seemed able to sleep sufficiently well by day. There were comparatively few indications of nervous irritability, etc., pointing to lack of sleep.

18. But although the results of the inquiry are on the whole encouraging, they certainly emphasize the importance of adequate provision for the health and comfort of the workers. It is probable that as the work continues over a long period and the novelty wears off the strain will become more serious, the standard of physical

efficiency will be lowered, and the output consequently decreased unless care is taken to avoid unnecessary burdens and to secure such amelioration as is practicable. The provision of well-managed canteens, for example, is particularly important as the cost of food increases; suitable lodgings or hostels are more needed as factories enlarge and workers are encouraged to come from a distance; hours of work should be restricted within reasonable limits, with sufficient pause at the week end and with periodical holidays; satisfactory arrangements for transit are essential if unnecessary fatigue and illness are to be avoided, especially during the winter months; properly staffed and equipped ambulance stations and rest rooms are needed where girls temporarily incapacitated by illness or accident may obtain treatment or advice. A welfare supervisor whose duty it is to care for the physical well-being of all women employed should always be a member of the staff employed by the firm. The provision of day nurseries may sometimes be necessary.

19. If proper care and forethought are exercised there seems no reason why women and girls, suitably selected and supervised and working under appropriate conditions, should not take their place in munition factories and carry out many operations hitherto considered fit only for men without permanent detriment to their future health.

JANET M. CAMPBELL, M. D.
LILLIAN E. WILSON, M. D.

LONDON, *October, 1916.*

105796°—Bull. 230—17—12

EXTENSIVE

TABLE COMBINING FACTORY, SOCIAL, AND MEDICAL

1. Factory.....	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
2. Manufacture. Processes on which persons examined were employed.	Cartridges and fuses; machines, lathes, automatic; handwork— assembling, and in danger area—filling.	Cartridge and fuse filling; handwork, danger area, filling, finishing filled cases, machine lathes, automatic.	Cartridges; light automatic machines.	Cartridges; machines, automatic, light press, handwork, light bench work; danger area—light machines.	Hand grenades, machines, lathes, presses, automatic, handwork, light bench work, assembling, etc.
3. Number employed.	955.....	475.....	2,500.....	850.....	150.....
4. Number examined.	105.....	92 (three-fourths were girls under 18).	149.....	210.....	130.....
5. Condition in the factory.	Good.....	Good, except insufficiency of lavatory accommodation.	Not good.....	Fairly good....	Fair.....
(a) Sanitation, etc.	New, well-built premises; clean, well ventilated.	Mostly new buildings, clean and well ventilated.	Some over-crowding and defective ventilation.	New, well built, except machine shop; ventilation poor.	Old premises; ventilation, etc., fairly good.
(b) Feeding....	No canteen. Mess room; insufficient cooking stoves.	No canteen; mess room; cooking.	Canteen. Fairly good.	Canteen satisfactory.	No canteen, mess room, no cooking.
(c) Welfare.....	No welfare worker.	Matron and assistant, working type.	Matron and assistant.	No welfare work.	Welfare worker, occupier's daughter.
(d) First-aid...	Surgery; 2 nurses.	No surgery; no nurse; ambulance boxes.	Surgery and 5 nurses.	Surgery and nurse.	Ambulance box in small office at rest room.
6. Means of transit.	Firm's own vehicles from station, 1½ miles.	Bad; station 1½ miles distant.	Inadequate trams; majority spend under 1 hour traveling.		
7. Housing.....	Majority live at home; fairly good.	All but 5 lived at home; semi-rural districts.	Majority live with parents.		
8. Hours of work.	(1) Day and night shifts—day, 68; night, 64 hours. (2) Day shift + O. T. = 68 hours. (3) 3 eight-hour shifts = 52 hours.	(1) Day and night shifts; 7 days = 61½; 6 nights = 59½. (2) Day shift + O. T., alternate 6 and 7 days = 69—76 hours. (3) 2 shifts, 8 hours, 7 days = 52½—43 hours.	Day and night shifts; days = 67 and 69; night, 63. 	(1) Day and night shifts, (108 women) 7 days = 72; 6 nights = 63 hours. (2) Day shift + O. T. (92 women) 7 days = 77; 6 nights = 68 hours.	(1) Day and night shift—7 days, 6 nights. (2) Day shift + O. T.
9. Wages.....	Time rate + war bonus, for 54 hours = under 18 years, 9s. 6d. to 12s. [\$2.31 to \$2.92]; over 18 years, 17s. 3d. [\$4.20].	Time rate, 2d. to 3½d. [4.1 to 7.1 cents] per hour (wages raised after arbitration a few weeks later).	Time and piece rate; rate per 53 hours, under 18, from 6s. to 9s. [\$1.46 to \$2.19]; over 18, from 10s. to 12s. [\$2.43 to \$2.92].	Time rate, starting for adults at 15s. [\$3.65].	Piece work; wages range from 14s. to 45s. [\$3.41 to \$10.95].
10. Posture at work.	Work seated, 72; work standing, 15; work either, 13=105.	Work seated, 47; work standing, 11; work either, 24=82.	Complaints made that sitting was not permitted.		

INQUIRY—WOMEN.

CONDITIONS COMPILED FROM THE REPORTS OF THE INVESTIGATORS.

No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	
Small arms charges: Machines, presses, light automatic machine and hand presses.	Fuses: Machine lathes—hand gauging and in danger area, light bench work on loaded fuses.	Cartridges and fuses: Machine—automatic machine lathes; press—hand-work, gauging and examining; danger area—filling cordite, fulminate, tetryl.	Shells and fuses: machines, light automatic.	Shells.....	Shells: Machine lathes—hand cleaning, varnishing, etc.	
120.....	1,000.....	7,148.....	1,004.....	76.....	(a)	(b) 900.
70.....	100.....	170.....	156.....	46.....	28.....	86.
Fair.....	Bad.....	Fairly good.....	Fair.....	Good.....	Good.....	Fair.
New factory, all good except no heating yet.	Low standard of cleanliness, ventilation, etc., throughout.	Conditions vary in different sections—not a high level.	Ventilation unsatisfactory.	Ventilation poor.	Good....	Ventilation poor.
No canteen. Mess room, cooking.	No provision made for meals, no room, no cooking.	Canteens insufficient and unsatisfactory.	No canteen. Mess room, cooking.	Canteen, also mess room and cooking.	Canteen good.	Mess room, cooking.
Forewoman has some welfare duties. No provision made.	No welfare worker. No provision made. No nurse.	Welfare workers—not satisfactory. Surgery and 5 nurses one section, other no provision. Not good. Majority spend over 1 hour up to 2½ hours.	No welfare worker. 2 surgeries. Ambulance man.	No welfare worker. Ambulance box in office.	Majority live near. Good....	Majority live near. Good.
			Good.....			Welfare worker.
			Fairly good. Live at home.	Fairly good....	Ambulance box.	Arrangements poor.
Day and night shifts—4 days = 6½, 5 nights = 5½ (night shift abandoned as unprofitable the week the examination was made).	Day shifts + O.T.—7 days = 77 hours, some cases 80 hours illegally. An easy-going, undisciplined factory, which may account for the long hours not having produced a worse effect.	(1) Day and night shifts—7 days—day, 68; night, 63. (2) 3 shifts, 8 hours—4 days = 48 and 49½.	Day and night shifts—day = 52 hours; night = 55.	Day and night shifts, 6 turns = 63½ hours.	Day shifts and O.T. Sunday = 70½.	
Piecework (no further information).	Piecework + bonus. Danger area, wages 20s. to 30s. [\$4.87 to \$7.30]. (20 per cent of those examined). Machine shops 30s. to 8s. [\$7.30 to \$19.47]. Work seated, 20; work standing, 60; work either, 20.	Time and premium bonus. Rate for 48 hours—16 to 21 years = 9s. to 14s. [\$2.19 to \$3.41], 21 and over = 14s. [\$3.41]. Complaints—sitting not allowed.	Piecework, minimum £1 [\$4.87] and bonus. Time wage, day, £1 [\$4.87]; night, £2 [\$9.73].	Time wages, from 15s. to 28s. [\$3.65 to \$6.81] weekly.		Standing at lathes.

180 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

INTENSIVE INQUIRY—

MEDICAL

1. Factory.....	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
11. Medical classification—	22 per cent showed symptoms of overstrain.		“Large proportion showed signs of fatigue.”		
A.....	59 per cent.....	61 per cent.....	65.8 per cent.....	61.4 per cent.....	50 per cent.....
B.....	30 per cent.....	26.8 per cent.....	29.5 per cent.....	32.9 per cent.....	38.5 per cent.....
C.....	11 per cent.....	12.2 per cent.....	4.7 per cent.....	5.7 per cent.....	11.5 per cent.....
12. Ailments—					
Indigestion...	5.7 per cent.....	12.2 per cent.....	10.7 per cent.....	19 per cent.....	17.7 per cent.....
Constipation...	11.4 per cent.....	12.2 per cent.....	25.5 per cent.....	18.1 per cent.....	10.7 per cent.....
Headache (frequent).	2.3 per cent.....	8.5 per cent.....	6.7 per cent.....	25.2 per cent.....	31.5 per cent.....
Sleeplessness.	9.5 per cent.....	6.1 per cent.....	12.7 per cent.....	8.1 per cent.....	5.4 per cent.....
Muscular pains.	22.8 per cent.....	18.3 per cent.....	17.4 per cent.....	18.6 per cent.....	11.5 per cent.....
Anæmia.....	10.4 per cent.....	7.3 per cent.....	24.2 per cent.....	38.1 per cent.....	16.9 per cent.....
Disorders of menstruation.	14.3 per cent.....	12.2 per cent.....	12.1 per cent.....	22.9 per cent.....	4.6 per cent.....
Disorders of vision.	11.4 per cent.....	23 per cent.....	10.7 per cent.....	15.2 per cent.....	14.6 per cent.....
Defective teeth.	22.8 per cent.....	26.8 per cent.....	16.8 per cent.....	20 per cent.....	27.7 per cent.....

HEALTH OF WOMEN IN MUNITION FACTORIES. 181

WOMEN—Concluded.

RESULTS.

No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.
		Large proportion showed signs of fatigue.			
52.9 per cent...	38 per cent....	40 per cent....	68.6 per cent...	65 per cent....	72.8 per cent.
35.7 per cent...	49 per cent....	48.2 per cent....	25.6 per cent...	27.5 per cent...	24.6 per cent.
11.4 per cent...	13 per cent....	11.8 per cent....	5.8 per cent....	7.5 per cent....	2.6 per cent.
20 per cent....	10 per cent....	32.3 per cent....	11.5 per cent....	7.5 per cent....	19.3 per cent.
17.1 per cent...	22 per cent....	28.2 per cent....	51.9 per cent...	20 per cent....	14.9 per cent.
44.3 per cent...	44 per cent....	27.1 per cent....	28.2 per cent...	5 per cent....	9.6 per cent.
31.4 per cent...	6 per cent....	10 per cent....	10.3 per cent....	17.5 per cent...	9.6 per cent.
25.7 per cent...	18 per cent....	25.9 per cent....	19.8 per cent....	27.5 per cent...	9.6 per cent.
20 per cent....	37 per cent....	31.2 per cent....	13.4 per cent....	30 per cent....	15.8 per cent.
10 per cent....	27 per cent....	22.9 per cent....	41.7 per cent...	77.5 per cent...	28.9 per cent.
11.4 per cent...	34 per cent....	25.9 per cent....	40.4 per cent...	25 per cent....	25.4 per cent.
41.4 per cent...	31 per cent....	48.2 per cent....	19.2 per cent...	15 per cent....	44.7 per cent.

MEDICAL CERTIFICATES FOR MUNITION WORKERS.

[Memorandum No. 16.]

Various witnesses have called the attention of the committee to difficulties which have arisen in regard to medical certificates put forward by munition workers in support of absences from work on account of illness. On some certificates no information is given as to the cause of illness or as to its probable duration. It is seldom stated whether immediate absence from work is essential or whether it can be postponed for a brief period until a particular job has been completed. Apart from this, cases have been brought to the notice of the committee in which the certificates have been given on odd slips of paper and do not show the address of the medical practitioner.

In order to meet these difficulties the committee have prepared a form of certificate which should, in their opinion, afford the desired information, and at the same time be easily and quickly filled in. It is suggested that in the case of national factories copies of this form of medical certificate should be supplied to panel practitioners and other medical practitioners in the neighborhood with a request that the form may be used for all medical certificates given to munition workers. The adoption of a similar procedure might be suggested to controlled establishments.

The general adoption of this medical certificate will, the committee hope, serve to meet many of the difficulties which are at present experienced in dealing with absences of munition workers on account of illness, and, in addition, may have the incidental advantage of providing a basis for the collection of valuable data as to the incidence of different types of illness and as to periods of absence involved.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.

Chairman.

E. H. PELHAM, *Secretary.*

February, 1917.

APPENDIX.

FORM OF MEDICAL CERTIFICATE.

A. I hereby certify that I have (1) this day, on _____, 191____, examined:
(Name) _____ (Sex) _____
(Address) _____
who in my opinion is rendered unfit (2) to follow his (her) usual occupation
by reason of (3):
(1) Respiratory (bronchitis, consumption) _____
(2) Digestive (dyspepsia, gastric ulcer) _____
(3) Circulatory (functional or structural, anemia) _____
(4) Nervous (fatigue, local or general nervous disorders) _____
(5) Senses (eyestrain, ear disease) _____
(6) Other conditions (infectious diseases, rheumatism, and general dis-
eases) _____
B. Is immediate rest from work absolutely necessary? _____
C. Absence from work (4) is (is not) likely to be necessary for longer than a
week.

(Signed) _____
(Qualifications) _____
Address _____

(Date of signing) _____

To be filled up by the firm: Period of absence _____ days.

NOTES.

- (1) If the certificate is signed on a day other than that on which the patient was examined, the words "this day" are to be struck out and the date of examination inserted in the space provided. If this is not done the doctor will be understood to certify that he examined the patient on the date of signing.
- (2) The words "unfit to follow his usual occupation" are to be understood to include not only cases in which the patient's illness (or injury) renders him physically incapable of performing his work, but also cases in which the illness (or injury) is of such a nature that the patient's health would be seriously endangered by continuing to perform it.
- (3) The words in brackets are only given as examples. The diagnosis should be entered under the appropriate heading. If an exact diagnosis can not be recorded, the system of the body principally affected should be indicated.
- (4) The word "is" or "is not" (as the case may require) to be struck out in line C where it is possible to make this prognosis.

HEALTH AND WELFARE OF MUNITION WORKERS OUTSIDE THE FACTORY.

[Memorandum No. 17.]

1. In previous memoranda the committee have dealt mainly with the health and welfare of munition workers as affected by the conditions of employment inside the factory,¹ and have only referred incidentally to other conditions of almost equal importance outside the factory, such as housing, transit, and recreation. The necessity in the present emergency of transferring workers from their homes to distant places where their labor is required has created an unparalleled situation, and problems of the first importance to the nation are arising simultaneously in munition areas in various parts of the kingdom, especially as regards women and girls. The committee are of opinion that the situation calls for some more complete and systematic action than can be taken locally by isolated bodies of persons; however public spirited and sympathetic they may be. The Ministry of Labor, through their organization of employment exchanges throughout the country, meet the demand for labor by a supply drawn from every available source, but it is no part of their responsibility to safeguard the health and welfare of those whose service they obtain.

2. By the provision of hostels and clubs and by other means voluntary societies are performing a most useful work, which is far from being confined to their own members. The committee also desire to place on record their cordial recognition of what has been accomplished through the energy and enthusiasm of the local advisory committees, which have been set up on the recommendations of the central advisory committee of the Ministry of Labor and Home Office, to undertake, in addition to other duties, this welfare work outside the factory for transported workers. It is, therefore, from no lack of appreciation of the work of these committees that the Health of Munition Workers Committee must express the opinion that the time has now come to supplement and reinforce them by a larger degree of State action than has hitherto been deemed necessary.

3. The committee are strongly of the opinion that it is the duty of the State to determine the nature and extent of the provision to

¹ "Welfare supervision" No. 2. [Reprinted in Bulletin No. 222.] "Employment of women," No. 4. [Reprinted in Bulletin No. 223.] "Hours of labor," No. 5. [Reprinted in Bulletin No. 221.]

be made in each area, and to take such steps as are requisite for its attainment. For this purpose full use should be made of the services of local advisory committees and of other voluntary bodies, to the value of whose work reference has already been made. Every advantage should also be taken of the powers and experience possessed by local authorities in regard to such matters as housing, public health and sanitation, lighting, and the maintenance of public order. The aim, in fact, should be not to supplant the work of these various bodies, but by the appointment of special officers and by other means to supplement and coordinate. A local organization might thus be provided which under the supervision of the State should be qualified effectively to undertake the solution of the manifold and difficult problems involved in providing for the health and welfare outside the factory of the women and girls employed in munition centers.

4. The position may be briefly stated as follows:

By the agency of the State women and girls are being exported from their homes and imported into munition areas.

By the agency of the State the liberty of the individual to throw up her work and to take her labor elsewhere is restricted:

On the State, therefore, the responsibility lies not only for suitably housing these transplanted workers, but also for securing the safeguards needful for their health and morals, the maintenance of which is essential to the nation.

5. The problems which present themselves for solution may be roughly grouped under four heads: (a) Personal questions; (b) Housing accommodation and transit, (c) Sickness, (d) Leisure. In regard to each of these the committee have suggestions to make as to what is required and the means to be adopted to accomplish the end in view. These suggestions are largely based on experience gained in different areas.

PERSONAL QUESTIONS.

6. *Only normally healthy, clean, and wholesome-minded women and girls should be exported.*—In some cases women and girls received in lodgings and hostels have been found to be in such a condition of person and clothing that the assistance of the sanitary authority had to be invoked for cleansing or disinfection. In other cases women and girls have been imported who suffer from physical disabilities, or are in an unsuitable physical condition. In some instances women of bad character have been associated in lodgings or hostels with respectable women and girls. Such instances, even if not numerous, exert far-reaching effect and rumors spread quickly through a neighborhood, losing nothing by repetition, and cause

many housewives to close their doors against munition workers as lodgers.

The committee accordingly suggest that all women and girls before being exported should be examined by a doctor or by a nurse working under his supervision. They are glad to learn that arrangements to this end are being made by the ministry.

7. *Mothers of infants or of families of young children should not be exported.*—The arrival of mothers in a town accompanied by quite young infants, or three or four young children, having traveled long distances, is becoming more and more common—the mother is attracted, in the absence of the father on active service, by the prospect of high wages in munition works, and brings her baby or children with her. To find lodgings where these are not unwelcome, and where some one will undertake the care of the children while the mother is out at the factory, is no easy task. The committee consider that this practice of taking children across country by train to some distant munition area and leaving them to strangers all day or all night should be discouraged.

They accordingly suggest that inquiry into such matters should be made at the source of supply by the nurse mentioned above or by voluntary helpers of experience.

8. *No woman or girl should be exported without a sufficiency of clothing or of money.*—Women and girls frequently arrive at munition centers without luggage, or any clothing except what they are wearing, and without any money; they are often hungry and thirsty, having had no food on a long journey. In some cases poverty is the cause, in many others the reason given has been that they had heard that everything necessary, including the first week's lodging, was provided free. As the first wages are not due for a week, and frequently are not paid until after 10 days or a fortnight (the first week or a few days' wages being kept back), the plight of these women and girls in a strange town is not only uncomfortable, but a serious danger.

9. The committee accordingly suggest that information should always be given at the employment exchange, verbally and by printed notices, that sufficient change of clothing, as well as money for emergency expenses on the journey, must be taken. When the need is proved, financial help should be forthcoming from a fund administered locally, safeguards being taken for the refunding of the loan out of wages. The practice already sometimes adopted of giving advances pending the first payment of wages might be extended.

10. *Travelers across country should be seen off and met at the station.*—The need for the protection of those unaccustomed to travel, especially if the distance is great, is well recognized. Where such services have not been organized, serious inconvenience and evil has

arisen in many instances. To meet these difficulties local agents should always see the women and girls off by train, receive them at the station on arrival, and direct them to their employment exchange or lodging. In some cases arrangements have been found necessary for meeting parties in the course of their journey when they have to change stations or trains.

HOUSING ACCOMMODATION AND TRANSIT.

11. *Suitable and sufficient board and lodging should be provided for all exported women and girls not otherwise provided for.*—For this purpose there should be provided: (a) Reception or clearing house, (b) hostels, (c) lodgings, and (d) convenient means of transit.

12. *A reception or clearing house* should be provided for any women and girls arriving without having secured lodgings, and for whom such can not be found before nightfall, or whose circumstances or condition make it difficult to allot lodgings without further inquiry. Such a clearing house has already been provided in some districts, generally with the help of the Ministry of Munitions, and is indeed essential in localities where large numbers of women and girls arrive by train from distant places, often late in the day, without any arrangements having been previously made for lodgings. The house needs to be suitably equipped for receiving all classes. It should be under the charge of a lady superintendent with considerable experience in dealing with women under any emergency; she should preferably have had some nursing training and be a person of kindly, tactful character. The inmates should have separate cubicles; adequate washing and bathroom accommodation, and facilities for washing clothing should also be provided. Good, plain, appetizing food and a cheerful, warm sitting room are necessary. A homeless woman or girl, full of vague fears at taking up unaccustomed work, especially in an explosives factory, may spread uneasiness and even alarm among her associates. Depression and fear are contagious and have been known to cause many to return home the day after arrival. But cheerfulness and courage are also contagious, and the influence of a lady superintendent or voluntary helpers among new arrivals at a reception hostel is of great value. The stay is generally only for a night or two—a week should, unless the case is exceptional, be the maximum—the inmates being found suitable lodging at the earliest moment. At some of these reception hostels, arrangements are made with the factory to refund the cost of board and lodgings from wages on the first pay day by consent of the employee.

13. *Hostels.*—The congregation of great numbers of workers in particular centers has necessitated large schemes of temporary housing. In some areas hostels have been established in existing build-

ings by voluntary agencies, and also by the State acting either directly or through the agency of private firms. In addition, the State has had to erect temporary hutments, providing in some instances for several thousand workers. It is beyond the scope of this memorandum to discuss in detail the lines on which such accommodation can best be provided, but experience suggests certain essentials for success which may be briefly referred to.

14. Hostels are not generally attractive to industrial workers, who are unused to communal life; moreover, the housing together under new conditions of large numbers of women and girls of various ages and classes creates difficulties not easily overcome. Much depends on the personality of the lady superintendent and the character of her assistants and servants, who should be carefully chosen and controlled. As much freedom as is compatible with good order should be allowed to the inmates, who are independent workers not living under any community rule. The bedrooms should be separate, self-contained cubicles. The public rooms, dining, and recreation rooms should be bright, airy, and well warmed; in addition, the need for rest and the companionship of a few friends should be met by a sufficient number of small sitting rooms. Their absence has doomed some otherwise satisfactory hostels to failure, since many women and girls soon tire of organized recreation night after night, and having worked hard in a factory for many hours crave the quiet rest of a room more nearly resembling home.

15. *A lodging*, with or without board, in a family is the readiest and generally most acceptable arrangement for women and girls. In most localities efforts have been made by the local advisory committees or other agencies to obtain information as to possible lodgings; these are visited by voluntary or paid workers and lists of approved lodgings compiled. Much useful work has thus been done in suitably housing women and girls; but if the fullest and best advantage is to be taken of the lodging capacity of the locality, a larger and more elaborate local organization will be required than can generally be carried through by voluntary work unaided. What appear to the committee to be required are arrangements similar to those employed in the army for billeting soldiers in a town, if modified to meet the special needs of women and girls. Just as the commanding officer of a regiment receives from the local authority and police of a town or village through the regimental billeting officer complete information respecting the accommodation available in every house, with particulars concerning the character of the street and of the landlady, so those locally responsible for the welfare of munition workers could obtain from the same source similar details respecting lodgings for women and girls. By supplementing the

information so received by inquiries at each house, such as a billeting officer makes, there could be formed in advance a register containing the record of all material points. With the assistance of local public health officials and police, lodgings could be obtained to suit varying classes of lodgers, disreputable localities or unapproved persons would be avoided, and equal opportunity would be given to all the townspeople to respond to the call of patriotism by receiving munition workers. A standard of accommodation, food, and service for certain rates could be laid down.

16. One advantage arising from such an organized system of billeting would be that agreements as to terms could be made, as in the army, not between lodger and landlady, but between the responsible local organization and the landlady, and the money payment would be made by the organization. Such a system is already in force in one town, and gives great satisfaction; the workers pay their rent to the "housing superintendent," a lady who by means of assistants and a voluntary staff of ladies calls weekly at each lodging and pays the rent. These visits afford an opportunity for receiving complaints from either lodger or landlady and for rectifying what is amiss or removing difficulties. A high standard is thus obtainable, and abuses are removed. Unfortunately, lodgers sometimes leave without paying their landlady her just dues, and some guarantee of payment is essential.

17. A difficulty which confronts all who attempt to place women and girls in suitable lodgings is to prevent them from drifting into unsuitable surroundings. They easily move from house to house, leaving no address behind and giving no notice of change at the factory. An organized system of billeting would assist to overcome this trouble; landladies could be required to notify the change of lodgers, and the requirements of the registration act might be enforced so far as the lodgers themselves were concerned.

18. *Transit.*—The suitability of lodgings is closely affected by the existence of reasonable facilities for traveling from the place of residence to the factory by train, tramway, or omnibus. The committee have already expressed their views on this subject.¹ Health, time-keeping, temper, and output all suffer when to the day's work is added the discomfort and fatigue of a long walk to and fro in bad weather or in darkness, or a scramble to squeeze into a crowded railway carriage, tram or omnibus, with a long journey in a bad atmosphere. In the darkness of early morning and at night, when no lights are allowed to be shown on the railway, separate compartments for women are desirable, and no traveling without a light inside the carriage should be allowed; in some places carriages without

¹ "Employment of Women," No. 4, p. 5, par. 8. [Reprinted in Bulletin No. 223.]

blinds or other means of shading the windows are used for the conveyance of workpeople of both sexes. Under these circumstances artificial light can not be used, and the journey is made crowded together in total darkness.

SICKNESS.

19. *Arrangements for sickness among lodgers.*—Large hotels have, as a rule, a small hospital with a nurse. Smaller hostels should be provided with sick rooms to which the patients may be removed if nursing and attention are needed beyond what the servants can render. But illness, even of quite a temporary character, presents more difficulty among women and girls in lodgings in a strange place. For lodgers living with the family and sharing a room or a bed with other lodgers, illness is a great misfortune and may, through neglect, become very serious; it may, if infectious or contagious, be a source of danger to others and cause absence from work of many who are needed at the factory.

20. The committee suggest that an organized system of billeting would give the opportunity for the establishment of regulations governing illness among lodgers. For example, notification of illness might be made to the local organization by the landlady or the lodger after more than one day's absence from work and the factory would be informed; the lodgings would be visited and steps taken to see that proper attention is being given and medical attendance obtained if necessary. The name and address of the organization should be posted up in every lodger's room. In the case of infectious or contagious illness the medical officer of health would be notified and his advice and cooperation immediately obtained. If the number of munition workers billeted in a town is large the available hospital accommodation may be inadequate; a special sick room, hostel, or cottage hospital will then become necessary for cases which, although not serious, can not be suitably or conveniently nursed by the landlady in lodgings. Such provision for illness is specially needed where there is a factory in which workers are likely to be affected by the materials handled.

21. *Arrangements for the care of maternity cases* are frequently needed to meet the requirements of different classes of cases, both from the medical and the social point of view. It is important to bear in mind that the occurrence of pregnancy among the imported workers, whether wives or single women, calls for special arrangements for the care of the health of the prospective mother. Considerable anxiety has been caused to welfare supervisors and others who have been obliged to discharge from the factory women and girls not in a fit condition to remain longer at work there. Where

the work is heavy, or there is special risk from explosion or from poisonous materials, it is necessary to dismiss pregnant women at an early stage. They are dependent on wages which cease on leaving work, and if, as not infrequently happens, they are unable or unwilling to return home an embarrassment may arise. Provision appears necessary to meet such cases without drawing too much attention to the subject, which might easily be brought into undue prominence.

22. The committee accordingly suggest that in any munitions area where it is needed a committee working with the local advisory committee should be formed consisting of women, preferably married women and medical women. The committee would be responsible for any case of pregnancy brought to their notice by factory welfare supervisors, landladies, hostel superintendents, friends, or by the woman herself. They would keep in touch with the case and deal with it confidentially and sympathetically. Whenever possible arrangements should be made for the woman to return home. For those who can not be sent home or who have no home a hostel might be provided under the auspices of one of the philanthropic organizations for women, such as the Church Army, the Salvation Army, or the Young Women's Christian Association. The hostel would receive women and girls for whom no light and suitable work could be found in the factory; they would be boarded and lodged and provided with occupations appropriate to their conditions and, if possible, sufficiently remunerative to render them self-supporting, at least for a portion of their stay. The supervision of the hostel should be in the hands of a matron and assistants with training and experience who would be interested in helping those under their care to keep in good health and spirits and to recover, where necessary, self-esteem and a hopeful outlook on life for themselves and their children. Arrangements for the confinement of the inmates and the aftercare of the infants would also be a duty of the committee. It may be suggested that when the lying-in wards of workhouse infirmaries are used they might be made more attractive or the slur of pauperism removed from them. Much valuable work would thus be accomplished for the Nation in giving a good start in life to the children of munition workers, while all harmful publicity would be avoided.

LEISURE.

23. *Recreation* is a necessity for munition workers, and special provision should be made for the large numbers of women and girls away from home and friends. Especially should the leisure of the week ends be provided for so that the benefits which proper rest and recreation afford may be secured. This important matter can not be left to chance. If opportunities of wholesome amusements, refresh-

ment, and recreation are not provided the public houses and less desirable places of entertainment may benefit. but everyone else suffers.

24. The committee suggest that steps should be taken, if possible in cooperation with the local authority, to organize (preferably with the assistance of a committee of the munition workers themselves) recreation on a scale sufficient to meet the needs of large numbers. "Winter gardens" and cafés for refreshment, music, dancing, etc., are attractive, and full use should be made of all public halls in winter and parks and open spaces in summer for entertainments, bands, and sports. Philanthropic and other societies should be encouraged to open small clubs in various parts of the town, so as to be easily accessible to tired workers, who do not always want to journey to the center of the town for amusement during their leisure. Well-to-do residents may often be found willing to contribute their share by offering hospitality in their own houses on Saturdays and Sundays to parties of women and girls and to allow the use of their gardens in summer.

25. Facilities for divine worship, religious instruction, and spiritual ministrations according to the convictions of the various denominations are no less worthy of consideration for munition workers than for the Army and Navy. The existing local provision may not always be adequate or conveniently situated.

26. *Public order.*—To bring large numbers of young people into any locality must increase the difficulty of maintaining public order and good behavior at all times. Just as in university towns there are proctors and in military centers there are military police, so where large numbers of women and girls are assembled for munition work women police and patrols are desirable. Special dangers beset young women away from home and friends; the impossibility of excluding altogether from those who flock into munition areas some women of bad character, the necessity for subduing the lighting of streets and courts and open spaces, and the change of shifts at the factory early and late all contribute to conditions of difficulty for which the trained women police service is well adapted. In many towns women police are now working successfully; they work under the chief constable, they are uniformed and trained as recognized members of the force, and in some towns they are "sworn in." Voluntary women patrols have been found very useful working in cooperation with the police. They are more especially helpful in dealing with young girls whose thoughtlessness may be placing them in the way of temptation.

27. *The encouragement of sobriety among the population* is an important branch of the welfare work; questions as to the number and the status of the public houses in munition areas, the hours dur-

ing which drink may be sold, and other matters of a like nature, should be referred to the central control board (liquor traffic) for consideration and action in accordance with the needs of each locality.

CONCLUSIONS.

28. *To sum up, the committee making the following recommendations as to steps to be taken to promote the health and welfare outside the factory of women and girls in munition areas:*

(a) *Personal questions.*—(1) All women and girls before being exported should be examined by a doctor or a nurse working under his supervision.

(2) Inquiry should be made before exportation as to the age and number of children of married women, and the arrangements proposed to be made for their care. The inquiry might be made by a nurse or voluntary helper of experience.

(3) Advice should be given before exportation to every woman and girl to provide herself with a sufficient change of clothing, and of money for emergency expenses on the journey. When the need is proved, financial help should be forthcoming from a fund administered locally, safeguards being taken for the repayment of the loan from wages. The practice of giving advances pending the first payment of wages might be extended.

(4) Arrangements should be made at places of export and of arrival for travelers to be seen off and met at the railway station.

(b) *Housing accommodation and transit.*—(1) A clearing or reception house should be provided where women and girls can be housed for a night or two, until suitable lodgings are found for them. It should be in charge of an experienced superintendent. Separate cubicles, good baths and washing accommodation, appetizing food, and a cheerful sitting room should be provided.

(2) Much of the success of a hostel depends upon the character of the superintendent and her staff. As much freedom as is compatible with good order should be allowed. The need for rest and the companionship of a few friends should be met by a sufficient number of small sitting rooms. Many women and girls soon tire of organized recreation.

(3) The provision of suitable lodgings should be organized on the same lines as the billeting of soldiers. Lodgings should be obtained to suit varying classes of lodgers. Standards of accommodation at varying rates should be laid down. Payments for board and lodgings should be made through the local organization responsible for the supply of lodgings; opportunities are thus obtained for visiting lodgings and removing abuses. The tendency to move into unsuitable surroundings might be controlled.

(4) Reasonable facilities for the transit of workers to and from the factories should, as far as possible, be arranged.

(c) *Sickness*.—(1) Arrangements for the notification of illness in lodgings should be made and enforced. A special sick-room hostel or cottage hospital may be required.

(2) A special committee of women (preferably married women and medical women) should be formed to keep in touch with maternity cases. A hostel, under the auspices of a philanthropic society, may be needed to provide for those who can no longer be suitably employed at the factory, and who can not return home. Arrangements for the confinement of inmates would be necessary.

(d) *Leisure*.—(1) Organized means of recreation and of wholesome employment of leisure should be provided.

(2) For the preservation of order and for preventive work, women police should be appointed, assisted where desirable by women voluntary patrols.

(3) Questions regarding the sale of drink should be referred to the central control board (liquor traffic) for action.

29. The committee desire to express their thanks to the central advisory committee on women's war employment (industrial), who have afforded them much assistance in the preparation of this memorandum.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*

January, 1917.

APPENDIX.

CONTENTS OF OTHER BULLETINS RELATING TO LABOR IN GREAT BRITAIN AS AFFECTED BY THE WAR.

- Bulletin No. 221. Hours, fatigue, and health in British munition factories.
- Introduction.
 - Summary of the committee's conclusions.
 - Sunday labor (Memorandum No. 1).
 - Hours of work (Memorandum No. 5).
 - Output in relation to hours of work (Memorandum No. 12), reported by H. M. Vernon, M. D.
 - Industrial fatigue and its causes (Memorandum No. 7).
 - Sickness and injury (Memorandum No. 10).
 - Special industrial diseases (Memorandum No. 8).
 - Tetrachlorethane poisoning (report of the British medical inspector of factories).
 - Dope poisoning (leaflet issued by the British factory inspector's office).
 - Ventilation and lighting of munition factories and workshops (Memorandum No. 9).
 - Effect of industrial conditions upon eyesight (Memorandum No. 15).
 - British treasury agreement as to trade-union rules affecting restriction of output.
 - Munitions of war act, 1915, relating to labor disputes and restoration of trade-union conditions after the war.
 - Munitions of war (amendment) act, 1916.
 - Munitions tribunals (provisional), rules for constituting and regulating munitions tribunals in England and Wales.
 - Compulsory arbitration in munitions industry in France.
- Bulletin No. 222. Welfare work in British munition factories.
- Introduction.
 - Summary of committee's conclusions.
 - Legal regulation of welfare work in Great Britain.
 - Value of welfare supervision to the employer, by B. Seebohm Rowntree, director of welfare department, British ministry of munitions.
 - Welfare supervision (Memorandum No. 2).
 - Industrial canteens (Memorandum No. 3).
 - Canteen construction and equipment (Memorandum No. 6).
 - Investigations of workers' food and suggestions as to dietary (Memorandum No. 11).
 - Washing facilities and baths (Memorandum No. 14).
- Bulletin No. 223. Employment of women and juveniles in Great Britain during the war.
- Introduction.
 - Summary of the committee's conclusions.
 - Replacement of men by women in industry in Great Britain.

Bulletin No. 223. Employment of women and juveniles in Great Britain during the war—Concluded.

Extension of employment of women in Great Britain in 1916.

Employment of women in Great Britain (Memorandum No. 4).

Migration of women's labor through the employment exchanges in Great Britain.

Employment and remuneration of women in Great Britain—munitions orders.

Output of munitions in France.

Regulations as to wages of workers in munitions factories in France.

Juvenile employment in Great Britain (Memorandum No. 13).

Juvenile employment committees in Great Britain.

Employment of women and boys in munition work in Italy.

ADDITIONAL MATERIAL RELATING TO LABOR IN FOREIGN COUNTRIES AS AFFECTED BY THE WAR.

WOMEN IN INDUSTRY.

Woman's war work in Great Britain. Summary of British War Office report on woman's war work. (London, Sept., 1916. 92 pp. 72 illustrations.)

(In MONTHLY REVIEW, December, 1916, pp. 88-92.)

Employment of women on munitions of war. Summary of Ministry of Munitions pamphlet, entitled "Notes on the Employment of Women on Munitions of War, with an Appendix on Training of Munition Workers." (London, 1916. 94 pp., ill.)

(In MONTHLY REVIEW, September, 1916, p. 105.)

Employment of women in retail stores. Summary of reports of the shops committee appointed by the Secretary of State for the Home Department to consider the conditions of retail trade which can best secure that the further enlistment of men or their employment in other national service may not interfere with the operations of that trade. (London, 1915. 10 pp.)

(In MONTHLY REVIEW, July, 1916, pp. 162, 163.)

LABOR CONDITIONS AND LEGISLATION.

Effect of the war upon railway labor in Great Britain. Article based on report of the general secretary of the National Union of Railway Men in Great Britain, 1916.

(In MONTHLY REVIEW, August, 1916, pp. 81, 82.)

Proposed Ministry of Labor in Great Britain. Article based on proceedings of British Trades-Union Congress, September 6 to 11, 1915.

(In MONTHLY REVIEW, August, 1916, pp. 82, 83.)

Report of the chief inspector of factories and workshops. Summary of annual report of British factory inspector's office for 1915. (London, 1916. 15 pp.)

(In MONTHLY REVIEW, December, 1916, pp. 121-123.)

Extension of unemployment insurance in Great Britain.

(In MONTHLY REVIEW, November, 1916, pp. 65-68.)

Labor in Great Britain after the war. Resolutions of conference of representatives of capital and labor held in London, January, 1917.

(In MONTHLY REVIEW, March, 1917, pp. 479, 480.)

Industrial unrest in Great Britain. Summary of Chapter II of Labor, Finance, and the War, edited by A. W. Kirkaldy. Published by authority of the Council of the British Association for the Advancement of Science. (London, 1916.)

(In MONTHLY REVIEW, April, 1917, pp. 520-525.)

New ministries in the British Cabinet.

(In MONTHLY REVIEW, May, 1917, pp. 770, 771.)

Minimum-wage law in France.

(In MONTHLY REVIEW, December, 1915, pp. 36-41.)

Chinese labor in France. Summary of article by "S. G. C., a Chinese correspondent," in the *New Statesman*, January 13, 1917. p. 343.

(In MONTHLY REVIEW, March, 1917, pp. 480, 481.)

Compulsory arbitration in Norway.

(In MONTHLY REVIEW, September, 1916, pp. 78, 79.)

Great Britain: *The Public General Acts, 1914-16*, London. Printed for F. Atterbury, King's Printer of Acts of Parliament, by Eyre & Spottiswoode (Ltd.), 1916. XII, 459 pp. Price, 3s.

Great Britain: *Manual of Emergency Legislation*, comprising all of the acts of Parliament, proclamations, orders, etc., passed and made in consequence of the war to September 30, 1914. Edited by Alexander Pulling, London. Printed for F. Atterbury by Darling & Son (Ltd.), September, 1914. XI, 572 pp. Price, 3s. 6d.

Great Britain: Supplement No. 1, to November 2, 1914, to the *Manual of Emergency Legislation*. November, 1914. VII, 54 pp.

Great Britain: Supplement No. 2, to December 15, 1914, incorporating and superseding Supplement No. 1 to the *Manual of Emergency Legislation*. December, 1914. XIII, 217 pp. Price, 1s. 6d.

Great Britain: Supplement No. 3, to April 30, 1915, in continuation of Supplement No. 2 to the *Manual of Emergency Legislation*. May, 1915. XVIII, 219 to 697 pp. Price, 2s. 6d.

Great Britain: Supplement No. 4, to August 31, 1915, in continuation of Supplement No. 3 to the *Manual of Emergency Legislation*. September, 1915. XXVII, 462 pp. Price, 2s. 6d.

Great Britain: *Manual of Emergency Legislation, Defense of the Realm Regulations made to May 23, 1916*. Second edition. London. Printed for F. Atterbury by Darling & Son (Ltd.), 1916. X, 102 pp., ill.

Canada: Copies of proclamations, orders in council, and documents relating to the European war; compiled by the department of the secretary of state of Canada. Ottawa, Government Printing Bureau, 1915. XX, 209 pp.; appendixes, 142 pp.

Canada: First supplement to copies of proclamations, orders in council, and documents relating to the European war. Ottawa, 1915. XXXII, 526 pp.; appendixes, 350 pp.

Canada: Second supplement to copies of proclamations, orders in council, and documents relating to the European war. Ottawa, 1916. LXVI, 527 to 1050 pp.; appendixes, 351 to 537 pp.

Canada: Order in council of March 23, 1916, for the extension of the provisions of the *Industrial Disputes Investigation Act, 1907*, other than section 63, to include employers and employees engaged in the construction, production, repairing, manufacture, transportation, and delivery of ships, vessels, works, buildings, munitions, ordnance, guns, explosives, and materials and supplies for the use of the military or naval forces.

Canada: Order in council of November 10, 1916, respecting the high cost of living, as amended by order in council of November 29, 1916.

Canada: Sessional Paper No. 35a. The provision of employment for members of the Canadian expeditionary force on their return to Canada, and the reeducation of those who are unable to follow their previous occupations because of disability. A plan submitted by the secretary of Military

198 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

- Hospitals and Convalescent Homes Commission, together with appendices dealing with similar work in England and on the Continent of Europe. Ottawa, 1915. 53 pp.
- Canada: Sessional Paper No. 185. Pensions granted and money allowances made to members of the Canadian expeditionary force since beginning of war, to February 16, 1916. Ottawa, 1916. 83 pp.
- Canada: Ministry of Agriculture. Patriotism and production more than usual. Agricultural war book. Ottawa, January, 1915. 157 pp.

GOVERNMENT REGULATION OF INDUSTRIES AND COMMODITIES.

- Restrictions on output of textile establishments in Germany. Article based on material in Reichs-Arbeitsblatt, November, 1915; Soziale Praxis, November 11, 1915.
(In MONTHLY REVIEW, April, 1916, pp. 81, 82.)
- Government control of food supplies in Great Britain.
(In MONTHLY REVIEW, March, 1917, pp. 399-407.)
- Government control of food supplies in France.
(In MONTHLY REVIEW, April, 1917, pp. 525-533.)
- Government control of coal mines in Great Britain.
(In MONTHLY REVIEW, April, 1917, pp. 533, 534.)
- Government control of food supplies in Germany.
(In MONTHLY REVIEW, May, 1917, pp. 703-727.)
- Government control of food supplies in Italy.
(In MONTHLY REVIEW, May, 1917, pp. 727-744.)

WAGES.

- Wages of miners in Germany during the first year of the war. Article based on material in Soziale Praxis, Berlin, 1915, Vol. XXV., No. 4, October 28, 1915, p. 89.
(In MONTHLY REVIEW, April, 1916, pp. 80, 81.)
- Minimum-wage law in France.
(In MONTHLY REVIEW, December, 1915, pp. 36-41.)
- New regulations as to wages of workers in munitions factories in France. Text of decree issued by minister of munitions on January 17, 1917.
(In MONTHLY REVIEW, March, 1917, pp. 362-365.)

PRICES.

- Foreign food prices as affected by the war.
(In Bulletin No. 170 of the U. S. Bureau of Labor Statistics. (May, 1915.) Also summarized in MONTHLY REVIEW, July, 1915, pp. 42-44.)
- Increase in retail prices of coal in Great Britain. Summary of British Board of Trade report of departmental committee to inquire into the causes of the present rise in the retail prices of coal sold for domestic use. (London, 1915.)
(In MONTHLY REVIEW, July, 1915, pp. 45-56.)
- Retail prices in foreign countries.
(In MONTHLY REVIEW, September, 1915, pp. 46-57; October, 1915, pp. 44-49; December, 1915, pp. 44-53; March, 1916, pp. 80-85; July, 1916, pp. 80-91; November, 1916, pp. 49-60; February, 1917, pp. 244-251.)
- Increase in prices of commodities in Great Britain, 1916. Summary of interim report on meat, milk, and bacon of British Board of Trade departmental committee on prices. (London, 1916. 20 pp.)
(In MONTHLY REVIEW, January, 1917, pp. 51-56.)

Wholesale prices in Great Britain.

(In MONTHLY REVIEW, April, 1917, pp. 586-588.)

EMPLOYMENT.**Employment conditions in foreign countries.**

(In MONTHLY REVIEW, July, 1915, pp. 60-80; August, 1915, pp. 16-20; October, 1915, pp. 49-52; December, 1915, pp. 56-71; March, 1916, pp. 86-89; July, 1916, pp. 92-98; January, 1917, pp. 136-149.)

Land settlement and unemployment in England. Summary of introduction and Part I of the final report of the British departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the settlement or employment on the land in England and Wales of discharged sailors and soldiers. (London, 1916. 30 pp., fold., chart.)

(In MONTHLY REVIEW, April, 1916, pp. 11-13.)

Employment of discharged soldiers and sailors on the land in Great Britain. Summary of Part II of the final report of the British departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the settlement and employment on the land in England and Wales of discharged sailors and soldiers. (London, 1916. 39 pp.)

(In MONTHLY REVIEW, September, 1916, pp. 87-90.)

INDUSTRIAL DISEASES.

A nonpoisonous dope for airplanes. Parliamentary statement by British War Office and Admiralty.

(In MONTHLY REVIEW, January, 1917, pp. 97, 98.)

INDUSTRIAL FATIGUE.

Some new studies of industrial fatigue. Summary of the following reports:

Interim report on an investigation of industrial fatigue by physiological methods, by A. F. Stanley Kent, Professor of physiology, University of Bristol. Great Britain, Home Department. London, August, 1915, 34 pp. [Cd. 8056.]

Second interim report on an investigation of industrial fatigue by physiological methods, by A. F. Stanley Kent, professor of physiology, University of Bristol. Great Britain, Home Department. London, August, 1916. 76 pp., 18 charts. [Cd. 8335.]

The question of fatigue from the economic standpoint. Interim report of the committee, consisting of Prof. J. H. Muirhead (chairman), Miss B. L. Hutchins (secretary), Mr. P. Sargant Florence (organizing secretary), Miss A. M. Anderson, Prof. Bainbridge, Mr. E. Cadbury, Prof. Chapman, Prof. Stanley Kent, Dr. Maitland, Miss M. C. Matheson, Mrs. Meredith, Dr. C. S. Myers, Mr. C. K. Ogden, Mr. J. W. Ramsbottom, and Dr. J. Jenkins Robb. Report submitted at the Manchester meeting of the British Association for the Advancement of Science in 1915. Manchester, 1915. 67 pp.

The question of fatigue from the economic standpoint. Second interim report of the committee. Report submitted at the Newcastle meeting of the British Association for the Advancement of Science. Newcastle, 1916. 24 pp.

(In MONTHLY REVIEW, December, 1916, pp. 97-105.)

WELFARE WORK.

- Welfare work in Great Britain. Summary of book on welfare work: Employers' experiments for improving welfare work in factories, by E. Dorotheo Proud. (London, G. Bell & Sons (Ltd.), 1916. xvii, 363 pp. 7s. 6d. net.)
(In MONTHLY REVIEW, December, 1916, pp. 81-88.)

COAL-MINING INDUSTRY.

- Organization in coal mines to increase output in Great Britain. Summary of report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry. (London, 1915.) [Cd. 7939.]
(In MONTHLY REVIEW, July, 1915, pp. 56-58.)
- Compulsory cartel or monopoly in the German coal-mining industry.
(In MONTHLY REVIEW, November, 1915, pp. 83-85.)
- Conditions prevailing in the coal-mining industry in Great Britain. Summary of second report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry.
(In MONTHLY REVIEW, July, 1916, pp. 151-153.)
- Effect of the war on the coal-mining industry in Great Britain. Summary of third report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry. (London, 1916. 17 pp.)
(In MONTHLY REVIEW, April, 1917, pp. 534, 535.)
- Increase in retail prices of coal in Great Britain. (See Prices.)

LIST OF OFFICIAL DOCUMENTS RELATING TO LABOR AND THE WAR IN GREAT BRITAIN RECENTLY RECEIVED BY THE U. S. BUREAU OF LABOR STATISTICS.

ACTS OF PARLIAMENT.

- Ministry of Munitions Act, 1915 (5 and 6 Geo. 5, ch. 51).
Munitions of War Act, 1915 (5 and 6 Geo. 5, ch. 54).
Munitions of War (Amendment) Act, 1916 (5 and 6 Geo. 5, ch. 99).
Police, Factories, etc. (Miscellaneous Provisions) Act, 1916 (6 and 7, Geo. 5, ch. 31).
Defense of the realm manual (Manuals of emergency legislation), third enlarged edition, revised to February 28, 1917. Contains Defense of Realm Acts, Regulations, and Orders (March, 1917). (Includes food orders.)
Defense of the Realm Regulations (monthly edition), consolidated and revised to March 31, 1917.
Agreement regarding acceleration of output on Government work, between trade-unions and Government, March 17-19, 1915. (Known as Treasury Agreement of March, 1915.)

MEMORANDA AND CIRCULARS ISSUED BY THE MINISTRY OF MUNITIONS.

- Memorandum (L. 30) containing circulars, etc., bearing on dilution of labor.
Memorandum (L. 30) containing circulars, etc., bearing on dilution of labor.
Later and revised issue of L. 30.
Circular (M. W. M. T. 2) on munitions tribunals, outlines organization and gives list of those established.
Constitution and functions of local labor advisory boards. (National advisory committee on war output.)

- Memorandum (M. M. 84) for the guidance of persons seeking employment on munitions.
- Memorandum (badges, 8) war-service badges. Instructions for the guidance of employees, August, 1916.
- Army reserve munitions workers (A. R. M. W. 40). Notes for the guidance of employers to whose employment men are assigned. October, 1916.
- War-munitions volunteers (W. M. V. 40). Notes for the guidance of employers to whom workmen are transferred by authority of the Ministry of Munitions. December, 1915.
- (W. M. V. 19.) Form for use by employers in asking for war-munitions volunteers from the labor exchanges.
- Memorandum (M. M. 14) for the guidance of employers in regard to leaving certificates, January, 1917. (Superseded similar memorandum of September, 1916.)
- Memorandum (M. M. 16) on leaving certificates issued for the guidance of workpeople, January, 1917.
- (L. 47a.) Conditions under which aliens may be employed in munitions factories.
- Memorandum (M. M. 95) on records for the purposes of the Munitions of War Act.
- (M. M. 26.) Form for "Report of changes in workshop rules made since the Treasury Agreement of March, 1915." (Prepared by national advisory committee on war output.)
- (M. M. 56. Form for record of departure from working conditions, etc.
- Rules made by the Minister of Munitions under Munitions of War Act, regarding limitation of profits, March 30, 1917.
- (L. 42.) Rewards for inventions, etc., in controlled establishments.
- (N. M. 13.) Duties of lady superintendents (sometimes called lady welfare supervisors).
- (Welfare B. 14.) Suggested scheme for boy supervision. (With forms.)
- Memorandum to welfare supervisors of boys.
- Memorandum (training 3, November, 1915). Scheme for training semiskilled munition workers in technical schools.
- (L. 85.) Letter regarding advance in wage rates of females. Dated April 4, 1917. [Detailed orders regarding this matter not yet received by Bureau.]

STATUTORY RULES AND ORDERS UNDER THE MUNITIONS OF WAR ACTS.

- 1915, No. 641. (Industrial disputes.)
- 1915, No. 671 (S. 43). (Factory discipline.)
- 1915, No. 839. (Establishments covered.)
- 1915, No. 1000 (S. 61). War-service badges.
- 1915, No. 1001. War-service badges.
- 1915, No. 1002. (Factory discipline.)
- 1916, No. 106. (Factory discipline.)
- 1916, No. 107. (Establishments covered.)
- 1916, No. 108 (S. 8). Tribunals.
- 1916, No. 121. Leaving certificates.
- 1916, No. 123. Tribunals.
- 1916, No. 127 (S. 9). (Factory discipline.)
- 1916, No. 137 (L. 3). Tribunals.
- 1916, No. 159. Tribunals.
- 1916, No. 179 (S. 10). Tribunals.

202 EFFICIENCY AND FATIGUE IN BRITISH MUNITION FACTORIES.

- 1916, No. 180. Tribunals.
- 1916, No. 181. Employment and remuneration. (Females.)
- 1916, No. 182. Employment and remuneration. (Wages of semiskilled and unskilled men.)
- 1916, No. 191. Employment of aliens.
- 1916, No. 279. Employment of ex-munition workers.
- 1916, No. 314. (Establishments covered.)
- 1916, No. 315 (S. 22). Tribunals.
- 1916, No. 355. (Industrial disputes.)
- 1916, No. 411. Employment and remuneration. (Females.)
- 1916, No. 412. Employment and remuneration. (Wages of semiskilled and unskilled men.)
- 1916, No. 447. Remuneration of women and girls on munition work of a class not recognized as men's work.
- 1916, No. 450. Employment of ex-munition workers.
- 1916, No. 456. Employment and remuneration of girls under 18 years of age on munition work of a class customarily done by male labor of 18 years and over.
- 1916, No. 512. Employment of ex-munition workers.
- 1916, No. 530. (Establishments covered.)
- 1916, No. 549. (Limitation of profits.)
- 1916, No. 586. Employment and remuneration. (Females.)
- 1916, No. 587. Employment and remuneration. (Females.)
- 1916, No. 589. Employment and remuneration. (Wages of semiskilled and unskilled men.)
- 1916, No. 615. Employment of ex-munition workers.
- 1916, No. 618. Remuneration of women and girls on munitions work of a class not recognized as men's work.
- 1916, No. 621. Employment and remuneration. (Females.)
- 1916, No. 649. Tribunals.
- 1916, No. 662. (Factory holidays.)
- 1916, No. 663. (Factory holidays.)
- 1916, No. 664 (S. 37). (Factory holidays.)
- 1916, No. 665 (S. 38). (Factory holidays.)
- 1916, No. 703. Employment and remuneration. (Females.)
- 1916, No. 704. Employment and remuneration. (Females.)
- 1916, No. 718 (S. 46). Tribunals.
- 1916, No. 719. Tribunals.
- 1916, No. 732. (Industrial disputes.)
- 1916, No. 759. Employment and remuneration. (Females.)
- 1916, No. 791. Employment of ex-munition workers.
- 1916, No. 813. Employment of ex-munition workers.
- 1916, No. 855. (Establishments covered.)
- 1916, No. 856. Employment of ex-munition workers.
- 1916, No. 888. Employment and remuneration. (Females.)
- 1916, No. 890. Employment of ex-munition workers.
- 1917, No. 9. Employment and remuneration. (Females.)
- 1917, No. 10. Employment and remuneration. (Females.)
- 1917, No. 48. Employment and remuneration. (Females.)
- 1917, No. 49. Employment and remuneration. (Females.)
- 1917, No. 71. Employment and remuneration. (Wages of semiskilled and unskilled men.)
- 1917, No. 72 (S. 7). Tribunals.
- 1917, No. 142. (Establishments covered.)

- 1917, No. 143. Employment of ex-munition workers.
 1917, No. 180. Employment of ex-munition workers.
 1917, No. 282. (Establishments covered.)
 1917, No. 313. Employment and remuneration. (Females.)
 1917, No. 347. (Establishments covered.)
 1917, No. 348. Employment of ex-munition workers.

MEMORANDA, HEALTH OF MUNITION WORKERS COMMITTEE OF THE MINISTRY OF MUNITIONS.

[Issued at various dates 1915 to 1917.]

- No. 1. Sunday labor.
 No. 2. Welfare supervision.
 No. 3. Industrial canteens.
 No. 4. Employment of women.
 No. 5. Hours of work.
 No. 6. Canteen construction and equipment (appendix to No. 3).
 No. 7. Industrial fatigue and its causes.
 No. 8. Special industrial diseases.
 No. 9. Ventilation and lighting of munition factories and workshops.
 No. 10. Sickness and injury.
 No. 11. Investigation of workers' food and suggestions as to dietary. (Report by Leonard E. Hill, F. R. S.)
 No. 12. Statistical information concerning output in relation to hours of work. (Report by H. M. Vernon, M. D.)
 No. 13. Juvenile employment.
 No. 14. Washing facilities and baths.
 No. 15. The effect of industrial conditions upon eyesight.
 No. 16. Medical certificates for munition workers.
 No. 17. Health and welfare of munition workers outside the factory.
 Interim report (Feb., 1917) on industrial efficiency and fatigue. Contains Memoranda 7 and 12; and three other studies, entitled: "The comparative efficiencies of day and night work," "The causes and conditions of lost time," and "Incentives to work with special reference to wages."

MISCELLANEOUS REPORTS, ETC.

- Annual report of the chief inspector of factories and workshops for the year 1916. (1917.)
 Juvenile Education. Final report of departmental committee on juvenile education in relation to employment after the war. Vol. I. Report, March 16, 1917. [Cd. 8512.]
 Farm of Borgie. Memorandum respecting farm presented by Duke of Sutherland for settlement of soldiers and sailors, November 10, 1916. (By under-secretary for Scotland.)
 Licensing partially disabled men as drivers of public motor vehicles. Report of special committee, July 1, 1916.
 Report of committee of privy council for scientific and industrial research for the year 1915-16. (1916.)
 File of letter forms to employers and workers, issued by Ministry of Munitions, regarding various matters arising under the acts, orders, etc.
 Posters issued by Ministry of Munitions, for use in factories, regarding orders issued, etc.
 File of forms used in priority of work regulations, issued by Ministry of Munitions

U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES } . . . { WHOLE NUMBER 221
BUREAU OF LABOR STATISTICS }

INDUSTRIAL ACCIDENTS AND HYGIENE SERIES: No. 15

HOURS, FATIGUE, AND HEALTH
IN BRITISH MUNITION FACTORIES

REPRINTS OF THE MEMORANDA
OF THE BRITISH HEALTH OF
MUNITION WORKERS COMMITTEE

3



APRIL, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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BULLETIN OF THE U. S. BUREAU OF LABOR STATISTICS.

WHOLE NO. 221.

WASHINGTON.

APRIL, 1917

HOURS, FATIGUE, AND HEALTH IN BRITISH MUNITION FACTORIES.

INTRODUCTION.

The British Health of Munition Workers Committee was appointed in the middle of September, 1915, by the Minister of Munitions, with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops."

The composition of the committee is as follows:

Sir George Newman, M. D. (chairman).

Sir Thomas Barlow, Bart., K. C. V. O., M. D., F. R. S.

G. Bellhouse, factory department, Home Office.

Prof. A. E. Boycott, M. D., F. R. S.

J. R. Clynes, M. P.

E. L. Collis, M. B., factory department, Home Office.

W. M. Fletcher, M. D., F. R. S., Secretary of Medical Research Committee.

Leonard E. Hill, M. B., F. R. S.

Samuel Osborn, J. P., Sheffield.

Miss R. E. Squire, factory department, Home Office.

Mrs. H. J. Tennant.

E. H. Pelham (secretary).

The committee took evidence in various industrial centers from employers, representatives of workers, and other interested persons, and made numerous special studies and investigations. In addition, members visited a large number of factories and workshops, and discussed matters with the management, with foremen, and with individual workers. With this information, and having the advantage of the special knowledge and experience already possessed by members of the committee, it has published up to the present time (April, 1917) 15 memoranda, dealing with one or more of the subjects intrusted to it.

As these memoranda are the work of a committee especially qualified by technical knowledge and special experience, and present many suggestions and recommendations made with the purpose of

6 HOURS, FATIGUE, ETC., IN BRITISH MUNITION FACTORIES.

securing maximum output over a period of months, or even years, and at the same time safeguarding the health and physical efficiency of the workers, it is believed that their reproduction at this time will be of value in a similar way to industry and labor in this country. The memoranda have been arranged in three groups, the related subjects being brought together, and are reprinted as bulletins of the United States Bureau of Labor Statistics under the following titles:

BULLETIN NO. 221, HOURS, FATIGUE, AND HEALTH IN BRITISH MUNITION FACTORIES.

Sunday Labor (Memorandum No. 1). November, 1915. 6 pp. [Cd. 8132.]

(Summarized in MONTHLY REVIEW of the U. S. Bureau of Labor Statistics, May, 1916, pp. 66, 67.)

Hours of Work (Memorandum No. 5). January, 1916. 9 pp. [Cd. 8186.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 77-79.)

Statistical Information Concerning Output in Relation to Hours of Work (Memorandum No. 12). (Report by H. M. Vernon, M. D.) August, 1916. 11 pp. [Cd. 8344.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 105-119.)

Industrial Fatigue and its Causes (Memorandum No. 7). January, 1916. 11 pp. [Cd. 8213.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 79-81.)

Sickness and Injury (Memorandum No. 10). January, 1916. 10 pp. [Cd. 8216.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 88-90.)

Special Industrial Diseases (Memorandum No. 8). February, 1916. 8 pp. [Cd. 8214.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 83-88.)

Ventilation and Lighting of Munition Factories and Workshops (Memorandum No. 9). January, 1916. 9 pp. [Cd. 8215.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 81-83.)

The Effect of Industrial Conditions Upon Eyesight (Memorandum No. 15). October, 1916. 8 pp. [Cd. 8409.]

(Summarized in MONTHLY REVIEW, April, 1917, pp. 538-540.)

BULLETIN NO. 222, WELFARE WORK IN BRITISH MUNITION FACTORIES.

Welfare Supervision (Memorandum No. 2). December, 1915. 7 pp. [Cd. 8151.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 68, 69.)

Industrial Canteens (Memorandum No. 3). November, 1915. 7 pp. [Cd. 8133.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 69, 70.)

Canteen Construction and Equipment (Memorandum No. 6). (Appendix to No. 3.) January, 1916. 7 pp. and plates. [Cd. 8199.]

(Summarized in MONTHLY REVIEW, June, 1916, p. 91.)

Investigation of Workers' Food and Suggestions as to Dietary (Memorandum No. 11). (Report by Leonard E. Hill, F. R. S.) August, 1916. 11 pp. [Cd. 8370.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 56, 57.)

Washing Facilities and Baths (Memorandum No. 14). August, 1916. 8 pp. [Cd. 8387.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 150, 151.)

BULLETIN NO. 223, EMPLOYMENT OF WOMEN AND JUVENILES IN GREAT BRITAIN DURING THE WAR.

Employment of Women (Memorandum No. 4). January, 1916. 10 pp. [Cd. 8185.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 74-76.)

Juvenile Employment (Memorandum No. 13). August, 1916. 8 pp. [Cd. 8362.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 92-97.)

In the present bulletin the memoranda relating to hours of labor and industrial fatigue are reproduced in full, preceded by a summary of the more important suggestions and recommendations of the committee.

There has been added also the report of the Treasury agreement of March 17, 18, and 19, 1915, between representatives of the British Government and representatives of the trade-unions, in which it was agreed in behalf of the trade-unions that all trade-union or shop rules and customs tending to restrict production or to limit the employment of semiskilled or female labor should be suspended for the period of the war, the Government on its part agreeing to require all contractors and subcontractors on munitions or other war work to bind themselves to restore such trade-union rules and customs after the war. It was further agreed that machinery should be provided for the prompt settlement of all labor disputes and that no dispute should be allowed to result in a suspension of work.

The text of the Munitions of War Act, 1915, and the Munitions of War (Amendment) Act, 1916, under which the terms of this agreement were enacted into law, is also given.

SUMMARY OF THE COMMITTEE'S CONCLUSIONS.

Upon the subject of *Sunday labor* (Memorandum No. 1), the evidence before the committee led them to hold that "if the maximum output is to be secured and maintained for any length of time a weekly period of rest must be allowed. Except for quite short periods, continuous work, in their view, is a profound mistake and does not pay—output is not increased. On economic and social grounds alike this weekly period of rest is best provided on Sunday.

"The committee desire to state that, in their opinion, the foremen and the higher management even more certainly require definite periods of rest. These individuals have never spared themselves, they carry a heavy burden of responsibility and they can not be replaced. * * * It is of primary importance in the interests of the nation that they should be allowed that rest which is essential to the maintenance of their health.

"In conclusion, the committee desire to emphasize their conviction that some action must be taken in regard to continuous labor and excessive hours of work if it is desired to secure and maintain, over a long period, the maximum output. To secure any large measure of reform it may be necessary to impose certain restrictions on all controlled establishments, since competition and other causes frequently make it difficult for individual employers to act independently of one another."

In the preparation of the memorandum on *Hours of work* in munition factories (Memorandum No. 5) the committee seem to have been influenced by consideration of what is immediately practicable regarding the health of the worker in relation to a maximum output, in view of exceptional conditions entailed by the war. It is suggested that an increased number of hours may be obtained by overtime or by a system of shifts and that the committee greatly prefers the latter, although recognizing that it is impracticable to establish shifts universally. The committee's objections to overtime, briefly stated, are: (1) It is liable to impose too severe a strain upon the workers, which adversely affects the rate of production and quality of output during the whole period of work as well as during the hours of overtime; (2) it frequently results in a large amount of lost time, which is attributed to workers becoming exhausted and taking a rest, and also to sickness; (3) it imposes a very serious strain upon the management, the executive staff, and foremen, since they can not take days off, like the ordinary worker; (4) it is liable to curtail

unduly the period of rest and sleep available for those who have to travel long distances to and from their work, a matter of special importance in the case of young persons; (5) the fatigue entailed increases the temptation to men to indulge in the consumption of alcohol.

Admitting that overtime must continue, the committee suggested definite restrictions to govern it. For adult male workers the committee recommends:

1. The average weekly hours (exclusive of meals) should not exceed 65 to 67, including overtime. Hours in excess of 65 should only be worked for short periods and to meet sudden and unexpected circumstances. It may be desirable to differentiate to some extent between different kinds of work, and to fix a rather low limit of hours for work requiring close individual attention.
2. Where practicable, the overtime should be concentrated within three or four days in the week, which should preferably not be consecutive.
3. Where overtime is worked, it is specially important that there should be no Sunday work.

As respects women, the committee expresses the belief that the strain of long hours is serious and that conditions of work in excess of the normal legal limit of 60 hours a week ought to be discontinued as soon as practicable, although little objection is seen to such moderate overtime during the week as can be compensated for by an earlier stop on Saturdays. The committee feels that the need for overtime among women and girls is much less pressing than it is for men, and that wherever practicable the system should be abandoned in favor of shifts. Although it is recommended that boys should be allowed to be employed overtime up to the maximum suggested for men, it is thought that every effort should be made not to work boys under 16 more than 60 hours a week.

Although work on shifts involves night work, the committee makes it clear that night work is not to be regarded as a good thing in itself and offers the following objections to the system:

1. It is uneconomical. Though wages are paid at a higher rate, the rate of output, more particularly during the last two or three hours of the 12-hour shift, is generally lower.
2. Supervision is frequently unsatisfactory.
3. Conditions of lighting are seldom so good as in daytime and make fine work more difficult.
4. Workers experience great difficulty in sleeping by day.
5. The unfamiliar meal hour makes it difficult for the workers to consume substantial food, and their digestion is liable to become deranged.

In its special study of *Output in relation to hours of work* (Memorandum No. 12) the object of the committee was to ascertain the hours of employment most likely to produce a maximum output over periods of months or even years. It held that output can not be maintained at the highest level for any considerable period if the

conditions were such as to lead to excessive fatigue and to deterioration in the health of the workers. The committee's investigations covered operations of distinctly different character, some demanding heavy manual labor, others of a light, more or less sedentary, nature. It was found that the time schedule producing the maximum output varied with the character of the operation.

The committee found that for men engaged in very heavy labor the maximum hours of actual work yielding the most effective results appear to be 56 or less per week, for men engaged in moderately heavy labor probably 60 per week, while for men and youths engaged in light labor, such as tending semiautomatic machines, probably 64 hours per week should be the maximum.

As a method of speeding up production, the committee recommended the careful regulation of rest pauses. It was found that the operatives, if left to themselves, took rests at irregular and often unsuitable times, hence it would be much better if the rest pauses were chosen for them. For instance, a 10-minute break in the middle of the morning and afternoon spells during which the operatives remained at their machines, but took tea or other nutriment brought them by boys or by traveling canteens, has been found a valuable aid to output. Some types of work need longer and more frequent rest pauses than others, and the best time can only be determined by experience. After being fixed, they should remain compulsory and rest pauses at other times be checked so far as possible.

The committee's study of *Industrial fatigue and its causes* (Memorandum No. 7) is closely related to its three memoranda dealing with hours of labor. The committee had the benefit of studies of fatigue made by the Home Office¹ and by a committee of the British Association for the Advancement of Science,² and the committee's report may be regarded as the summing up of these various studies of fatigue and its own studies of hours of labor. The committee again emphasize the importance of the regulation of hours and of daily and weekly rests, made with due consideration of the character of the work performed.

The committee in recording their conclusions say: "The committee are bound to record their impression that the munition workers in general have been allowed to reach a state of reduced efficiency and lowered health, which might have been avoided without reduction of output by attention to the details of daily and weekly rests.

¹ Great Britain, Home Office. Second interim report on an investigation of industrial fatigue by physiological methods, by A. F. Stanley Kent, M. A., D. Sc., professor of physiology in the University of Bristol. London, 1916. 76 pp., 18 charts.

² British Association for the Advancement of Science. "The question of fatigue from the economic standpoint." Interim report of the committee, Manchester, 1915. 67 pp. British Association for the Advancement of Science. "The question of fatigue from the economic standpoint." Second interim report of the committee, Newcastle, 1916. 24 pp. See MONTHLY REVIEW of the U. S. Bureau of Labor Statistics, December, 1916, p. 97.

The signs of fatigue are even more noticeable in the case of managers and foremen, and their practical results are probably more serious than in the case of the workmen.

"It is of great importance to note that a special and strenuous voluntary effort in labor, if it be maintained under a badly arranged time-table of work and rest, does not necessarily bring increased output over a long period, however praiseworthy the intention of effort may be. Under wrong conditions of work, with excessive overtime, it is to be expected, indeed, that some deliberate 'slacking' of the workers might actually give an improvement of output over a period of some length by sparing wasteful fatigue, just as the 'nursing' of a boat crew over a part of a long course may improve their performance. It can not under such circumstances be said that a workman so restraining himself, consciously or unconsciously, is doing more to damage the output, on the whole, than the employer who has arranged overlong hours of labor on the baseless assumption that long hours mean high output."

In its report on *Sickness and injury* (Memorandum No. 10) the committee pointed out certain injurious conditions which should be guarded against as likely to diminish seriously the efficiency of the labor force. The injurious conditions enumerated are:

- (1) Excessively long hours of work, particularly by night, if continued, produce fatigue, irritation, and sickness. "You will find," wrote Sir James Paget, "that fatigue has a larger share in the promotion or permission of disease than any other single casual condition you can name."
- (2) Cramped and constrained attitudes or posture during work, which prevent the healthy action of lungs and heart.
- (3) Prolonged or excessive muscular strain, e. g., the lifting of heavy weights, prolonged standing, may produce rupture or varicose veins.
- (4) Machinery accidents.
- (5) Working in unventilated or insufficiently ventilated workshops predisposes to disease and gravely interferes with individual energy and physical capacity. The effect of continuously working in a stagnant or polluted atmosphere is not trifling or insignificant.
- (6) The air, even if fresh, may be too hot or too cold, too humid or too dry; either extreme should be avoided to insure reasonable bodily comfort and the most efficient work.
- (7) Imperfect lighting, whether by day or night, conduces to eyestrain and headaches.
- (8) Working with or in the presence of gases, vapors, poisons, and irritating substances (e. g., "doping") may lead to direct poisoning.
- (9) Dust produced in certain industries, unless effectually safeguarded, may induce lung diseases.
- (10) The manufacture and use of high explosives involve risk to the workman.

Equally important with these influences, in the opinion of the committee, is the predisposition to disease arising from a failure to give proper attention to personal hygiene. In commenting upon

these influences likely to impair industrial efficiency, the committee pointed out that, "in the past, when the supply of labor was plentiful, the necessity for a study of the influences which affect human efficiency may have escaped recognition, but to-day, when skilled labor is scarce, the necessity is obvious. To conserve energy and efficiency is, other things being equal, the way to improve output."

For the purpose of remedy and treatment, the committee finds two elementary principles; namely, that prevention is better than cure, and that for treatment to be most effective it must deal with the beginnings of disease. The committee recommends, as a preliminary safeguard, the medical examination of all workers on their admission to the factory, in order to secure, as far as may be, their initial physical fitness for employment. In the opinion of the committee, the factory management has two further duties in the matter: First, they must reduce to a minimum any unfavorable conditions obtaining in the plant, providing proper sanitary conditions and accommodations, safeguarding machinery, controlling hours of labor, furnishing canteen facilities, and securing sufficiently warmed, lighted, and ventilated workrooms; second, they must make arrangements for an adequate medical and nursing scheme.

The committee points out the urgent necessity and value of first-aid work because of the increased number of accidents due to the abnormal demands of munitions work. To meet these increased dangers, the committee suggests the adoption of various methods of prevention, such as the proper and effective guarding of machinery, the adoption of safety appliances, the proper regulating of dangerous processes, the adequate lighting of the factory, and the more careful cleaning of machinery. The committee emphasizes also the pressing need for the provision of suitable means of treatment, especially first-aid treatment for minor injuries and the instruction of employees in first aid, and the thorough organization of first-aid and surgical provision. Systematic recording of all cases of sickness and accident the committee regards as of the utmost importance in the effective treatment of sickness and injuries.

The committee's report on *Special industrial diseases* (Memorandum No. 8) gives the causes, methods of prevention, and treatment for the principal industrial diseases which have been found to affect munition workers. These diseases are: Poisoning due to lead, trinitrotoluol, tetryl or tetranitromethylanilin, fulminate of mercury, tetrachlorethane, and nitrous fumes. Dermatitis, or eczema, caused by exposure to trinitrotoluol, tetryl, and fulminate of mercury, are also discussed.

The committee emphasizes the importance of facilities for the prompt treatment of all cases of sickness and injury, especially in those establishments where poisonous substances are used.

In its report on *Ventilation and lighting* (Memorandum No. 9) the committee calls particular attention to the importance of adequate provisions for ventilation and lighting, in view of the special conditions under which work in munition factories is carried on at the present time. Efficient ventilation is absolutely essential for the maintenance of the health and comfort, and therefore the efficiency and capacity of the workers. The need of effective methods of ventilation is intensified at this time, not only by the increase in the number of workers, but also by the continuous occupation of shops by day and night. There is under these conditions no interval in which natural ventilation can restore a vitiated atmosphere, and each shift succeeds to the bad conditions left by its predecessor.

The committee calls attention to the fact that bad lighting affects output unfavorably, not only by making good and rapid work more difficult but by causing headaches and other effects of eyestrain. The difficulties of supervision, which are always considerable, are further increased if the lighting facilities of the workshops are insufficient. The committee names as the essentials of good lighting: (1) Adequacy; (2) a reasonable degree of constancy and uniformity of illumination over the necessary area of work; (3) the placing or shading of lamps so that light from them does not fall directly on the eye of the operator when engaged at his work or when looking horizontally across the workroom; (4) the placing of lights so as to avoid the casting of extraneous shadows on the work.

In its report on the *Effect of industrial conditions upon eyesight* (Memorandum No. 15) the committee calls attention to the need of special measures to prevent undue strain upon the eyesight or to reduce the liability to accidents to a minimum. These are: (1) Testing of eyesight of operatives to be employed on close work and supplying them with glasses where necessary; and (2) guarding the eyes from flying particles of metal by the use of goggles.

General measures designed to improve the physical health of the workers and so to enable them to resist the effects of fatigue include the proper lighting of factories, the provision of canteens, and adequate time for rest and sleep.

SUNDAY LABOR.

[Memorandum No. 1.]

To the Right Honorable David Lloyd George, M. P., Minister of Munitions.

SIR: 1. The committee were appointed by you, with the concurrence of the Home Secretary "To consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops."

2. Since their appointment in the middle of September, the committee have taken evidence in London and other important centers from employers, representatives of workers, and other interested persons. In addition a large number of factories and workshops situated in different parts of the country have been visited by one or more members of the committee. At such visits the opportunity has been taken to discuss matters with the management, with foremen, and with individual workers. The committee have also had the advantage of the special knowledge and experience already possessed by some members of the committee at the time of their appointment.

3. In the course of their investigations the committee have found that both employers and workers were specially concerned at the present time with the problem of Sunday labor. The committee have been so impressed with the urgency and importance of this question that they have thought it right to submit an interim report dealing with this question at once without waiting until they were in a position to deal also with other questions falling within their terms of reference.

4. The problem of Sunday labor, though materially affected by various industrial questions and the established custom of Sunday rest, is—as regards munition works—primarily a question of the extent to which workers actually require weekly or periodic rests if they are to maintain their health and energy over long periods. Intervals of rest are needed to overcome mental as well as physical fatigue. In this connection account has to be taken not only of the hours of labor (overtime, 12-hour shifts, 8-hour shifts), the environment of the work and the physical strain involved, but also the mental fatigue or boredom resulting from continuous attention to work.

As one manager put it, it is the monotony of the work which kills—the men get sick of it.

5. The great majority of the employers consulted are unfavorably disposed to Sunday labor. Their objections may be broadly classified under three heads:

- (a) *Administrative*.—Supervision is difficult and imposes a severe strain on the foremen; yet deputies are not easy to obtain.
- (b) *Economic*.—Sunday labor means high wages often coupled with increased cost of running the works. Though attendance on Sundays is generally good it is not, for various reasons, always accompanied by a satisfactory individual output. Moreover, Sunday labor is frequently accompanied by bad timekeeping on other days of the week.
- (c) *Religious and social*.—There is a considerable feeling that the seventh day, as a period of rest, is good for body and mind.

Although, therefore, employers generally are opposed to Sunday work, it has been widely adopted, (a) on account of heavy demands for output, or (b) because employers have been forced into it by a desire of their workpeople to obtain the double, or at least increased, pay. When adopted, the hours are often considerably shorter than on an ordinary day. The work may begin later and end earlier; overtime is generally dispensed with. In at least one instance the work is confined to a morning of four hours. Saturday night shifts are frequently abandoned, and Sunday night shifts started at a later hour than usual. On the other hand there are still a number of factories where the hours on Sunday are as long as on other days, or even longer, as in cases where transfer from a 12-hour day shift to a 12-hour night shift is made by working for a continuous period of 18 hours at the change.

6. The committee understand that, in response to the request of employers, the Home Secretary has issued orders permitting Sunday labor by "protected" persons (i. e., women and young persons under 18 years of age) in a limited number of cases. At the present moment, for the whole United Kingdom, there are about 50 orders covering women, girls, and boys, and also about another 30 for boys only. As a rule employment on Sundays has only been sanctioned when the hours of work on other days of the week are moderate, and even when Sunday work has been allowed it has been usual to impose conditions restricting employment as regards individuals, e. g.:

- (a) That women and young persons shall not be employed on two consecutive Sundays;

- (b) That they shall have time off on Saturday;
- (c) That they shall only be employed on Sundays in cases of emergency;
- (d) That they shall be employed for a portion of the day only.

7. Evidence in the form of statistics of output in regard to Sunday labor is hardly obtainable; even where the output of work may be such as would in normal circumstances permit of the collection of such figures, the rapid growth in the number of persons employed, the greater employment of women, the increasing efficiency of inexperienced workers, and other similar causes render comparison difficult, unreliable, or impossible. Even where the requisite data might be available it has not generally been found possible for the management to find the necessary time for its collection and tabulation. The representative of one important firm, however, informed the committee that in one of their shops where heavy machine work was done by men of a good average trade-union type they had recently extended the relief at the week end and so reduced the average weekly hours from $78\frac{1}{2}$ to $65\frac{1}{2}$. Though the normal hours were thus reduced by 13, the average number of hours (60) worked during the three months succeeding the change exceeded the average number of hours ($59\frac{1}{2}$) worked during the six months preceding the change. Moreover, in his opinion, the output per hour was improved. Though accurate figures of this kind are not generally available, statements are made by many employers that seven days' labor only produces six days' output; that reductions in Sunday work have not, in fact, involved any appreciable loss of output, and even the less observant of the managers seem to be impressed with the fact that the strain is showing an evil effect. The loss of time on other days has led an employer to the somewhat paradoxical position of confining Sunday work to those who have attended regularly during the week, i. e., to give a rest on Sundays to those who, in fact, need it least. There is undoubtedly some tendency toward a reduction or discontinuance of Sunday labor. It is becoming increasingly realized that there are limits to hours of labor beyond which no commensurate output is obtained. Perhaps inevitably, employers started their production of munitions by sprinting as if for a short race whereas it is becoming evident that the course will be a long one and that the hours of labor must be so organized as to enable the output to be maintained at a regular level for a lengthy period. This is all the more important in that employers have been compelled to engage many untrained men who lacked both the skill and the reserve of energy and staying power possessed by the regular munition worker.

8. The evidence from the side of the employees is naturally less definite. The trade-union officials seem clearly of opinion that the

men are beginning to get "fed up" and are feeling the need of more rest, to which need is attributed much of the lost time. It is stated that many men continue at work who in ordinary times would be absent on account of ill-health. Though a high rate of wages may have rendered Sunday labor popular in the first instance, the committee are not convinced that this is still everywhere the case. At one important center the representatives of the workers urged the abolition of the long "change over" shifts and the stoppage of all ordinary work on Sundays between 8 a. m., and 8 p. m. They definitely preferred relief on Sunday to relief on Saturday afternoon (though elsewhere the Saturday relief is preferred). An employer in the same place informed the committee that at his factory work was generally stopped from 10 p. m. on Saturday to 6 a. m. on Monday, and that the day shift preferred to work on from 6 p. m. to 10 p. m. on Saturday afternoon in order that they might be set free on Sunday. At another important center the representatives of the workers, while they thought that an immediate stoppage of all Sunday work might lead to trouble over wages, definitely urged that the workers should be given one Sunday off in every two or three. Certainly, whatever difficulties there may have been or still are, the fact remains that a number of prominent employers have succeeded in reducing or abolishing seven days' labor.

9. The evidence before the committee has led them strongly to hold that if the maximum output is to be secured and maintained for any length of time, a weekly period of rest must be allowed. Except for quite short periods, continuous work, in their view, is a profound mistake and does not pay—output is not increased. On economic and social grounds alike this weekly period of rest is best provided on Sunday, and the committee are strongly of opinion that Sunday work should be confined—

- (a) To sudden emergencies, including the occasional making up of arrears in particular sections; and
- (b) To repairs, tending furnaces, etc. (the men so employed being given a corresponding period of rest during some other part of the week).

Speaking generally, the need for this relief from work on Sunday is more urgent for "protected" persons than for adult males, and for men on overtime than for those on double shifts, and the need may also vary somewhat according to the number of hours worked during the week and the environment and character of the work; but the committee consider that the discontinuance of Sunday labor should be of universal application and should extend to all classes of workers, except that where the work must necessarily be continuous special arrangements will be necessary.

10. Should the early stoppage of all Sunday work be considered for any reason difficult, if not impossible, to bring about, the committee trust that it will at least be practicable to lay down the principle that Sunday labor is a serious evil which should be steadily and systematically discouraged and restricted. They suggest that, pending a general discontinuance of such labor, there are various ways in which an important improvement might be effected:

- (a) Where two shifts (one for day and one for night) are worked, to discontinue the practice by which the change from one shift to the other is made by requiring the men to work continuously for a period and a half instead of by closing down on Saturday night or during the period of the day shift on Sunday. Closure on Saturday nights seems desirable even when the change of shift is made less often than once a week, since the night shift seems to be generally regarded as a greater strain than the day shift.
- (b) Where three 8-hour shifts are worked, to omit one or two shifts on Sunday.
- (c) Where workers are employed only during the day with overtime, to reduce so far as possible the hours of work on Sunday.
- (d) To give all workers alternate Sundays off, or at the very least a Sunday off at frequent intervals:
 - (i) By allowing a certain number to get off each Sunday;
 - (ii) By closing completely, say, one Sunday in every two or three;
 - (iii) By closing alternately in particular departments.
- (e) To give another day off in place of Sunday or, at any rate, to let workers on long hours off early on Saturdays or at other times.
- (f) To increase the employment of relief gangs where this can be satisfactorily arranged for, by obtaining either—
 - (i) Relief workers amongst ordinary staff; or
 - (ii) Relief week-end shifts of volunteers.

11. The above conclusions have reference to the hours of labor of workers, but the committee desire to state that, in their opinion, the foremen and the higher management even more certainly require definite periods of rest. These individuals have never spared themselves; they carry a heavy burden of responsibility and they can not be replaced. The committee have with regret noted among them obvious signs of overwork. It is of primary importance in the in-

terests of the nation that they should be allowed that rest which is essential to the maintenance of their health.

12. In conclusion, the committee desire to emphasize their conviction that some action must be taken in regard to continuous labor and excessive hours of work if it is desired to secure and maintain, over a long period, the maximum output. To secure any large measure of reform it may be necessary to impose certain restrictions on all controlled establishments, since competition and other causes frequently make it difficult for individual employers to act independently of one another.

Signed on behalf of the committee,

GEORGE NEWMAN.

E. H. PELHAM, *Secretary*.
NOVEMBER, 1915.

HOURS OF WORK.

[Memorandum No. 5.]

In the preparation of this memorandum the committee have necessarily been influenced by considerations of what is immediately practicable regarding the health of the worker in relation to a maximum output, in view of the exceptional conditions entailed by the war. The limits of hours which they propose are based on the expectation that the war will be of long duration, and are such as they think can reasonably be continued over a protracted period. Many divergent factors have had to be weighed one against another and a number of the suggestions made are the resultant of a balance of considerations. The memorandum is directly concerned only with the hours of employment of workers engaged on the production of those munitions of war for which the ministry are directly responsible; it is not, for example, concerned with the hours in the shipbuilding or textile trades. One aspect of the question of hours of employment has already been considered in the committee's memorandum on "Sunday labor" (Memorandum No. 1¹); but even though a weekly or Sunday rest be conceded, important questions will remain as to how far an extension of the working hours during the week can be maintained and made to secure a maximum of output over a long period of time. An increased number of hours may be obtained either by overtime (by which is meant a lengthening of the normal daily hours of work) or by a system of shifts. The committee greatly prefer the latter alternative, but recognize that, for reasons which will be discussed later, it is impracticable to establish shifts universally.

OVERTIME.

2. Overtime is commonly justified on the ground that no other arrangement is possible owing to a dearth of workers and to the difficulties of increasing plant, and it is contended that, though the output per hour may not be maintained, the system does result in increased production. It should be noted that as the most highly skilled workers (tool and gauge makers, tool setters, etc.) are the most difficult to obtain, they have been most generally employed on overtime, and have frequently had to work exceedingly long hours. At one time cases of men working as much as 90 hours per week were common; more recently there has been a tendency to reduce hours, but even so, weekly totals of 70 to 80 hours are still frequent.

Some overtime amongst this class is no doubt inevitable, but the committee are satisfied that hours such as these can not be worked with impunity, and they most strongly urge that every effort should be made, either by "dilution" of labor or otherwise, to extend the shift system to this branch of the industry as rapidly as possible.

3. The objections to overtime may be briefly stated as follows:

- (1) It is liable to impose too severe a strain on the workers. Many witnesses assert that while for an emergency overtime is effective, after a period the rate of production tends to decrease and the extra hours to produce little or no additional output. Moreover the quality of the output may be adversely affected during the whole period of work and not only during the hours of overtime.
- (2) It frequently results in a large amount of lost time. In part this is to be attributed to the workers becoming exhausted and taking a rest, and also to sickness, noticeable chiefly amongst the older men and those of weak constitution.
- (3) It imposes a very serious strain upon the management, the executive staff, and the foremen, both on account of the actual length of the hours worked and the increased worry and anxiety to maintain output and quality of work. These men can not take days off duty like the ordinary workers.
- (4) It is liable to curtail unduly the period of rest and sleep available for those who have to travel long distances to and from their work, a matter of special importance in the case of young persons.
- (5) The fatigue entailed increases the temptation to men to indulge in the consumption of alcohol; they are too tired to eat and seek a stimulant.

4. The committee have not found that as yet the strain of long hours has caused any serious breakdown among workers, though many general statements indicative of fatigue have been received by the committee; in particular there is medical evidence to the effect that the long hours are beginning to make themselves felt upon the older men and upon those who suffer from physical infirmity. It is noticeable, too, that there is a general tendency toward a reduction of hours. There is good reason for believing that the increased pay and the better food that workers have been able to enjoy in consequence have helped to counteract the strain of long hours, and there is little doubt, too, that both men and women have been stimulated to make a special effort by an appreciation of the national importance

of their work. These influences have been thus summarized by a trade-union official:

- (1) Will-power. Men have continued at work in a condition that (under ordinary circumstances) would have put them off for a week or two. Even when a man comes off for a time he is anxious to get back again as quickly as possible. I have had one or two cases of serious breakdown. The main factor is that practically all the men want to do their best.
- (2) Better wages mean better food for a large number of men with families, and they mean a little better provision for those families, which again reacts upon the man's health and his work. In these cases it is not so much the saving or possibility of saving money, but the satisfactory spending of it which is the factor of importance.
- (3) The possibility of getting more money has also its effect. You read much about the slacker. There is quite a large proportion of workmen really too anxious for overtime—employers will corroborate—even under normal conditions.

It would be a mistake, however, to depend too largely upon the operation of influences of this kind, or to hope that they can continue indefinitely to be effective against fatigue. The committee are satisfied that if men are asked to work for 15 hours a day for weeks and months on end (as is the case now in certain areas) one of two results must follow. Either the health of the workers will break down or they will not work at full pressure. In either case output must suffer. It must be remembered, moreover, that the problem to be considered is not so much whether the workers have been able to withstand the strain of extra hours up to the present, as whether they are likely to continue to withstand it under similar conditions for a further protracted period.

5. Amongst the executive and foremen there is already evidence of considerable fatigue, and numerous instances have been brought to the notice of the committee where men of this class have had to be allowed special holidays to enable them to recuperate. It is hardly necessary to emphasize the importance of maintaining the health and physical efficiency of this class, upon whom depends principally the organization and discipline of the works. In some instances it has been found possible to arrange for members of the executive and foremen to share the duty during hours of overtime, an obviously desirable arrangement where it can be managed.

6. While, then, the committee recognize that overtime must continue, they suggest that it should be subject to certain definite restrictions somewhat on the lines indicated in the following paragraphs. They feel, however, that a final judgment upon overtime must be reserved until there has been an opportunity to observe the effects of restricted Sunday work, a reform which they hope will follow as a

result of the recommendation put forward in their first memorandum.

7. *Adult males.*—There is an extraordinary conflict of opinion as to the number of hours that can profitably be worked. On the one hand the advocate of the 48-hour week is emphatic in his view that this is the maximum a man can be employed effectively. "All overtime is bad," said the representative of one large firm, "we only work if driven to do so by urgent demands from the ministry, and even then our men become disorganized, and it is doubtful if our output is in any way increased." On the other hand, those who are employing their workers for 15 hours a day, sometimes with Sunday work in addition, state with apparently equal confidence that such hours are not excessive, that they have been worked in times of peace, and that they can not be reduced without loss of output. It is noticeable that amongst those in favor of shorter hours are employers who have given the most careful study to the question of industrial fatigue and scientific management, and it is at least significant that, so far as the committee can learn, no employer who has once adopted the shorter scale of hours ever desires to return to a longer period. If, however, the 48-hour week is to be made a success, the reduction of hours must be accompanied by a reorganization in factory management, which it would be difficult or impossible to carry out at the present time. Amongst those who favor the longer hours are to be found some of the largest employers of labor. While the committee hesitate to criticize the action of firms of such great experience, it seems self-evident that men can not work continually for 15 hours a day with good effect, more particularly when, as is often the case at the present time, there has to be added to the day's labor a journey of an hour or more to and from the works. The hours thus described—6 a. m. to 9 p. m.—appear to have their origin in trade custom—they add "a quarter" to the ordinary day's work and have been adopted in normal times to meet temporary trade pressure. The pressure now, however, is not temporary, and preparation must be made for a prolonged period of overtime. "The longer the hours, the greater the amount of broken time," is a maxim that has been repeated again and again, and the committee feels that much of the broken time is due to a sense of fatigue which leads the workers to take time off for rest. There remains, however, between these two courses a *via media*, which the committee believe to be satisfactory and which they find has in its favor a great body of public support. It allows a maximum of 10 to 12 hours of overtime a week. One large employer, who is also engaged in organizing some of the national factories, expressed the view that a 65-hour week averaged over a period of time, with a maximum of 80 hours in any

one week, was as much as men ought to be asked to work. Another put the limit at 2 hours' overtime a day. The following statement by a trade-union representative is to the same effect:

Where there is overtime beyond two hours daily there is evidence of fatigue and men can not be employed economically, from health and production point of view, on continuous overtime of three and four hours daily. Fatigue is rarely reaching the point of breakdown, but does affect health and production, and in my opinion will manifest itself later. In some cases where such overtime is worked, apart from night shifts, men are allowed one early night per week, and I think this is wise and economically sound.

Again, in the agreement between the Engineering Employers' Federation and the Engineering Trade Unions a limit of 32 hours of overtime per month was adopted, while the Home Office general order for munition factories (which, though it applies directly only to the labor of women and young persons, affects indirectly the hours of work of male adults, since their work is generally dependent upon that of the protected persons) provides for a maximum of 67½ hours a week and has been found to meet the needs of the great majority of the employers. It is evident that within the limits of prescribed hours the speed of work and the energy exerted differ widely; the committee, however, think that such hours can not reasonably be exceeded without affecting the physical efficiency of the workers, and accordingly, on the facts at present before them, they make the following recommendations as appropriate to the special conditions imposed by the war:

- (a) The average weekly hours (exclusive of mealtimes) should not exceed 65 to 67, including overtime. Hours in excess of 65 should only be worked for short periods and to meet sudden and unexpected circumstances. It may be desirable to differentiate to some extent between different kinds of work, and to fix a rather lower limit of hours for work requiring close individual attention.
- (b) Where practicable the overtime should be concentrated within three or four days in the week, which should preferably not be consecutive.
- (c) Where overtime is worked it is specially important that there should be no Sunday work.
- (d) The practice prevailing in certain districts of working from Friday morning, all through Friday night, and until noon on Saturday should be discontinued. Such hours may be permissible for short spells, but can not be satisfactory from the point of view either of health or output if continued for indefinite periods.

8. *Women and girls.*—Important as it is that hours of work for men should be kept within reasonable limits, it is essential that

hours of work for women and girls should be even more closely safeguarded. There is a general consensus of opinion (it is indeed beyond dispute) that women are unable to bear the strain of long hours so well as men, and, though there is some divergence of views, opinions as to what hours can profitably be worked vary to a much less extent than was found to be the case in regard to men. The great majority of the employers, when making their applications to the Home Office for exemption orders, have not asked to be allowed to work more than 65 hours per week, but beyond this the committee have been struck by the fact that in many of the works they visited the maximum hours allowed by the orders have seldom been worked continuously. Employers, not unnaturally, have sought permission for a wider limit of hours than is ordinarily necessary or desirable, in order that they may have latitude for dealing with special emergencies, and the Home Office orders were so drawn up as to provide for exceptional occasions of this kind. In order to investigate more closely the effect of long hours upon the health of operatives, the committee have recently instituted a series of intensive inquiries¹ among munition workers. Up to the present, only a few returns relating to women operatives have been collected; but, so far as they go, they do to some extent suggest progressive deterioration of health in proportion as the operatives had been employed for long hours and for long periods.

The committee are satisfied that the strain of long hours is serious, and they are of opinion that continuous work in excess of the normal legal limit of 60 hours per week ought to be discontinued as soon as practicable, though they think that some greater elasticity of hours might be allowed than is provided for by the factory acts, and they see, for instance, little objection to such moderate overtime during the week as can be compensated for by an earlier stop on Saturdays. They recognize, however, that the character of much of the work on which women and girls are engaged is at present such that it may be impracticable to carry this recommendation into effect forthwith, and some reasonable limit of time should be allowed for readjustment. Much necessarily depends upon the character of the employment, upon the conditions (including factory environment and piecework or time-work) under which it is performed, upon the sufficiency of food, upon whether the workers can sit while at work, and upon whether they live close to the factory or have to undergo, in addition to their actual labor, the added strain of traveling in crowded conveyances to and from their work. The committee feel

¹ These inquiries are being conducted by medical women, acting in conjunction with lady inspectors of the Home Office and the National Insurance Commission. Similar inquiries among men are also in contemplation. The validity of such inquiries must largely depend upon their continuance over a considerable period, upon reexaminations and upon the sufficiency of the numbers examined.

that the need for overtime amongst women and girls is much less pressing than it is for men; they are rarely employed on highly skilled work, and where there is still a good reserve of labor there should be little difficulty in gradually introducing shifts, or in other ways redistributing the work among a large number of operatives. They strongly urge that wherever practicable overtime should be abandoned in favor of shifts.

9. *Boys.*—In view of the extent to which boys are employed to assist adult male workers and of the limitation of supply, the committee, though with great hesitation, recommend that boys should be allowed to be employed on overtime up to the maximum suggested for men, but every effort should be made not to work boys under 16 more than 60 hours per week. Where overtime is allowed substantial relief should be insisted upon at the week ends, and should be so arranged as to permit of some outdoor recreation on Saturday afternoon.

SHIFTS.

10. Where shifts can be arranged they are to be preferred to overtime, not only because they involve less strain on foremen and workers, but because they enable the machines to be used for the whole 24 hours, and, in addition, produce a better and more uniform rate of output. Shifts are either double (day and night) or consist of three 8-hour periods.

11. *Day and night shifts.*—These are not always of equal length. Where the normal hours of work during the day are less than 12 (e. g., 6 a. m. to 5 p. m.) it is usual to place the remaining hours in the night shift. The ordinary daily hours have been fixed after prolonged struggles and negotiations between operatives and employers, and it has no doubt been thought advisable not to interfere with customs thus established; it may be argued, too, that by making the night shift somewhat longer than the day shift the total weekly hours for each shift are more nearly equalized, since there are usually fewer night shifts than day shifts. At the same time the committee can not but feel some regret that the strain of the night work should be increased by these additional hours, and they think it desirable that whenever practicable the night shift should not exceed the day shift in length. The two shifts are generally continuous and sometimes even overlap to enable the work in hand to be transferred to the new set of workers. It has been observed, however, that in some cases there is a short interval between the two shifts, which affords opportunity for cleaning and ventilating the shops, a matter to which the committee attach much importance.

12. While it is no part of the duty of the committee to express any views on the "8-hour day" as understood in the engineering

trades, the system of 8-hour shifts is one that has come very forcibly under their attention. There are undoubtedly certain advantages to be derived from this system of hours. They involve little or no strain upon the workers; the periods during which machinery must stand idle for meals are very much reduced, while significant statements have been put before the committee claiming beneficial effects upon output. Unfortunately, apart from any other reason, a shortage of workmen and the difficulties of supervision, as well as problems of housing and transit, to a large extent exclude 8-hour shifts from practical consideration, so far as male workers are concerned. The difficulties in the case of women are much less, and it is the more important to establish the 8-hour shift, in their case, because there are being attracted into munition works at the present time women who hitherto have been entirely unaccustomed to factory life, and who are on that account not unlikely to find the strain of a 12-hour day too great, while they could work readily and effectively through an 8-hour period.

Mention should also be made of a variant of the 3-shift system under which the first day shift works from 6 a. m. to 10 a. m. and again from 2 p. m. to 6 p. m., while the second day shift works from 10 a. m. to 2 p. m. and again from 6 p. m. to 10 p. m. This system is stated to produce a larger output because no intervals for meals are required and because the worker benefits from the four hours' interval, but it appears to be unpopular with the workers, chiefly because of the difficulty of occupying satisfactorily the four hours' interval, which is too short to allow the worker to go home and take up other occupation and too long to be spent in idleness at the works. The committee consider that the system should be discouraged, even where facilities for rest and recreation are provided at the factory, and they regard it as altogether unreasonable where such facilities do not exist.

13. *Adult male workers* are almost universally employed on double shifts. They appear on the whole to be standing the system well, more particularly where relief is given at the week ends. The committee see no reason to suggest any change.

14. *Women workers* are employed sometimes on 12-hour and sometimes on 8-hour shifts, but the latter arrangement is becoming, the committee are glad to note, increasingly common. The strain of the 12-hour night shift for women is considerable, even where workers are provided with seats, and the committee consider that the system should be abandoned wherever local difficulties of labor supply, housing, and transit can be overcome, and in no case should the hours worked at night exceed 60 per week. Whatever system of shifts is adopted, girls under 18 should not be employed on a night shift

unless the need is urgent and the supply of women workers is insufficient. In such cases the employment should be restricted to girls over 16 years of age, carefully selected for the work.

15. *Boys*, like the men, are generally employed on 12-hour shifts. It does not seem practical to suggest any change of system, but the committee hope that care will be taken to watch the effect of night work on individual boys and to limit it as far as possible to those over 16.

NIGHT WORK.

16. It has already been stated in paragraph 10 that shifts, where practicable, are preferable to overtime, but the committee do not desire it to be thought that they regard night work as a good thing in itself, and they deem it advisable to set out some of the objections to it which have come under their notice.

(a) It is uneconomical. Though wages are paid at a higher rate, the rate of output, more particularly during the last 2 or 3 hours of the 12-hour shift, is generally lower. The committee feel that this objection would be largely overcome by the workers being afforded an opportunity to obtain suitable refreshment about 4 a. m.

(b) Supervision is frequently unsatisfactory. This is chiefly due to the fact that not infrequently fewer and less experienced foremen are employed at night.

(c) Conditions of lighting are seldom so good as in daytime, and make fine work more difficult.

(d) Workers experience great difficulty in sleeping by day, partly because of the dislocation of the ordinary habits of life and partly because of the noises and disturbances which are almost inevitable in the daytime, except under specially favorable conditions.

(e) The unfamiliar meal hours make it difficult for the workers to consume substantial food and their digestion is liable to become deranged.

17. A question of considerable importance in connection with the shift system is how long the workers should remain on the night shift at any one time. A week is the most common period, more particularly where the three-shift system is in vogue. Elsewhere the changes are sometimes made fortnightly or monthly, and in some instances there is no alternation at all, the workers remaining continuously on day or night work, except for occasional changes amongst individuals carried out for the convenience of the persons concerned. There has been so much divergence of opinion as to the merits of the different systems that the committee have found it difficult to arrive at any definite conclusions. Those who favor the weekly change argue that the strain of the night work and the difficulties of obtaining adequate sleep during the day are such that it is unde-

sirable for workers to remain on night work for more than a week at a time. On the other side it is stated that repeated changes make it more difficult to settle down to either system, and that the night work after the first week becomes less trying, while the ability to sleep by day increases. While on physiological grounds the committee consider that much is to be said for infrequent changes, they think that this is a matter which must be settled locally largely on social considerations, and should be left to individual employers to determine in consultation with their workpeople. Whatever may be settled, provision should be made for the worker to have a period of rest before and after period of the night shift. Change of shift should be effected by dropping one or more shifts and not by working for one and a half periods.

SPELLS AND BREAKS.

18. With certain minor qualifications existing arrangements for spells and breaks are generally satisfactory, and the committee have but few suggestions to make. Where work commences at 6 a. m. the ordinary breaks are half an hour for breakfast, and one hour for dinner. At some factories work only begins at 7 a. m. or 8 a. m., the workers being expected to have had their breakfast before arrival. The committee do not feel that there is any real objection to the system, though the earlier of these two hours is liable to involve a long spell of work, and even if the men have had a good meal before starting the distance to be traveled to work may necessitate a very long period between breakfast and dinner. In such cases a brief interval, when tea can be taken, may prove beneficial. A tea interval is usually allowed for men only when overtime is worked; it usually consists of half an hour, but in some cases it is reduced to a quarter of an hour or 20 minutes. A reduced mealtime of this kind has generally been established in order to enable the workers to get home at an earlier hour, and there is much to be said for it on this account; it affords, however, little enough time to get a meal, and it should only be permitted where arrangements are made for the tea to be actually ready for the workers as soon as they stop work. Women workers are frequently allowed short intervals in the morning or the afternoon or both. It seems to be generally agreed that women can not profitably work long spells without any break or refreshment, and the committee feel that breaks of this kind are to be encouraged. An opportunity for tea is regarded as beneficial both to health and output, and a break in the morning is specially important where women are expected to have breakfasted before starting work.

19. Where double shifts are worked two intervals usually are allowed at night, one of an hour and the other half an hour; but in a

number of cases the first interval is also reduced to half an hour. The committee are very strongly of the opinion that this is a mistake and recommend that intervals amounting to not less than one and one-half hours should be allowed as on the day shifts. Night work is certainly more strenuous than day work, and it is illogical therefore to allow a reduced period for meals and rest during the night. These objections are particularly valid in the case of women, since they often experience difficulty in eating a proper meal at night unless they are allowed plenty of time, and they appear to benefit in other ways by the opportunity of rest afforded by the longer interval. It has been argued that as the workers have nowhere to go during the night, an hour at a time is too long. This objection would, however, be overcome by the adoption of two intervals of three-fourths of an hour each, which would allow adequate time for taking a meal and at the same time not make either interval unnecessarily long. The committee think it important that there should be some opportunity for rest and refreshment, more particularly in the case of women, between about 3 a. m. and 4 a. m. The postponement of the second break until this hour helps the workers to carry on through the trying hours at the end of a night shift.

20. Where women are employed on 8-hour shifts an interval of half an hour is allowed, occasionally with a brief second interval. Provided that no considerable part of the time has to be spent in the preparation of the meal this interval appears to be sufficient.

HOLIDAYS.

21. The committee consider it most important that the ordinary factory holidays should not be interfered with. They afford a definite break in a long period of strain, and a favorable opportunity for recuperation. This opportunity could be used to fuller advantage if adequate traveling accommodation and railway facilities were provided for conveying large numbers of workers to convenient health resorts and holiday centers.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*
JANUARY, 1916.

OUTPUT IN RELATION TO HOURS OF WORK.

REPORT BY H. M. VERNON, M. D.

[Memorandum No. 12.]

1. In a previous memorandum (No. 5) the committee recommended that the average weekly hours of labor, including overtime, should not exceed 65 to 67 for men, and 60 hours for women. They suggested that it might be desirable to differentiate to some extent between different kinds of work, but they did not offer any detailed information, because at the time they had not sufficient data at their disposal to warrant definite conclusions. In order to remedy this deficiency, special investigators, including myself, have been engaged for many months past in collecting statistics concerning output in relation to hours of labor at a number of munition works, and I am now bringing forward a portion of the data which I have obtained as they appear to me, not only to afford information concerning the most suitable hours of labor in certain specific munition operations, but also to suggest some of the principles which should be followed in fixing the hours of labor for munition work in general.

2. I understand that the object of the committee is in many ways similar to that of the managers of munition works, and is to ascertain the hours of employment most likely to produce a maximum output over periods of months, or maybe even of years. They hold that output can not be maintained at the highest level for any considerable period if the conditions are such as to lead to excessive fatigue and to deterioration in the health of the workers. If health and physical efficiency are maintained they would raise no a priori objections to any given number of hours, however long. Further, in considering the relative value of, say, a 65-hour week as compared with a 55-hour week the question is whether the former or the latter will produce the greater total weekly output, rather than whether any extra cost involved by the additional output is justified by the economic or military conditions existing at any given time.

3. The statistical data collected with one exception concern the output of day shifts, and they were collected in large and recently built munition works, where the conditions of labor, such as lighting, warming, ventilation, and the provision of canteens, were as favorable as possible. All classes of operatives were on piecework, they were paid at a high rate of wages, and there were no trades-union

restrictions whatever upon output. Hence there was every possible stimulus for them to exert their maximum powers of production. It is more convenient to describe first the data obtained relating to the output of women, as one group of them is specially complete.

WOMEN ENGAGED IN MODERATELY HEAVY LABOR.

4. The complete series of output data just referred to concerns women engaged in turning aluminum fuse bodies. The operatives were standing all day at capstan lathes and had to subject each fuse body to seven successive boring and cutting operations. These operations required close attention throughout and some delicacy of manipulation, so that no relaxation of effort was permissible during the actual turning. Nearly 200 operatives were engaged on the work, but for the purposes of statistical analysis the output of only 100 of them could be considered. None were included unless they had attained their maximum output (which statistical examination of individual output showed was attained after 3 weeks' experience) and were engaged on the operation for 15 or more weeks out of the 24 weeks of the statistical period dealt with. For many months previous to this period the hours of labor had usually been $77\frac{1}{2}$ per week, except that in the second week of each month there was no Sunday labor, or the hours were reduced to $69\frac{1}{2}$ per week. From Table I we see that in the 6-week period just before Christmas the actual hours of work averaged 68.2 per week, or 6.6 hours less than the nominal hours (74.8 hours). Taking the average hourly output of fuse bodies as 100, the total (relative) output per week comes to 6,820. The next fortnight was much broken by the Christmas holiday. This amounted practically to a week if the days taken without permission be added to those officially sanctioned. It will be noted that in the week and a half before this holiday the output rose distinctly above the previous average (viz, 6 per cent), but in the half week immediately following it fell considerably below the average (viz, 11 per cent). Both of these variations form a typical feature of output data in relation to holidays, while another typical feature is the considerable and persistent rise which follows on a holiday. In the present instance this rise amounted to 11 per cent more than the average for the pre-Christmas period, or the total output reached its absolute maximum of 7,615 per week. The beneficial effects of the holiday upon output undoubtedly lasted four weeks and probably more, but the reduction in the hours of labor from January 24 onward precluded the possibility of tracing it further. After a 4 days' holiday at the beginning of August the output of a smaller group of the operatives, 40 in number, remained high for 5 weeks and was 7 per cent greater than the average output during the next 8 weeks.

TABLE I.—ONE HUNDRED WOMEN TURNING FUSE BODIES.

Week ending—	Actual hours of work per week.	Nominal hours of work per week.	Hours of broken time per week.	Relative output per working hour.	Hours of work multiplied by relative output.	Remarks concerning output.		
Nov. 14	62.0	67.5	5.5	98	6,820	Hourly output fairly steady.		
Nov. 21	64.8	75.5	6.7	99				
Nov. 28	66.7	75.0	8.3	102				
Dec. 5	70.9	77.2	6.3	96				
Dec. 12	69.1	76.2	7.1	99				
Dec. 19	71.3	77.3	5.5	107				
Dec. 26	41.8	46.0	4.2	105				
Jan. 2	32.8			89				
Jan. 9	65.2	69.3	4.1	113			7,615	Subsequent considerable increase of hourly output, whilst total output rises to a maximum, 12 per cent greater than that of pre-Christmas period.
Jan. 16	70.3	77.2	6.9	107				
Jan. 23	70.3	76.3	6.0	112				
Jan. 30	62.4	68.5	6.1	111	6,591	Reduction of hours of labor from 74.3 to 67.5 has no immediate effect on hourly output, hence a considerable reduction of total output.		
Feb. 6	60.8	66.5	5.7	102				
Feb. 13	49.2	52.0	2.8	108	7,343	Temporary shortage of material and reduction in hours of labor.		
Feb. 20	47.0	52.0	4.4	106				
Feb. 27	61.4	66.5	5.1	118				
Mar. 5	62.2	66.5	4.3	125				
Mar. 12	54.8	58.5	3.7	127				
Mar. 19	62.1	66.5	4.4	121				
Mar. 26	60.4	66.5	6.1	121				
Apr. 2	68.6	64.8	6.2	121				
Apr. 9	54.9	58.5	3.6	121				
Apr. 16	62.9	66.5	3.6	126				
Apr. 23	47.0	49.5	2.5	125				

5. The output data of Table I indicate that the beneficial effect on output of a reduction in the weekly hours of labor from 74.3 to 67.5 was not immediately manifest. Even a reduction to 52 hours seems to have no influence, but this was owing to a temporary shortage of material. From February 27 onward the hours of labor were 66½ per week (or 58½ in the second week of each month, when there was no Sunday labor), and we see that during a period of eight weeks the hourly output now averaged 23 per cent more than in the pre-Christmas period. The total output is 7,343 per week, or 8 per cent more than in the pre-Christmas period, in spite of the hours of labor being nominally 10.5 less, and actually 8.5 less. It is probable that the 60 hours worked per week were still too many to give the best total output, but at least they justify the statement that in order to attain a maximum output women engaged in moderately heavy manual labor should not work for more than 60 hours per week. Observations adduced below suggest that an equally good total output could be maintained if the actual working hours were reduced to 56 or less per week.

6. It might be thought that the great improvement in hourly output under the shorter hours régime was due, partly or wholly, to increased skill of the operatives or improvements in the machinery. Neither of these hypotheses can be substantiated. On classifying the operatives into two groups, according as they had been engaged

in turning fuse bodies for about five months previous to the statistical period dealt with, or for about one and a half months on an average, the hourly output of the former group was found to be 1 per cent less than that of the latter group during the pre-Christmas period, and 1 per cent more than it was during the spring period, or in other words, it was the same within the limits of chance error. As regards the other alternative, no change had been made in the tools, the machinery, the nature of the operation, or the quality of the alloy used during the statistical period dealt with, or for $4\frac{1}{2}$ months previous to it.

7. Further proof of the advantage of shorter hours was afforded by the output data of some of the operatives on an earlier occasion. One group of them, 17 in number, worked only 51.8 to 62.6 hours per week for five weeks in June and July, and during the last three weeks of this period their hourly output was 18 per cent greater than that of another group of 14 operatives who were working the usual long hours. Subsequently, when both groups worked the same long hours, their output was identical.

BROKEN TIME AND SICKNESS.

8. It will be seen from Table I that the operatives lost on an average 6.6 hours per week of "broken" time before Christmas and 4.6 hours per week in the final 8-week period, or that they lost practically half a day per week in this way. But even this does not represent by any means the total time lost, for I have put in a separate category such time as was presumably lost by indisposition. I have made the arbitrary assumption that operatives who put in less than 45 hours per week of actual work out of a nominal $58\frac{1}{2}$ or more did so because of sickness rather than slackness, and I have excluded them in calculating the broken time data quoted in the table, though I retained them when calculating the output of fuse bodies per working hour. In the 6-week pre-Christmas period 4.1 per cent of the weeks worked by the operatives were "short" weeks of less than 45 hours, the average time of actual work amounting to 30.2 hours per week. In addition, the operatives were absent altogether for 2.1 per cent of the weeks. Sickness increased considerably after Christmas, for in the 5-week period, January 3-February 6, 5.7 per cent of the weeks were short weeks, and 3.6 per cent of them were absent weeks, whilst in the 7-week period, February 21-April 9, no less than 12.4 per cent of the weeks were short weeks (averaging 28.6 hours), and 5.4 per cent of them were absent weeks, in spite of the fact that the nominal hours of labor were 10.8 less than in the pre-Christmas period.

9. There can be no doubt that the frequent occurrence of these short and absent weeks was due very largely to fatigue resulting from the strain of the heavy lathe work, for women engaged in light sedentary occupations showed only about a third as many lapses. I was able to obtain data concerning the timekeeping of no less than 400 women and girls engaged in the sedentary occupations of viewing, gauging, and assembling the component parts of fuses, and in Table II are given the average numbers of short and absent weeks observed in the 6 weeks before Christmas, when the nominal hours of labor were 76 per week; in the 5 weeks after Christmas, when they were 75 per week; and in the subsequent 7 weeks (Feb. 7-Mar. 26), when they were 64 per week. Taking first the women of 21 and over, for they alone are strictly comparable in age with the fuse-turning women, it can be seen that in each of the statistical periods dealt with these women put in only about a third as many short weeks as the fuse turners, while they were absent three times less frequently in two of the statistical periods and about half as frequently in the third period.

TABLE II.—WEEKS IN WHICH OPERATIVES WORKED LESS THAN 45 HOURS OR WERE ABSENT.

Age of operatives.	Number of operatives.	Short weeks.			Absent weeks.		
		6 weeks before Christmas.	5 weeks after Christmas.	7 weeks following (Feb. 7-Mar. 26, or Feb 21-Apr. 9).	6 weeks before Christmas.	after Christmas.	7 weeks following.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
14-16.....	71.....	1.3	1.7	3.6	2.9	1.7	1.4
17-18.....	58 (fuse).....	.3	3.1	5.0	.7	3.9	2.4
19-20.....	96 (gaugers).....	2.4	2.9	6.4	2.0	1.7	3.3
21 and over.....	175.....	1.4	2.1	3.4	.7	2.1	1.8
21 and over.....	100 (fuse turners)	4.1	5.7	12.4	2.1	3.6	5.4

10. As regards the girls engaged in sedentary work, the table shows that those of 19 to 20 years put in the most short and absent weeks, while those of 14 to 16 put in the least, and in this respect corresponded closely with the women of 21 and over. In Table III are recorded the average hours of broken time observed in the three statistical periods mentioned, and it will be seen that here again the girls of 14 to 16 resembled the women of 21 and over in keeping the best time, while the young women of 19 to 20 were on the whole the worst timekeepers. If comparison be made with the data relating to the fuse-turning women, it will be seen that on an average the adult women engaged in this sedentary work lost only about half as much time as they did.

11. It should be mentioned that these gauging women were not on piece rates like all the others, but were on day rates with the addi-

tion of a large bonus on output if above a certain minimum. Doubtless this system of remuneration tended to improve their time keeping to some extent, though probably not much. Thus the group of women recorded in the next section, who were engaged on the light labor of milling a screw thread, were paid at piece rates, and yet kept time very much better than the fuse-turning women, and not much worse than the gauging women.

TABLE III.—BROKEN TIME OF WOMEN GAUGING FUSES.

Age of operatives.	Number of operatives.	Average hours of broken time per week during—		
		6 weeks before Christmas.	5 weeks after Christmas.	7 weeks following.
14-16.....	71	2.9	3.9	3.2
17-18.....	58	3.9	5.2	3.0
19-20.....	96	3.5	5.9	4.0
21 and over.....	175	2.5	4.7	3.0

12. It is evident that in fixing the number of hours required to produce a maximum output close attention must be paid to the effect of any given number of hours on timekeeping. If an increase in the hours of labor from 50 to 60 per week caused the total output of the operatives, taken as a group, to increase permanently by, e. g., 10 per cent, it would be worth while to adopt these hours, but if after a few weeks of the longer hours it were found that 5 per cent more of the operatives were absent from sickness, and 10 per cent more of them were putting in short weeks of an average of 30 hours instead of the nominal 60 hours, there would be no gain whatever in the total output. Now, it will be seen from Table II that in the third of the statistical periods dealt with 9 per cent more of the fuse-turning women were putting in shorter weeks than of the gauging women, while 3.6 per cent more of them were absent. If, therefore, it were found that by cutting down the hours of actual work of the fuse-turning women from 60 to 56 they were able to reduce their short and absent weeks to those shown by the gauging women, the output would remain practically unchanged. For other and independent reasons, to be mentioned later on, it seems probable that a reduction of the working hours to 56 per week would have no adverse effect on output, and hence there can be little doubt that this number of hours is the absolute maximum for the type of work under consideration, and that if anything it errs on the side of excess.

13. Another point to be borne in mind in fixing hours of labor is the time taken by the operatives to get from their homes to the works, and vice versa. Personal observation leads me to think that the operatives referred to in this memorandum took on an average some-

what less than an hour each way, though I have no exact statistical data on the subject. There was an efficient tram service at their disposal.

WOMEN ENGAGED IN LIGHT LABOR.

14. In the next type of munition work to be described, the operatives were milling a screw thread on the fuse bodies. This necessitated their standing at semiautomatic machines, where they removed one fuse body and inserted another every minute or so. The requisite muscular effort was moderate and simple in character, and took up only about a fifth of the total time required for the operation. For the remaining four-fifths of the time the operative had nothing whatever to do, and so the call upon her attention and her muscles was very much less than that experienced by the operatives previously described. The output of 21 women was investigated over a similar statistical period, but it seems unnecessary to quote the results in full. The average records adduced in Table IV show that the hourly output varied in the same direction as that of the fuse-turning operatives, but to a very much more limited extent. In the 3 weeks after Christmas it was only 6 per cent greater than in the 5 weeks before it, and since the average hours of work were somewhat shorter, the total output remained practically unchanged. A considerable reduction of working hours did not lead at first to any improvement of hourly output, but this established itself after 4 weeks, and was maintained at a steady level during the next 8 weeks. In that the average excess of hourly output amounted only to 9 per cent above that of the pre-Christmas period, the total output became reduced to 4 per cent below it. However, in the 3 weeks after Easter the hourly output improved a further 3 per cent so that the total output reached to within 0.6 per cent of the pre-Christmas value. Probably the best number of hours is something between the limiting values investigated, or about 62 hours, for if the output of 109 per hour were maintained over this time, the total output would work out at 6,758, or slightly above that of the pre-Christmas period.

TABLE IV.—TWENTY-ONE WOMEN MILLING A SCREW THREAD.

Statistical period.	Average hours of actual work.	Average hours of broken time.	Average (relative) hourly output.	Hours multiplied by output.
5 weeks preceding Christmas (Nov. 15-Dec. 19).....	67.4	4.4	100	6,740
2 weeks at Christmas (Dec. 20-Jan. 2).....	44.7	3.5	98	.....
3 weeks after Christmas (Jan. 3-Jan. 23).....	63.7	3.0	106	6,752
4 weeks later (Jan. 24-Feb. 20).....	53.1	2.6	104	5,522
8 weeks later (Feb. 21-Apr. 16).....	59.3	3.6	109	6,463
2 weeks at Easter (Apr. 17-Apr. 30).....	39.4	2.7	108	.....
3 weeks after Easter (May 1-May 21).....	59.8	2.6	112	6,698

MEN ENGAGED IN HEAVY LABOR.

15. The labor assigned to male munition workers is, as a rule, considerably heavier than that assigned to women; but making due allowance for the greater strength and endurance of the man, we find that his output is similarly affected by a reduction in the hours of labor. One of the most fatiguing types of munition work so far investigated by me is that of "sizing." In the sizing of fuse bodies the article is usually subjected to four separate operations, in each of which it is clamped to a small flywheel and handle and is screwed through a steel tap so as to cut a screw thread on it. The operations require no manual dexterity, but they are a great and continuous strain on the muscles of one arm and shoulder and to a less extent on those of the back. The operatives seldom use both arms, as they prefer to keep the "screwing" hand dry and use the other for picking up the oil-covered fuse bodies. The output of a group of 27 operatives was investigated and the mean results are given in Table V. The hours of labor were always shorter than those worked by the women. They never exceeded 71 hours in any one week and seldom included Sunday labor. The hourly output showed a marked drop during the Christmas fortnight and a considerable rise (to 118) for the first week after this fortnight, but the average output during the six weeks after Christmas was only 9 per cent greater than that of the pre-Christmas period in spite of the fact that the weekly hours of labor were 10.4 shorter. Evidently the operatives took a long time to adapt their rate of production to the shorter hours, for the hourly output subsequently averaged 22 per cent in excess of that of the pre-Christmas period. This caused the total output to be no less than 10 per cent greater, and it is probable that even this figure does not represent the full effect of reducing the hours of labor, for after Easter the hourly output improved a further 2 per cent and the total output was increased to 13 per cent above that of the pre-Christmas period. However, a part of this improvement may have been only the temporary effect of the holiday. The week February 14-20 is omitted, as the operatives worked only 41 hours, owing to shortage of material.

TABLE V.—TWENTY-SEVEN MEN SIZING FUSE BODIES.

Statistical period.	Average hours of actual work.	Average (relative) hourly output.	Hours multiplied by output.
6 weeks preceding Christmas (Nov. 8-Dec. 19).....	61.5	100	6,150
2 weeks at Christmas (Dec. 20-Jan. 2).....	38.3	89	.....
6 weeks after Christmas (Jan. 3-Feb. 13).....	51.1	109	5,570
8 weeks later (Feb. 21-Apr. 16).....	55.4	122	6,759
2 weeks at Easter (Apr. 17-Apr. 30).....	41.0	112	.....
3 weeks later (May 1-May 21).....	56.2	124	6,969

16. The broken time is not quoted in the above table, as the nominal hours of labor were rather uncertain. Moreover, the operatives appeared to have had some freedom in selecting their own hours of work. The plan adopted in calculating the weekly hours of actual work was different from that observed in the other data quoted in this memorandum, for all weeks were included in which 20 hours or more were worked. The reason of this change was that these sizers, though they were absent altogether for only 1.8 per cent of the weeks included in the statistical period dealt with, were in the habit of putting in short weeks of 40 hours or less with some frequency. If only those operatives who put in 45 hours or more had been included, the average weekly hours of actual work would have come to about two hours more than the figures quoted in the table.

17. The operatives engaged in sizing fuse bodies were all full-grown men, but certain other sizing operations were performed by youths. The output of one of these groups may be quoted, but in that it concerns only nine operatives, the data are not so reliable as those just recorded. The youths 14 to 17 years of age were sizing steel base plugs, and from Table VI we see that their hourly output was 16 per cent greater in the 4 weeks after Christmas than it had been before, in spite of a slight increase in the hours of labor, whilst it was no less than 42 per cent greater in the 11 subsequent weeks when the hours of labor were reduced from 70.3 to 57. In consequence, the total output attained a value 19 per cent in excess of that of the pre-Christmas period. Even this value does not represent the full effect of the reduced hours of labor, for in the three weeks after Easter the hourly output was 55 per cent above that of the pre-Christmas period and the total output 38 per cent above it. Such results are so astonishing that one is naturally inclined to doubt their validity, but there appears to be no reason for denying their substantial accuracy. The boys must have been seriously overworked by the long hours, and hence the 8 to 12 hour reduction of the working week accelerated their rate of production much more than did the 6-hour reduction accelerate that of the men "sizers."

TABLE VI.—NINE YOUTHS SIZING BASE PLUGS.

Statistical period.	Average hours of actual work.	Average (relative) hourly output.	Hours multiplied by output.
5 weeks preceding Christmas (Nov. 15-Dec. 19).....	62.3	100	6,830
2 weeks at Christmas (Dec. 20-Jan. 2).....	46.3	106	.....
4 weeks after Christmas (Jan. 3-Jan. 30).....	70.3	116	8,155
11 weeks later (Jan. 31-Apr. 16).....	57.0	142	8,094
2 weeks at Easter (Apr. 17-Apr. 30).....	42.1	135	.....
3 weeks later (May 1-May 21).....	60.9	155	9,440

MEN ENGAGED IN MODERATELY HEAVY LABOR.

18. Typical examples of moderately heavy labor are found in shell making, and all the data described in this section relate to the output of 3-inch shrapnel shells. One of the most important and lengthy of the operations is that known as boring the powder chamber. This operation is performed on capstan lathes provided with three sets of boring tools, and it requires considerably more muscular energy than that involved in turning fuse bodies, though not so much as in sizing. At one shell factory, where the male operatives were being largely replaced by women, I was informed that though the women attained a good output in most operations, they produced only about half as many shells as the men did in this particular operation, since they had not the necessary strength.

19. The data in Table VII concern the output of 23 operatives, all of whom had been 4 months or more at the process previous to the statistical period recorded. During these months they worked at first for 53 hours per week, and subsequently for 49½ hours, and had attained their maximum output for these particular hours of labor. When their hours were suddenly increased to 64 per week (7 hours on Sunday), we see that they maintained their hourly output for three weeks with very little diminution. After this time there was a shortage of material at irregular intervals, so the output data were rendered valueless for statistical purposes, but even if the hourly output had fallen considerably lower, the total output would still have remained higher during a 60-hour week than during a 48-hour week.

TABLE VII.—TWENTY-THREE MEN BORING THE POWDER CHAMBER.

Week ending—	Weekly hours of actual work.	Hours of broken time.	(Relative) hourly output.	Hours multiplied by output.
Nov. 7.....	48.5	1.0	100	4,780
Nov. 14.....	47.1	1.7	100	
Nov. 21.....	59.5	4.5	107	5,970
Nov. 28.....	60.5	3.5	98	
Dec. 5.....	59.1	1.4	94	

20. An important operation is to "finish, turn, and form" the shell, which consists in taking off a fine turning, and afterwards filing down the shell. This operation probably needs the expenditure of about as much muscular energy as that of turning fuse bodies. The data in Table VIII show the output of 22 men who had been engaged at this work for 10 weeks, on an average, previously to the statistical period dealt with.

TABLE VIII.—TWENTY-TWO MEN, FINISHING, TURNING, AND FORMING 3-INCH SHELLS.

Week ending—	Weekly hours of actual work.	Nominal hours of work.	Hours of broken time.	(Relative) hourly output.	Hours multiplied by output.	
Aug. 29.....	62.0	64	2.0	98	100	
Sept. 5.....	64.1		65			.9
Sept. 12.....	51.6		52			.4
Sept. 19.....	63.4		64			.6
Sept. 26.....	52.3	53	.7	105	-----	
Oct. 3.....	39.0	39	.0	112	5,905	
Oct. 10.....	51.2	52	.8	112		
Oct. 17.....	53.0	53	.0	118		
Oct. 24.....	51.2	53	1.8	112		

21. The hours of labor in the immediately preceding week had been 64, but before that they had been 49 for 3 weeks, preceded by 64 or more for 7 weeks. We see that, on an average, the hourly output during the last 3 weeks recorded in the table, when the hours of labor averaged 51.8 hours, was 14 per cent greater than in the first 4 weeks when they averaged 60.3 hours. It is probable that a portion of this improvement was due to increased skill of the operatives, who were found to require 3 or 4 months' experience before attaining their maximum output, but assuming that the whole of the improvement was the direct result of the reduced hours of labor, the total output is still less for the short-hour weeks than for the long ones. The timekeeping was extremely good and suggests that the operatives could easily stand the 60-hour week, for not only was the broken time 1 hour per week or less, but during the 60-hour period recorded the operatives were never absent for a whole week, and they put in only 4 per cent of short weeks. It should be mentioned that in calculating broken time the 45-hour limit referred to previously was retained for operatives working 58½ hours or more per week, but with operatives working a nominal 52 hours only those were excluded who put in less than 40 hours of actual work, and with operatives working a nominal 49½ hours only those who put in less than 38 hours of actual work.

MEN AND YOUTHS ENGAGED IN LIGHT LABOR.

22. In the operation known as "rough turning," the rough shell is turned approximately to size. During four-fifths of the time required the operative merely watches the lathe, so the labor is very much lighter in type than that previously described and resembles that required for milling a screw thread on fuse bodies. The hourly output of 18 men was investigated and was found to be constant within the limits of chance error, whether they were working 49, 53, or 64 hours per week. For instance, on changing from a 49½-hour to a 64-hour week, the hourly output during three consecutive weeks was 100, 102, and 101 on that of the preceding weeks taken as

100. Again, when the 20 operatives of a permanent night shift had their hours increased from $47\frac{1}{2}$ to $53\frac{1}{2}$ for one week, and then to 67 hours for two weeks, their output was 99, 97, and 96 in the 3 weeks respectively, that of the preceding weeks being taken as 100. There can be little doubt, therefore, that these operatives could have worked longer weekly hours than 64 or 67 without greatly diminishing their hourly output, and so have attained a greater total output. This conclusion is strongly supported by the data for youths which are now to be recorded.

23. The youths, 15 to 18 years of age, were engaged in boring out the top caps of fuses by means of semiautomatic machines. About four times a minute they unclamped one cap and clamped in another, these two clampings together occupying less than two seconds. For the rest of the time they stood at their machines doing nothing. From the average data recorded in Table IX, which concern the output of 17 operatives, it will be seen that before Christmas they averaged 75.6 hours per week of actual work out of the $78\frac{1}{2}$ nominal hours. In the 6 weeks after Christmas their hourly output went up 6 per cent, but in that they averaged 4.7 hours a week less than before, their total output was slightly diminished. The output of the week February 14-20 is omitted, as there was a shortage of material, but in the next 8 weeks, when the average hours were reduced to 59.4 per week, the output rose another 2 per cent. This rise by no means compensated for the considerable reduction in working hours, so we find that the total weekly output was actually 15 per cent less than in the pre-Christmas period.

TABLE IX.—SEVENTEEN YOUTHS BORING TOP CAPS.

Statistical period.	Average hours of actual work.	Average hours of broken time.	Average (relative) hourly output.	Hours multiplied by output.
5 weeks preceding Christmas (Nov. 15-Dec. 19).....	75.6	2.9	100	7,560
2 weeks at Christmas.....	50.0	2.7	106	.....
6 weeks after Christmas (Jan. 3-Feb. 13).....	70.9	4.6	106	7,515
8 weeks later (Feb. 21-Apr. 16).....	59.4	4.4	108	6,415
2 weeks at Easter (Apr. 17-30).....	40.8	4.6	95	.....

24. It seems probable, therefore, that to attain maximum output 70 hours or more per week of this light labor must be worked. It will be seen from the table that when the operatives were working over 70 hours per week their broken time was not excessive. Moreover, they put in only 2 per cent of short weeks and 3.6 per cent of absent weeks on an average, so the long hours did not appear to affect their health.

COMPARISON OF RESULTS.

25. The various types of labor investigated may conveniently be divided into five, viz, very heavy, heavy, moderately heavy, light, and very light. Of these types the "very heavy," such as sizing fuse bodies, and the "heavy," such as boring the powder chamber, are not well suited to women. On the other hand, the "light" type, such as boring top caps and rough-turning 3-inch shells, had better be confined to women, as it is waste of muscle to appropriate them to men, or even to youths. Very light types of labor such as sedentary gauging operations should evidently be confined to women and girls.

26. We have seen that for men engaged in the very heavy labor of sizing fuse bodies the maximum hours of actual work appeared to be 56 or less per week for men engaged in boring the powder chamber and in turning and finishing shells they were probably 60 or rather more, whilst for men rough-turning shells and for youths boring top caps they were probably 70 or even more. On the other hand, for women engaged in the moderately heavy labor of turning fuse bodies the maximum hours were 56 or less, whilst for women on the light labor of milling a screw thread they were rather over 60 hours. In so far as time keeping is a criterion, women and girls on the very light work of gauging fuses appeared to stand even 76 hours fairly well, but it is more than likely that their actual output was little, if any, greater than when they were working 64 hours, and so it is probable that this figure should be regarded as their maximum.

27. It must be realized that all of these data are provisional, but they clearly justify the conclusion that the hours of labor should be varied between wide limits according to the character of the work performed. This obvious fact is not realized by many managers of munition works, and the tendency is usually toward uniformity of hours for all types of labor and for workers of both sexes. The data adduced suggest that not only are women unsuited to the heavier types of work, but that even when engaged on the moderate and light types they are unable to stand such long hours as the men. Several sets of operatives, both male and female, were kept under close observation for many days in order that their powers of application might be investigated. Men engaged in boring the powder chamber and in turning and finishing shells were found, almost without exception, to stick to their work with admirable persistence, and it was very seldom that they rested even for a minute. On the other hand, women engaged in turning fuse bodies rested for times which in aggregate amounted to $1\frac{1}{2}$ hours out of the 12-hour day, and over an hour out of the 10-hour day, in addi-

tion to the hour or so of compulsory rest required for attention to their lathes at the hands of the tool-setters. About half an hour of the voluntary rest pauses occurred on starting and stopping work, but much of the remaining hour or half hour was probably due, not to idleness on the part of the women, but to fatigue, and to an instinctive knowledge that short rest pauses helped to prevent undue fatigue. Still, it would have been better if these pauses and the times lost in starting and stopping had been curtailed by, e. g., half an hour a day, and the women had been permitted a corresponding reduction in their weekly hours of labor.

28. It is to be borne in mind that all of the times mentioned are the maximum hours of actual work, supposing that a maximum output is required regardless of cost production. They necessarily impose a great strain on the operatives, and there can be no doubt that in many instances the strain was too great to be borne, and that the operatives had to drop out altogether. That is to say, the data quoted relate to the fittest who were strong enough to survive in the struggle, and not to the general mass of workers of all classes who tried their hand at munition work. It is almost impossible to discover the extent of this weeding out, but it is inevitably considerable. Hence the best hours of work, suited for peace times, are in every case considerably shorter than those mentioned, though the principle of graduating the number of hours of labor to the type of work performed still holds with undiminished force.

FURTHER POINTS FOR CONSIDERATION.

29. Though stern necessity may compel long hours of labor on the part of many munition workers, it is evident that, provided maximum output is maintained, the shorter the times for which they are shut up in the factories the better their chances of health and happiness. Hence everything possible should be done to speed up the rate of production so far as this can be done without making an extra call upon the physical energies of the operatives. Though I have no intention on the present occasion of discussing the matter in detail, I wish to suggest two simple plans of appreciably increasing the rate of production. The first depends on greater promptness in starting work. A few concrete instances will bring home the importance of this point, at least in some munition factories. In most works the motive power is electric, and in some the power supplied to each section is registered by a separate wattmeter. The machinery is started running shortly before work begins, and as the operatives get going, one after another, the power consumption steadily rises to a maximum, which is attained when all the operatives have started. By means of these power records the rate of

starting and stopping work can readily be ascertained in many instances, though not in factories where time is spent in preliminary collection of necessary tools and material, and in their adjustment. The accompanying figure [figure not reproduced] records the increments of electric power over that required to drive the free-running machinery, on starting and stopping the afternoon spell of work. The continuous line represents the power supplied to a large shell shop which turned out 30,000 3-inch schrapnel shells per week. We see that the power supplied started mounting up 2 minutes after starting time, and reached half its full value in 4 minutes. The dotted-line curve, representing the power supplied to a section of 200 women turning fuse bodies, did not begin to rise till 5 minutes after starting time, and did not attain half its maximum value until 11 minutes after starting time. In other words, the operatives wasted about 7 minutes more in starting than did the operatives in the shell shop, most of whom were men. On the other hand, the fuse-turners finished more strongly than the shell-shop operatives, as can be seen by comparing the two curves given on the right side of the figure, and it was found that both sets of operatives lost, on an average, about the same aggregate of time in starting and finishing during the course of the whole day, viz, 3½ minutes. The shell-shop operatives did not start much more promptly than the fuse turners in the morning, partly because there was more delay in the arrival of their material, but in spite of this, if the operatives of both shops had started equally promptly, and finished equally strongly, 9 minutes out of the 3½ would have been saved. There was no inherent reason why work should have been started promptly in one shop and not in the other. It was merely a custom of the particular shop, and even then the custom was not a fixed one. A series of meter readings of the women's section were taken for several days before and after the Easter holiday, and 9 days before the holiday the average amount of time wasted in starting after dinner was found to be 11 minutes; 2 days before it was 14 minutes. Two days after the holiday it was 16 minutes; 3 days after it was 15 minutes; and 5 days after it was 12 minutes. That is to say, it increased with the slackness of the operatives caused by the immediate approach of the holiday, and still more with their post-holiday lassitude.

30. There can be no necessity for the waste even of 25 minutes in starting and finishing work. Ten or 15 minutes should be ample allowance, and the 20 minutes thereby saved could be deducted from working hours without any reduction of output. At one large works the manager informed me that he made a point of going into the various shops at starting time and seeing that the operatives began work promptly. In this way a considerable amount of time was saved.

31. The other method of speeding up production on which I wish to lay stress has already been referred to in an earlier memorandum (No. 7). It consists in the regulation of rest pauses. The custom in many munition works is for the operatives to work for a spell of five hours, and then, after an hour's interval, for another spell of $4\frac{1}{2}$ to 5 hours. Such spells are undoubtedly too long in many types of munition work, but if a second break is introduced in the working day much extra time is lost in starting and stopping work. If the operatives are left to themselves they take rests at irregular and often unsuitable times. Hence it would be much better if the rest pauses were chosen for them. For instance, a 10-minute break in the middle of the morning and afternoon spells, during which the operatives remain at their machines, but take tea or other nutriment brought them by boys or by traveling canteens, has been found a valuable aid to output in some munition works. Some types of work need longer and more frequent rest pauses than others, and the best times can be determined only by experiment. After being fixed they should be made compulsory and rest pauses at other times be checked so far as possible.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*

AUGUST, 1916.

INDUSTRIAL FATIGUE AND ITS CAUSES.

[Memorandum No. 7.]

DEFINITION AND CAUSATION OF FATIGUE.

1. Fatigue is the sum of the results of activity which show themselves in a diminished capacity for doing work.

In ordinary language fatigue is generally associated with familiar bodily sensations, and these sensations are often taken to be its measure. It is of vital importance for the proper study of industrial fatigue, however, to recognize not only that bodily sensations are a fallacious guide to the true state of fatigue which may be present, and a wholly inadequate measure of it, but also that fatigue in its true meaning advances progressively, and must be measurable at any stage by a diminished capacity for work, before its signs appear plainly, or at all, in sensation.

2. In the animal body the performance of work depends on the activities of parts which are best considered under three groups—first, the complex nervous mechanisms of the brain and spinal cord, which are concerned in the initiation and distribution of impulses to action; second, the nerves, which conduct the impulses to muscles; and third, the muscles themselves, which by contracting finally perform external work.

Fatigue has been separately studied in all these parts. In its essential features the fatigue of all alike has been found, when it occurs, to depend not upon the simple using up ("exhaustion") of the substances supplying the chemical energy which is liberated during work, but upon the accumulation within the living elements of the products of the chemical changes involved. Fatigue of the animal machine, that is to say, is not to be compared with the failure of fuel as in a steam engine or with the running down of a clock weight, but rather with the clogging of the wheels in some mechanism by dirt.

The chemical products of activity in the nervous and muscular elements are removed by the blood, in part directly by irrigation and in part indirectly through chemical changes in the tissue itself induced by constituents of the blood. Rest after activity is not a passive state, therefore, but is itself an active process, or a series of active processes, leading to a restoration of the normal capacity for work. Time is required for these, and the time taken will be in pro-

portion to the amount of restoration needed. There will be a definite relation accordingly between the degree of any given activity and the time necessary for the completion of the subsequent restoration process. If the activity is repeated too quickly to give time enough for restoration after each action, fatigue will become progressively more intense as the debit balance accumulates, and each repeated act in consequence will be more and more impeded and will become smaller, until further action is impossible.

Of the three groups of organs just mentioned, the nervous system, the nerves, and the muscles, particular chemical and structural characters will decide in each case what time relation must exist between action and the rest needed for complete repair. In the conducting nerve fibers fatigue may be said not to occur; it is unrecognizable probably because of the extreme rapidity with which recovery here follows the very small changes associated with activity. Of the other two groups, the initiating and distributing nervous mechanisms of the brain and spinal cord are more quickly fatigued than the contracting muscles, and the important result follows that in the animal body the impulses to activity springing from the brain can not bring the muscles far toward complete fatigue before their sources are themselves fatigued and impotent. Even beyond that point, when the central nerve cells are inactive, impulses artificially sent, in experiment, along the indefatigable nerve fibers will still fail to produce more than partial fatigue in the muscles, for fatigue advances faster still in certain structures known as the end organs, which connect nerve fiber and muscle; there the impulses become blocked so that the muscle again escapes from further activity.

In the tired man the symptoms of fatigue are referred to the muscles; they ache, or they may appear to "give way under him," but in reality the most severe bodily activity fails to produce any close approach to complete fatigue of the muscles. The fatigue is fatigue of the nervous system, though in sensation its effects may be referred to the muscles themselves. A hunted animal may be driven to intense muscular fatigue, but in this extreme case the blood becomes charged with chemical products of activity, for the elimination of which no opportunity is given, and the muscles, with every other organ of the body, become poisoned. Even in laborious work it is doubtful whether a man by voluntary effort can cause his muscles to approach advanced fatigue. It is well known that a man apparently "run to a standstill" in a race may upon some new excitement run freshly again, under augmented stimulus from the nervous system, initiated there perhaps in part along new paths.

The problems then of industrial fatigue are primarily and almost wholly problems of fatigue in the nervous system and of its direct and indirect effects.

THE RHYTHM OF ACTION AND REST.

3. The necessary time relation between an action and the recovery from it in rest has been mentioned already. For every acting element a given rhythm of activity will allow exact recovery after each act, and will maintain the balance between action and repair throughout a long series. The heart, for instance, in alternating contraction and relaxation, may continue to beat incessantly through the life of a man without any accumulated fatigue for 70 years or more. Among the great variety of nerve centers there will be found a great variety in these time relations. Some may allow a relatively rapid rhythm, as in the act of breathing, where the rhythm, which is a nervous rhythm, may be almost incessant for years, while at the other end of the scale there are slower rhythms like those shown in the need for diurnal sleep.

In connection with this natural pace of the animal machine, to and fro, from action to rest, reference must be made to the wide adaptability of the animal mechanisms, and especially to that of the nervous system, in response to training and use. Complicated coordinations in the nervous system, at first easily fatigued, may by training, and, as it seems, by some improvement in the routes of connection due to the increase of traffic itself, become capable of maximum efficiency at a more rapid rhythm. A man will swing each leg, weighted with a heavy boot, as in walking, for 10,000 times in an unbroken march without notable fatigue, but he can not as an impromptu exercise raise his lightly weighted finger for more than a few score times at no faster rate before the movement comes to complete standstill.

4. The problem of scientific industrial management, dealing as it must with the human machine, is fundamentally a problem in industrial fatigue. The rhythms of industrial conditions, given by the hours of labor, the pace of machinery or that of fellow workers, or otherwise, are imposed upon the acting bodily mechanisms from outside. If these are faster than the natural rhythms, they must give accumulated fatigue, and cause an increasing debit, shown in a diminished capacity for work. It is therefore the problem of scientific management to discover in the interests of output and of the maintained health of the workers what are the "maximal efficiency rhythms" for the various faculties of the human machine. These must be determined by the organized collection of experience or by direct experiment. They must be separately determined, moreover, not only for the performance of relatively simple muscular movements, all of which depend on the action of "lower" nervous centers, but also for the "higher" coordinating centers, and for both of these the natural rhythms must be studied for the best arrange-

ment of short spells, and again for that of the hours of shifts, of the periods of sleep, and, at the last point of the scale, of holidays.

SIGNS AND SYMPTOMS OF FATIGUE.

5. It must be repeated that the subjective sensations of fatigue are not a measure, or even an early sign, of it. Real or objective fatigue is shown and is measurable by the diminished capacity for performing the act that caused it.

6. *Bodily fatigue*.—Fatigue following muscular employment is primarily nervous fatigue, as explained already, and we have seen that no advanced degree of muscular fatigue as such can be obtained by voluntary action, for fatigue in the nervous system outstrips in its onset fatigue in the muscles. In accustomed actions, however, as in walking or digging, where there has been habituation, the activity may be so prolonged without great nervous fatigue as to give approaching "exhaustion"—that is, notable loss of chemical substance—in the muscles. Industrial work is habitual work, but the case in which muscular labor is so intense and prolonged as to give exhaustion in this sense need not be considered here, nor the causation of the special symptoms which arise. It must be noted, however, that practically the whole of the mechanical energy and heat yielded by the body during work comes from the chemical energy stored in the muscles. In proportion as this store is called upon, and quite apart from the question of fatigue, it must be made good by supplies from the blood and ultimately from the food. Practically the whole of the energy transformed in the muscles is derived from carbohydrate material, and the importance of this in relation to the diet of workers is discussed in Memorandum No. 3.¹

For work in which severe muscular effort is required it seems probable that the maximum output over the day's work and the best conditions for the workers' comfort and maintained health will be secured by giving short spells of strenuous activity broken by longer spells of rest, the time ratio of rest to action being here, for maximal efficiency, greater than that for the employments in which nervous activity is more prominent or more complicated than in the processes involved during familiar muscular work.² This difference may be connected directly with the greater bulk of chemical material which must be mobilized when, as in severe muscular exercise, so large a

¹ Reprinted in Bulletin No. 222.

² This point is one of incessant practical interest in many industries, and it may be noted that it has an immediate bearing upon the routine proper for rapid trench digging. Two officers at the front recently, for a friendly wager, competed in making equal lengths of a certain trench, each with an equal squad of men. One let his men work as they pleased, but as hard as possible. The other divided his men into three sets, to work in rotation, each set digging their hardest for 5 minutes and then resting for 10, till their spell of labor came again. The latter team won easily. The problem here gives another obvious opening for scientific organization based on the results of experiment.

proportion of the whole body mass is engaged in the chemical events involved in movement and doing work; but further scientific study is needed here.

7. *Nervous and mental fatigue.*—It is under this head, as we have seen, that the special problems of industrial fatigue arise. The signs and symptoms of the fatigue will depend upon the nature of the particular work done, whether it be general bodily work of this or that kind, carried out in fixed routine, or whether it involve mental activity of a simple or of a more complicated kind. The fatigue may spring from the maintained use of intelligence and observation with varying degrees of the muscular effort necessary in every kind of work, or from the maintenance of steady attention upon one skilled task, or of distributed attention, as when several machines are to be tended or other manipulations performed; or, again, it may depend upon the continued use of special senses and sense organs in discrimination, whether by touch or sight. It will be affected greatly according to whether the worker has opportunity for obeying his natural rhythms, or whether unnatural rhythm is imposed upon him by the pace of the machine with which he works or by that of his fellow workmen. Considerations so inexplicable at present in terms of physiology as to be called “psychological” will also arise; if the work is of a “worrying” or “fussy” kind, with a multiplicity, that is to say, of imposed and irregular rhythms, fatigue will be more rapid, perhaps on account of the more numerous and “higher” nervous centers which become implicated.

Monotonous work—and much industrial work is monotonous—offers some special problems. It has been seen that uniformly repeated acts tend to become in a sense “automatic,” and that the nerve centers concerned become less liable to fatigue—the time ratio of necessary rest to action is diminished. But when monotonous series are repeated, fatigue may appear in what may be called the psychical field, and a sense of “monotony” may diminish the capacity for work. This is analogous to, if it does not represent, a fatigue process in unrecognized nervous centers. Conversely, “interest” may improve the working capacity even for a uniform monotonous activity, and the interest may spring from emotional states, or, as some think, from states of anticipatory pleasure before mealtime and rest (“end spurt”), or again, from a sense of patriotism eager to forward the munitions output.

It may be remarked that mental processes, like those involved, for instance, in adding up figures, may be maintained for very long periods—subject to the needs of change of posture and of diurnal sleep—with no great loss of capacity, that is, without marked fatigue in that particular process. Such diminution of capacity as occurs, and the sense of fatigue that is felt subjectively by common expe-

rience in such a task, appear to be due to "monotony," and to be removable by means of "interest."

8. For practical purposes in industrial management two chief characters of nervous fatigue must be observed. First, during the continued performance of work the objective results of nervous fatigue precede in their onset the subjective symptoms of fatigue. Without obvious sign and without his knowing it himself, a man's capacity for work may diminish owing to his unrecognized fatigue. His time beyond a certain point then begins to be uneconomically spent, and it is for scientific management to determine this point, and to determine further the arrangement of periods of rest in relation to spells of work that will give the best development over the day and the year of the worker's capacity. Second, the results of fatigue which advances beyond physiological limits ("overstrain") not only reduce capacity at the moment, but do damage of a more permanent kind which will affect capacity for periods far beyond the next normal period of rest. It will plainly be uneconomical to allow this damage to be done.

For these reasons, chief among others, it will be important to detect latent fatigue, and since sensations of fatigue are unpunctual and untrustworthy, means must be sought of observing the onset of fatigue objectively.

TESTS OF INDUSTRIAL FATIGUE.

(a) OUTPUT.

9. The true sign of fatigue is diminished capacity, and it follows from what has been said that measurement of output in work will give the most direct test of fatigue.

The output must be measured under the ordinary conditions of the work, and, in cases where from the nature of the work the output is not automatically measured, it must be tested by methods which do not allow the workers to be conscious at particular times of the test being made. In this way the errors due to special effort from interest or emulation will be eliminated. The results of work expressed in output must be corrected by allowance for all variable factors save that of the workers' changing capacity; changes in supply of steam or electric power and of raw material, for instance, must be determined for the correction and interpretation of the actual output returns. The output must be estimated for successive short periods (e. g., each hour) of the day's work, so that the phenomena of "beginning spurt" and "end spurt" and other variations complicating the course of fatigue as such, may be traced and taken into account. Isolated tests of output taken sporadically will be meaningless. The records must also extend over longer periods to show the onset of

fatigue over the whole day and over the whole week, and under particular seasonal or other conditions, in order to detect and measure the results of accumulating fatigue.

10. Measurements of output must obviously be recorded at so much for each individual or for each unit group. The size of total output will be meaningless, of course, without reference to the numbers engaged. But it will also be important for proper management to take account of the output of particular individuals. This in many factory processes is easily possible, and when it has been done the results have shown surprising variations of individual output which are independent of personal willingness and industry and have generally been quite unsuspected by the workers and their supervisors before the test was made. Information so gained is valuable in two respects. Good individual output is often the result of escape from fatigue by conscious or unconscious adoption of particular habits of manipulation or of rhythm. Its discovery allows the propagation of good method among the other workers. In the second place, these tests of individual capacity (or its loss by fatigue) give an opportunity for a rearrangement of workers and their assignment to particular processes of work. Astonishing results, bringing advantage both to employers and employed, have been gained in other countries by the careful selection of individuals for particular tasks, based not upon the impressions of foremen but upon the results of experiment.¹

11. If the proper adaptation to particular kinds of labor of the relations of spells or shifts of work to rest intervals and to holidays is to be determined, as it can alone be, by appeal to experiment, it will, of course, be an essential condition for success that the workers should cooperate with the employing management and give their highest voluntary efforts toward the maximum output during the spells of work. It is not surprising that where employers, following tradition rather than experiment, have disobeyed physiological law in the supposed interests of gain—and for a century this has been almost universal—the workers have themselves fallen very commonly into a tradition of working below their best during their spells of labor. In so far as hours of work in excess of those suitable for maximal efficiency have been imposed during the last two or three generations of modern industry upon the workers a tradition of slowed labor

¹ In certain special directions, and with special regard to munition work, the committee are causing some experimental observations to be made for their guidance. The services of Mr. Sargent Florence, working on behalf of the Medical Research Committee (National Health Insurance), have been placed at the disposal of this committee, and he is engaged in studying particular features of output under special conditions of labor at particular factories. In this work he has enjoyed the cordial cooperation of the manufacturing firms concerned, and to these the committee would offer their grateful acknowledgments. The committee propose later to make appropriate use of the results of these investigations.

must necessarily have arisen, probably in large part automatically, as a kind of physiological self-protection. Without some conscious or unconscious slackening of effort indeed during working hours of improper length in the past, the output might have been even more unfavorable than we know it to have been for the hours of work consumed.

It has happened, moreover, that, rightly or wrongly, a suspicion has grown up among workers that any device for increasing output will be used for the profit of the employer rather than for the increased health and comfort of the workers. It would be out of place here to touch on the economic and social problems which arise in this connection, but until such solutions are found for them as will bring a hearty cooperation between employers and employed, in the task of finding the optimum condition of work for the benefit of both, there will be no certain prospect of determining the true physiological methods for getting the best results in modern industrial occupations.

The committee believe that in the present time of crisis patriotic incentive has done much to abolish customary reduction of effort among munition workers, but it is of great importance to note that a special and strenuous voluntary effort in labor, if it be maintained under a badly arranged time-table of work and rest, does not necessarily bring increased output over a long period, however praiseworthy the intention of effort may be. Under wrong conditions of work, with excessive overtime, it is to be expected indeed that some deliberate "slacking" of the workers might actually give an improvement of output over a period of some length by sparing wasteful fatigue, just as the "nursing" of a boat crew over part of a long course may improve their performance. It can not in such circumstances be said that a workman so restraining himself, consciously or unconsciously, is doing more to damage the output on the whole than the employer who has arranged over-long hours of work on the baseless assumption that long hours mean high output.¹

In a specific instance before the committee, a group of five male voluntary Sunday workers in a certain munitions factory were able in 8 hours (or 7 hours free of meals) to exceed the average days' output of eight week-day men, who work 14 hours (or 12½ hours free of meals). These five men worked, no doubt, at a "sprint," which could not perhaps have been maintained daily. But there

¹ It is said that women workers now engaged upon munitions have no customary usages of sparing themselves, and that the weekly output per woman often exceeds that per man. The experienced manager of a large shell factory employing 1,200 men and 1,500 women expressed his confidence that the three 8-hour shift system gives better output and maintains better health than that of two 12-hour shifts. He is "satisfied that there is a period of slacking, often quite unconscious, during a 12-hour shift which is detrimental to output." Investigation elsewhere suggests, however, that the output for the long shift might be even worse without this unconscious restraint.

can be little doubt that they could repeat their eight hours' effort on, say, four days in a week; and, if so, the startling result follows that they could do in those four days rather more than the whole week's work of an equal set of men adopting the other system of hours. With this, moreover, they could enjoy not only longer nights and more recreation time in each working-day, but could also have three whole holidays in the week. Would these five volunteers be "slackers" if they did a full week's work judged by the 14-hour standard, or more, but had three holidays a week (available perhaps for a change of work) and slept longer at night? It is impossible to resist the conclusion that the paid week-day workers at this factory, who have been working their long hours for many months, might have greatly improved both their output and their comfort under a better chosen system of special efforts alternating with suitable rests. The work in question was work of a uniform "repetitive" kind, involving moderate physical exertion.

At another large factory the manager is considering closely the problems raised here. He is proposing to aim at "sprint," and hopes to get the same output from 7½ hours' work as from the present 10½ hours' work. He instituted a competition as to which shift and which group of men could do most as an experiment. He found that a small bonus "increased the output of a group of boys 120 per cent."

At one long-established factory a new shop has been built and staffed so as to produce 5,000 of a particular stock article of warfare per week, that estimate being based upon the results of the older shops doing the same work. New hands were engaged, and these in the new shop are now, after six months, producing in spite of their inexperience not only 5,000, as expected, but 13,000 of these articles per week. The older hands in the other shops do not approach this output, though all the mechanical conditions of work are practically equal. As patriotic interest in their output appears to be shared here by all the men alike, the lower output by the more experienced hands appears to be assignable only to the effects of long-standing customary restrictions upon habits or rhythm of work from which the newer hands are free.

In addition to the direct measurement of output certain secondary symptoms of fatigue may be studied usefully as its index.

(b) ACCIDENTS AND SPOILED WORK.

12. An important and early sign of fatigue in the nervous centers is a want of coordination and failure in the power of concentration. This may not be subjectively realized but may be shown objectively in an increased frequency of trifling accidents. The accidents are due to momentary loss of attention and may result in personal damage to the worker, trifling or serious, breakages of tools or materials, or the spoiling of work. In well-managed factories the incidence of accidents of this kind is recorded for unit periods throughout the day, and these records may provide a good secondary index to fatigue, but only in so far as they are corrected by reference to the rate of work being done and other variables. Results of the use of this method by Mr. Sargant Florence have recently been published in the report made to the British Association at Manchester in last September, but at present these results lack the necessary parallel determinations of rate of output and other factors for their correction.

(c) ASSOCIATED FATIGUE AND LABORATORY TESTS.

The primary sign of fatigue in a given function is diminished capacity. But there is evidence to show that accumulated fatigue in connection with a given act may affect adversely the condition of other parts of the nervous system not immediately employed. There is little experimental knowledge, however, as to whether this effect, shown in associated fatigue, is more direct and definite in kind than the effect upon general health to be mentioned below. The appearance of associated fatigue will need for its detection and study the application of special tests, involving the use of suitable apparatus and laboratory accommodation. The committee are causing some observations of this kind to be made, and the results of these will be the subject of a later report if it appears desirable.

It should be remembered, however, that experiments of this kind will have no validity unless the fallacies due to emotions and ideas, such as a sense of novelty, interest in the desired result, anticipation of release from experiment, unconscious suggestion by the observer, and so on, are eliminated by the most rigid attention to experimental conditions and by long series of control observations. The objects of experimentation must be trained for the purpose, and it is unlikely that tests of this kind will offer results of sufficient value to justify the special education of teams of selected workers for the prolonged studies which the method demands.

Prof. Stanley Kent has communicated recently to the Home Office¹ the results of some preliminary experiments in this connection. He has inquired whether fatigue due to industrial work shows its effects in associated changes of nervous functions not directly employed in it, as, for instance, in diminishing the quickness of response to signals, in blunting the acuity of hearing, or the acuity of vision, or in lowering other nervous functions. His general findings are sufficient to show that these indirect associated results of fatigue provide no regular and trustworthy index of the primary fatigue. They give indications, but irregularly in some cases and not at all in others, that the general "tone" of the nervous system is depreciated after a day's work, and declines also during a week's work.

(d) SICKNESS, LOST TIME, AND "STALENESS."

13. The accumulated results of fatigue are damaging to general health, and they will be reflected in the sickness returns and in the returns of lost time. Many problems arise here which can not be discussed in detail,² and they are complicated by the influence of other factors, which will be discussed in the following section. Without

¹ Interim report on an investigation of industrial fatigue by physiological methods (Cd. 8056). Price 4½d. (9 cents).

² Further reference is made to this subject in the committee memorandum on sickness and injury.

complete analysis of other variables, sickness returns will be only an indirect guide in the study of fatigue as such.

14. Reference must be made here, however, to a pronounced and common symptom of industrial fatigue, which appears to be the reflection in the workman's general health and "spirits" of the results of accumulated nervous fatigue rather than a direct or measurable sign of it. At the present time in very many munition factories the complaint is made by workers, and not least by the most intelligent and willing of them, that they are feeling "done up," or "fair whacked," to use local phrases, and the evidence shows that this state of "staleness" is becoming increasingly common and obvious. By experienced managers and medical officers this condition of staleness is attributed almost wholly to persistent long hours and the deprivation of weekly rest. It has grave accompaniments, which paradoxically appear not only in a state of lethargy and indifference, but also in a craving for change and excitement. No doubt the restlessness of the condition must often predispose also to indulgence in the alleviations given by alcohol. At all points the state is apt to set up a vicious circle in which the very need for change and rest prevents the proper use of such chances of rest as are given.

The following is typical of many reports made to the committee:

The works manager who showed me round had worked 361 days out of 365, and looked worn. He would welcome Sunday holidays. A skilled toolmaker had had eight days' holidays—including one for a funeral—since the war began (14 months). He complained of the strain on his nerves.

The officials of a very large trade-union said that overtime was generally considered to be excessive. The most skilled workmen were becoming nervy.

Proper attention earlier in the war to the need for weekly rest would have prevented a large part of the diminished capacity of this kind that has been allowed to appear and would have averted much costly and wasteful expenditure upon imperfect work. But stress must be laid here on a further point. For the avoidance of staleness in conditions of strenuous labor it is not enough to treat workmen in the bulk and to regulate daily and weekly rests upon a physiological basis devised for the average. If that be done, widespread evils like those too commonly present now may be avoided, but good management will consider always the individual workman as well. The committee have no doubt that in very many cases—perhaps in almost all—in which staleness is well marked or has even advanced to definite sickness, a single "day off," given occasionally at the right time, would have avoided much wasteful reduction of capacity and in the worst cases the total loss of many days of work.

THE STUDY OF INDUSTRIAL FATIGUE. .

15. By studies of industrial fatigue measured by tests of individual output a large body of valuable information has already been gained in various countries, and its application wherever management is scientific has become a commonplace of administration.¹ It must be admitted, however, that in England—and, no doubt, to the detriment of both health and wealth—management based upon the experimental science of industrial fatigue is far less common than in the factories and business concerns of America and of Germany. The committee, in their memorandum (No. 5) upon hours of work, paragraph 7, have already pointed to the surprising uncertainty commonly found in this country, even where professional knowledge is to be expected, with regard to the proper solution of some of the most elementary practical problems of labor management.

16. In the rapid enlargement and organization of munition factories in this country there has been, and is, the most urgent need for the application of the results of experience scientifically acquired. Upon a sudden national emergency the accumulation of fatigue and its results in workers might well be temporarily disregarded, but now, though the special need persists, the race is to be a long one, and a failure to conserve the maximum efficiency of the workers must be disadvantageous. Misguided efforts to stimulate workers to feverish activity in the supposed interests of the country are likely to be as damaging to the desired result as the cheers of partisans would be if they encouraged a long-distance runner to a futile sprint early in his race.

Even during the urgent claims of a war the problem must always be to obtain the maximum output from the individual worker which is compatible with the maintenance of his health. In war time the workmen will be willing, as they are showing in so many directions, to forego comfort and to work nearer the margin of accumulating fatigue than in time of peace, but the country can not afford the extravagance of paying for work done during incapacity from fatigue just because so many hours are spent upon it² or the further extravagance of urging armies of workmen toward relative incapacity by neglect of physiological law.

The committee have found many isolated instances in which the onset of industrial fatigue has been avoided by intelligent observa-

¹ References to published work may be found conveniently in *Fatigue and Efficiency*, by Josephine Goldmark, New York, 1913 (3d ed.), and in the interim report to the British Association (Manchester, 1915) by the committee upon the question of fatigue from the economic standpoint.

² On the question of Sunday work by exhausted men, one foreman said he did not believe in "a holiday on double pay." Another remarked that Sunday work gave "six days' output for seven days' work on eight days' pay."

tion of the output and of the returns of sickness and of lost time, and by prompt initiative in adapting the hours of work to physiological need; but these instances are exceptional. Taking the country as a whole, the committee are bound to record their impression that the munition workers in general have been allowed to reach a state of reduced efficiency and lowered health which might have been avoided without reduction of output by attention to the details of daily and weekly rests. The signs of fatigue are even more noticeable in the case of the managers and foremen, and their practical results are probably more serious than in the case of the workmen.

Examples may be given of the value of intelligent management:

At a large shell-making factory the men for the early months of war worked seven 12-hour day and seven 12-hour night shifts in the week. More recently Sunday work has been stopped (or at least every man has a weekly day of rest), and the men work from 6 a. m. to 7.30 p. m., with half an hour for breakfast and an hour for dinner, tea being brought to the men by the boys while the machinery is running. These hours are long, but, as a result of improvements in organization, they now produce an increased number of shells from half the number of workers. The manager here "attaches the greatest importance to the week-end rests."

At another large munitions factory men engaged in the heavy work of molding are required by the management to rest 15 minutes in every hour of work. The manager was satisfied that this was an arrangement good for the men and for the output. But the men objected to this long spell of rest in each hour because the work was piecework, and they thought the production would be lessened by it. The manager accordingly found it necessary to set a foreman to watch and to make the hourly rest compulsory. When this was done the output per hour was found to be actually increased.

At another munitions factory the committee learned that the manager had given a break of 15 minutes daily at 11 a. m. to girls engaged in sedentary work of a monotonous repetitive kind. During the break the girls had recreation in the open air. In spite of this deduction from their working hours of the time so spent, the output per day was increased.

17. The problems of industrial fatigue, already soluble in part by reference to an available body of knowledge well known and used in other countries, have become acute during the great recent development of the munitions industries of Great Britain. It is not too much perhaps to hope that the study of industrial fatigue and the science of management based upon it, which is now being forced into notice by immediate need, may leave lasting results to benefit the industries of the country during succeeding years of peace.

Our national experience in modern industry is longer than that of any other people. It has shown clearly enough that false ideas of economic gain, blind to physiological law, must lead, as they led through the nineteenth century, to vast national loss and suffering.

60 HOURS, FATIGUE, ETC., IN BRITISH MUNITION FACTORIES.

It is certain that unless our industrial life is to be guided in the future by the application of physiological science to the details of its management, it can not hope to maintain its position hereafter among some of its foreign rivals, who already in that respect have gained a present advantage.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*

JANUARY, 1916.

NOTE.

Several other important studies of industrial fatigue were published during 1915 and 1916 in Great Britain, and it is understood that the results of all of these studies were available to the committee and that its own report on industrial fatigue may be regarded as a summing up of these various studies of fatigue and its own studies of hours of labor. The studies referred to are the following:

"Interim Report on an Investigation of Industrial Fatigue by Physiological Methods"; by A. F. Stanley Kent, M. A., D. Sc., Professor of Physiology in the University of Bristol. Great Britain, Home Office, London, 1915. 34 pp.

"Second Interim Report on an Investigation of Industrial Fatigue by Physiological Methods"; by A. F. Stanley Kent, M. A., D. Sc., Professor of Physiology in the University of Bristol. Great Britain, Home Office, London, 1916. 76 pp., 18 charts.

"The Question of Fatigue from the Economic Standpoint." Interim Report of the Committee, British Association for the Advancement of Science. Manchester, 1915. 67 pp.

"The Question of Fatigue from the Economic Standpoint." Second Interim Report of the Committee, British Association for the Advancement of Science. Newcastle, 1916. 24 pp.

These various reports were summarized in an article entitled, "Some New Studies of Industrial Fatigue," in the December, 1916, issue of the Monthly Review of the United States Bureau of Labor Statistics, page 97.

SICKNESS AND INJURY.

[Memorandum No. 10.]

INTRODUCTION.

1. The effect of industrial occupation upon the health of the worker has been a subject of medical investigation since the seventeenth century. Early in the nineteenth century similar inquiries were instituted in England, and in 1831 Thackrah showed that the environment and conditions of factory life, or the mental and physical strain entailed, were associated with exceptional disablement, disease, or mortality among the persons employed. Numerous commissions have been appointed by the Government to ascertain more precisely the exact causes of such effects, and these have considered successively the general circumstances of the worker, the injurious influences of the factory system, the special conditions of certain occupations, the risks incurred in the use of machinery, and the results arising among those employed in dangerous trades. Thus has been accumulated a vast body of medical experience, growing with the growth of industry and with the increase of our knowledge of the causes of disease. Concurrently with the appearance of evidence of a medical and social character further light has been thrown upon the subject by actuaries, insurance agents, and statisticians. As long ago as 1853, Finlaison, the actuary of the national debt, said that "the real practical difference in the distribution of sickness seems to turn upon the amount of expenditure of physical force," and 50 years later, in 1903, Watson, who had studied the subject from an actuarial point of view, wrote that "the proportion of members sick during any year varies with occupation." Again, the experience of insurance authorities confirms the same view. The report on national health insurance for 1913-14 states that "in many cases the rate of sickness is affected by occupations or by the conditions incidental to particular occupations." Lastly, there is the incontrovertible evidence furnished by the bills of mortality steadily accumulating in proof as the years pass. The decennial reports of the registrar general demonstrate that certain occupations have a high comparative mortality, that this mortality is due to well-defined and preventable diseases, that the occupation may exert a greater influence on mortality than the aggregation of population and its associated conditions, and that occupational mortality is affected by the age incidence of the worker.

SICKNESS AND ITS CAUSES.

2. Sickness due, directly or indirectly, to industrial occupation takes various forms and degrees, from a passing headache to serious organic disease of fatal issue. The lungs, the heart, the digestive organs, the nervous system, the muscular system—each or all may be affected, with results harmful both to industrial efficiency and output and to personal health and expectation of life. Moreover, it must be remembered that an undue proportion of sickness in any group of workers usually represents among those not actually sick, lessened vigor and activity, which can not fail to reduce output. Disabling conditions or influences which injure some have a tendency to mark all. It is desirable that employers and their workpeople should have a general appreciation of these injurious conditions in order to be on the outlook to guard against them or mitigate their evil effect. Speaking generally, attention should be given to the following points:

- (1) Excessively long hours of work, particularly by night, if continued, produce fatigue, irritation, and sickness. "You will find," wrote Sir James Paget, "that fatigue has a larger share in the promotion or permission of disease than any other single casual condition you can name." (See Memorandum No. 7 on "Industrial fatigue and its causes.")
- (2) Cramped and constrained attitudes or postures during work, which prevent the healthy action of lungs and heart.
- (3) Prolonged or excessive muscular strain—e. g., the lifting of heavy weights, prolonged standing—may produce rupture or varicose veins.
- (4) Machinery accidents. (See below.)
- (5) Working in unventilated or insufficiently ventilated workshops predisposes to disease and gravely interferes with individual energy and physical capacity. The effect of continuously working in a stagnant or polluted atmosphere is not trifling or insignificant.
- (6) The air, even if fresh, may be too hot or too cold, too humid or too dry; either extreme should be avoided to insure reasonable bodily comfort and the most efficient work.
- (7) Imperfect lighting, whether by day or night, conduces to eyestrain and headaches.
- (8) Working with or in the presence of gases, vapors, poisons, and irritating substances (e. g., "doping") may lead to direct poisoning.

- (9) Dust produced in certain industries, unless effectually safeguarded, may induce lung diseases.
- (10) The manufacture and use of high explosives involve risk to the workman.

While this seems to be a sufficiently formidable list of disabling conditions, or conditions which without proper care and precaution may readily become disabling, it does not complete the inventory. At least as important as any of these occupational influences, but inseparable from them, is the predisposition to disease arising from an absence of personal hygiene. The necessities of individual health are few and simple, but they are essential. Suitable and sufficient food, fresh air, warmth, moderation, and cleanliness in the ways and habits of life, the appropriate interrelation of work, repose, and recreation of mind and body—these are the laws of hygiene, the elements of vital importance, for which facilities must be provided if the maximum industrial output of the individual is to be secured and maintained. Hence arises the necessity for the management to consider these matters for the workpeople in their charge, in addition to the health supervision of the external circumstances of the factory and its technical processes.

INDICATIONS OF SICKNESS.

3. *The indications of sickness* in a factory fall into four groups of facts, which come before the management. First, there is absence, broken time, irregular timekeeping, or diminished output of the individual worker. Every case of lost time or absence calls for inquiry. It should be properly recorded. A study of such records is certain to disclose the existence of adverse influences or circumstances, to-day unsuspected, which may denote the beginning of sickness. Secondly, there are the ordinary signs of ill health, the listless or jaded worker, lassitude, headache, faintness, cough, vomiting, etc. Thirdly, there is the sickness register which should be kept in all well-organized factories. The keeping and examination of this register should be the duty of a duly authorized officer, possibly a trained nurse or welfare supervisor. Medical certificates should be required, correctly recorded and carefully examined. Week by week the management should scrutinize their chart of sickness returns and study their rise and fall. Only thus can they keep themselves informed on this vital matter. Lastly, there are the death certificates, few in number, but extremely important as indications of the health of the workers as a whole. In the past, when the supply of labor was plentiful, the necessity for a study of the influences which affect human efficiency may have escaped recognition, but to-day, when skilled-labor is scarce, the neces-

sity is obvious. To conserve energy and efficiency is *ceteris paribus* the way to improve output.

4. The subject of the sickness rate is perhaps the most important of these four signs of a significant amount of ill health among employees, and it may be well to give an example in illustration thereof. A well-known and typical munition works had some 14,000 employees in July, 1914. After the outbreak of war the number rapidly increased; by the end of the year it had doubled, and in March, 1915, the number employed was upwards of 36,000. The percentage of sickness in July was 2.9; in December it was 2.4; and in the first quarter of 1915 it exceeded 4 per cent, to some extent probably owing to seasonal causes. During the same period the accident rate also showed some increase. A recent inquiry showed that in two departments the sickness rate among men on overtime was 5.5 as against 3.7 among those on double shifts. In one of these departments among a body of nearly 1,000 men working overtime the sickness rate reached 8 per cent, the leading causes being probably the greater age of the workers, a 15-hour day, frequent Sunday work, and the special strain of the work. The medical officer of the works attributed the increase of sickness and injury in the factory as a whole to (*a*) a large increase of employees (many new hands), (*b*) overtime, with its attendant fatigue, and (*c*) night work. The principal forms which the sickness took in order of importance were medically reported as influenza, digestive diseases, bronchitis and bronchial catarrh, nasopharyngeal catarrh, rheumatism, nervous diseases and neuralgia, tonsillitis, myalgia, and skin diseases. In another large works the sickness rate had risen to 4 per cent and was still rising, and at a third it was 7 per cent.

METHODS OF REMEDY AND TREATMENT.

5. At the foundation of any sound system of dealing with industrial disease lie two elementary principles, viz, that prevention is better than cure, and that for treatment to be most effective it must deal with the beginnings of disease. Bearing this in mind the preliminary safeguard is to provide for the medical examination of all workers on their admission to the factory in order to secure as far as may be their initial physical fitness for employment. In some munition works this preliminary medical examination is the usual practice and has been found of the greatest advantage, and in special departments, danger zones, etc., there is a periodical medical inspection. Such a procedure forms a convenient opportunity for the inculcation of sound doctrine as to the extreme importance of personal hygiene, cleanliness, and healthy habits. Having thus made sure that the individual worker begins well, the management has two

further duties in the matter. First, they must reduce to a minimum any unfavorable conditions obtaining in their works—providing proper sanitary conditions and accommodations, safeguarding machinery, controlling hours of labor, furnishing canteen facilities, and securing sufficiently warmed, lighted, and ventilated workrooms; secondly, they must make arrangements for an adequate medical and nursing scheme. Medical attendance is obtainable under the national insurance system or may be made available by special provision of a medical and hospital service for the factory; but nursing can only be obtained by the appointment of one or more trained nurses to undertake duties in the factory for both day and night shifts. Such arrangements have been instituted in many munition works, particularly where women are employed and have proved of great value to employers and workers alike. The duties of a factory nurse may include (a) supervision of the health of the workers, (b) superintendence of the rest room for those who are temporarily indisposed, (c) following up cases of sickness at home, (d) taking charge of first-aid treatment of injuries, and (e) in the absence of medical advice observing and controlling in its initial stages any threatened outbreak of the influenza type of sickness, which, if it extends, may temporarily paralyze output. Wherever nurses have been appointed the committee have found that the scope of their services has extended in many useful directions and they have no hesitation in recommending such appointments.

INJURY.

6. It is a matter of common knowledge that a large number of accidents of great or less severity occur in factories, and particularly in the nontextile trades, metal, engineering, and shipbuilding works. In 1913 178,161 accidents were reported in factories and workshops in the United Kingdom. Moreover, only accidents of a certain degree of severity are reported. A somewhat formidable return of accidents must therefore be anticipated in munition factories, which include not only metal and engineering work but certain dangerous trades and the manufacture of explosives. Moreover, at the present time, the introduction of new labor, and of employees unaccustomed to the processes concerned, particularly in conjunction with the need for speed and pressure, overtime, and night work with the consequent fatigue, must inevitably lead to greater risk of accident. In view of these facts, the committee have not been surprised to learn of the occurrence of many injuries among munition workers. The injuries in a typical munition works are not only open wounds, contusions, and abrasions, injuries to the eye, sprains, simple and compound fracture, and injured limbs, but also scratches, cuts, burns,

and other minor injuries which may readily lead to more serious conditions by neglect. The slightest wound may become infected with germs, and a greater or less degree of sepsis or blood poisoning supervene, with a resultant serious loss of time and efficiency, and possibly even risk to life and limb. The committee have therefore had to consider the prompt treatment of minor injuries, as well as the prevention or treatment of more serious conditions. It is obvious that much can be done by adopting various methods of prevention, such as the proper and effective guarding of machinery, the adoption of safety appliances, the proper regulation of dangerous processes, the adequate lighting of the factory, and the more careful cleaning of machinery. But whatever means be adopted the avoidance of accidents must largely depend on the intelligent cooperation of operatives and foremen in the maintenance and use of the appliances provided, and the committee would be glad to see an extension of the practice of forming committees of workers intrusted with the duty of investigating every accident which occurs in their own work place. In spite, however, of the most perfect regulations and precautions accidents will happen, and the committee desire, whilst drawing attention to the importance of prevention, to emphasize also the pressing need for the provision of suitable means of treatment, and particularly of what may be thought of as first aid treatment for minor injuries, which, by reason of their number, cause perhaps even more interruption to work than those of a more serious character.

7. Much has been accomplished in spreading knowledge of first-aid practice by the St. John Ambulance Association and similar organizations, and in many munition works there are employees who have had some such training. The committee fully recognize that in recent years there has been a marked advance in the provision made by the more enlightened employers for the treatment of injuries in factories. The day is past for condoning slovenly or inadequate provision, and they are satisfied that not only should advice and instruction be given to the worker as to the proper steps to be taken on the occurrence of accidental injuries, but that suitable arrangements should be made in all munition factories for the effective organization of means of emergency treatment.

INSTRUCTION OF THE WORKER.

8. The three methods of advising and instructing the employee, which commend themselves to the committee, are (a) intelligent and vigilant supervision by the foreman; (b) a training in the essentials of first aid of a sufficient number of workers to provide that in each shop there are at least one or two persons who know how to render first aid in cases of injury; such instruction may well include some lessons on the value of ventilation and the importance of using the

means provided to secure it; unfortunately, long hours of work and the difficulty of obtaining competent teachers make training difficult to organize at present, and more use must therefore be made of method (a); and also of (c), the distribution of leaflets or placards of instruction and advice. Any instructions issued should be simple and precise. The placards should be prominently displayed and a supply of leaflets kept readily available for distribution.¹

ORGANIZATION OF TREATMENT.

9. In the majority of factories some provision is made for the treatment of injuries, but inspection has indicated that there is great and urgent need of improvement, especially for treating minor injuries, which must always be numerous in munition factories. At one factory a well-equipped surgery, with a trained nurse in charge, may be found; at the next the surgical equipment is represented by a soiled roll of some so-called "antiseptic" lint or gauze, an open packet of absorbent wool, a few bandages, some antiseptic lotion, a bottle of carron oil, and an unclean pair of scissors, all kept in a dusty drawer. This is not sufficient and can not be approved.

What is required is an adequate though simple organization which provides (a) a local dressing station or aid post in each work place for minor injuries, and (b) a central dressing station or surgery for more serious cases or cases requiring continuous treatment. Any organization should make provision for an aid post in every work place for primary and emergency first aid, the several aid posts being kept in close touch with the central dressing station. Arrangements should also be made for the immediate conveyance to hospital of cases which can not be treated on the spot.

(a) LOCAL DRESSING STATION OR AID POST.

10. In order to be effective under industrial conditions any form of treatment for minor injuries must be extremely simple, easily understood, and readily applicable. Elaborate provision for the treatment of minor injuries is the less necessary because of its unsuitability under factory conditions, and because in machine shops wounds are usually comparatively free from germs. Further, the treatment must be always and promptly available. The workman who sustains a slight injury while at work will often decline to surrender a quarter of an hour of time and earnings in going to and from a central surgery to have his wound dressed. Time is a consideration, and the exigencies of factory life do not allow of an elaborate procedure. The aid post may take the form of a cupboard or box containing first-aid materials, with brief, simple, and clear

¹ A leaflet issued by the Home Office is printed in the Appendix.

instructions as to their use. The box should contain packets of sterilized dressings, a supply of iodine solution (alcoholic solution containing 2 per cent iodine), and a bottle of "eye drops." A pair of dressing scissors, some triangular bandages, safety pins, and a roll of plaster (1 inch wide) may also be found desirable. The sterilized dressings may suitably be of three sizes: (a) Three dozen small size, for fingers, composed of a strip of gauze or lint 8 inches long and 1 inch wide, with narrow tape attached to one end. The tape should be rolled up inside the strip, which is then wrapped in a cover of ordinary nonabsorbent wool and the whole sterilized. In use the wool is first removed and the dressing unrolled round the injured finger, when the tape is disclosed ready for tying the dressing in position; (b) one dozen medium size, for hands or feet, similar to the above but 18 inches long and $1\frac{1}{2}$ inches wide; and (c) one dozen large size, for which the ordinary field dressing may be taken as a pattern. The aid post should be under the care of an officer, preferably the foreman or forewoman, trained in first-aid work. This officer should keep a note of every case dressed, and should be responsible for seeing that the box is kept stocked and in proper order. Ordinarily one such aid post should be provided in each work place, but in large engineering shops several may be required.

(b) CENTRAL DRESSING STATION OR SURGERY.

11. The central dressing station should be an easily accessible room specially constructed or adapted for the purpose. The room or rooms set apart as a central dressing station should in large factories provide for a surgery, a rest room, and a storeroom and nurse's room. Where a surgery is used for workers of both sexes, a second small room will be found advantageous. The walls should be covered with glazed tiles, enameled iron sheets, or washable paint; the floor should be of smooth, hard, durable, and impervious material; the natural and artificial lighting should be ample; hot and cold water should be laid on or be immediately available; the room should be warmed in winter. A glazed sink is needed, the pipe being well trapped from the drain. A foot bath, preferably fixed and provided with hot and cold water, is desirable. The furniture should consist of a table, a couch, chairs, and cupboards. The room should not contain a carpet, rugs, curtains, table cloth, window blinds, or wall pictures. The keynote should be simplicity and cleanliness. The floor should be washed once a day with antiseptic fluid, and the walls at least once a week.

The object of the central dressing station being the treatment of more serious cases than can be dealt with at the aid post and the redressing of cases of minor injury, it is desirable that it should be properly equipped. It may also be convenient to use it for the medical examination of applicants for work.

The station must be in charge of a competent person with knowledge of ambulance work. Wherever possible a trained nurse should be on regular duty, ambulance assistants being selected from employees trained in first-aid work. Many large works now have a medical officer on the staff, who is responsible for the supervision of the surgery and available for serious cases before removal to hospital. The equipment of the surgery will largely depend upon the character of the accommodation provided and the experience of the person in charge, but the following will generally be required:

- (i) Stretchers, splints, and strong bandages for major accidents;
- (ii) Bandages and dressings for minor injuries (a stock should be kept to replenish the aid posts);
- (iii) A simple sterilizer and necessary surgical instruments, such as scissors, forceps, and tourniquet; and
- (iv) Simple lotions and drugs (with sufficient enameled basins).

SYSTEMATIC RECORDS.

12. As already suggested, it is important that a full and accurate register should be kept of all cases of sickness and accident, with particulars of dressings, redressings, and treatment.

Inquiry at many munition factories in regard to the records of first-aid treatment indicates that advantage would be gained by the adoption of some system of keeping records. Different methods of first aid and preliminary treatment are practiced at different factories, but no comparison of results can be made, owing to the lack of records. The committee therefore suggest that a case book should be kept, drawn up somewhat as follows:

Identification number.	Date.	Name of injured person.	Nature of injury or illness.	How caused.	Progress of case with dates of subsequent dressings, and the occurrence of any sepsis.	Date of final dressing.
1	25.11.15	Mary Smith	Crushed thumb	Fall of shell	25.11.15, 23.11.15, 30.11.15	3.12.15

Each case when first treated may appropriately receive a card, numbered to correspond with the entry in the case book, to be brought on the occasion of subsequent dressings.

70 HOURS, FATIGUE, ETC., IN BRITISH MUNITION FACTORIES.

[This card must be brought to the surgery each time the patient comes for treatment.]

Identification number.	Name.	Nature of injury or illness.	Date.	Instructions.
1	Mary Smith.	Crushed thumb.	25. 11. 15	To come to-morrow.
			23. 11. 15	To come on 30th.
			30. 11. 15	To come on 3d December.
			5. 12. 15	

RESULTS.

13. The committee are satisfied of the urgent necessity and value of some such organization as that suggested above. They have been much impressed in visiting munition works with the useful part performed by competent nurses and the large number of cases of injury or sickness which receive treatment. In 11 moderately sized works, employing about 35,000 workers, 38,000 surgical dressings were performed in the first 10 months of 1915, varying in ratio from 19 per 1,000 employed per month to 221 per 1,000 per month. At Woolwich Arsenal the medical department is organized centrally and locally, and is at present staffed by nine (including two women) medical officers, a matron, and four nursing sisters, with a large staff of nursing orderlies, clerks, etc. In the year 1914-15 there were 150,000 attendances for treatment or medical examination. Two other munition works report that in the last half of October, 1915, their nursing staff dealt with 2,348 and 2,028 cases, respectively.

While such data point to the need for first-aid work, information obtained from another munition factory suggests that the need to-day is proportionately greater than in normal times. In the autumn of 1914, when the hours of work were from 8 a. m. to 5.45 p. m., an average of 100 first-aid dressings were done at this factory each month per 1,000 employed; in 1915, for the same period of the year, when the hours of work were from 8 a. m. to 8 p. m., the average rose to 292, and at night when the hours of work were from 8 p. m. to 8 a. m. to 508. The firm attribute the increased proportion of cases to (i) longer hours, (ii) more thorough organization of first-aid treatment, and (iii) the fact that a greater proportion of the workers are at night employed on machines as compared with daytime, when about 20 per cent of the operatives are employed on inspecting and sorting. They further state that accidents occur more frequently among workers recently engaged or moved to new work.

14. The committee have received evidence and reports from all parts of the country of the economic and industrial value of the proper organization of a medical service within the factory, and they

are convinced that both on grounds of health and of securing improved output this subject demands the immediate attention of employers, and that adequate schemes of treatment, especially of minor injuries, are an important means of preventing loss of time and efficiency among the workers. They recommend, therefore, that provision for organized treatment should be made in every munition factory.

Signed on behalf of the committee,

GEORGE NEWMAN, M., D.
Chairman.

E. H. PELHAM, *Secretary.*

JANUARY, 1916.

APPENDIX.

[A leaflet issued by the Home Office.]

A SCRATCH OR SLIGHT WOUND.

Do not touch it.

Do not bandage or wipe it with a handkerchief or rag of any kind.

Do not wash it.

Allow the blood to dry and so close the wound naturally; then apply a sterilized dressing and bandage.

If bleeding does not stop, apply a sterilized dressing and sterilized wool, then bandage firmly.

If the wound is soiled with road dirt or other foul matter, swab freely with wool soaked in the iodine solution¹ and allow the wound to dry before applying a sterilized dressing.

A BURN OR SCALD.

Do not touch it.

Do not wash it.

Do not apply oil or grease of any kind.

Wrap up the injured part in a large dressing of sterilized wool.

Do not remove any dressing, but, if the injured part becomes painful and begins to throb, go to a doctor at once.

Destroy all dressings which have been opened but not used; they soon become infected with microbes, and then are not safe to use.

EYE INJURIES.

Apply the eye drops² to the affected eyeball by means of the camel-hair brush in the bottle.

¹ An alcoholic solution containing 2 per cent of iodine.

² Instructions to chemist for making eye drops:

Cocaine	-----	0.5 per cent,
Hyd. Perchlor.	-----	1 in 3,000,
	in castor oil.	

Weigh 95 grams of castor oil into a flask capable of holding twice the quantity. Add 0.5 gram of powdered cocaine. Warm on a water bath till dissolved. While the solution is still warm (but not hot) add 1 cubic centimeter of a solution containing 3.3 grams of mercuric chloride in 100 cubic centimeters of absolute alcohol. Mix the solutions by rotating the flask.

About half an ounce, or 15 cc., of this solution should be supplied in a bottle from the cork of which a camel's-hair brush is pendent in the fluid.

72 HOURS, FATIGUE, ETC., IN BRITISH MUNITION FACTORIES.

Do not try to remove any particle which can not be brushed away.
Tie up with a clean handkerchief or bandage.
Go to a doctor *at once*.
Prevention is better than cure; therefore, if your work entails danger to the eyes,

WEAR GOGGLES.

Goggles have saved hundreds of eyes; *thousands* have been lost for want of them.

NOTE.—Danger from minor injuries arises from blood poisoning which is caused when microbes infect a wound. The majority of wounds are at first "clean" that is they are not infected with microbes; such infection usually occurs later, and comes from handkerchiefs or other materials applied to stop bleeding or to wipe away blood, and, in the case of eye injuries, from efforts to remove fixed particles with unclean instruments. *It is better to leave a wound alone than to introduce microbes by improper treatment.* The congealing of blood is nature's way of closing wounds against infection and should not be interfered with.

Burns and scalds when the skin is not broken will heal if left alone; all that is necessary is rest and a protective covering. When blisters form they must not be pricked, except under medical advice.

Rest is an important aid to healing. A short rest at first allows healing to commence and often saves a long rest later. An injured hand or finger can be rested in a sling, and an injured eye by a bandage, but an injured foot or toe can only be rested in bed.

SPECIAL INDUSTRIAL DISEASES.

[Memorandum No. 8.]

1. Work at certain industrial processes entails special risks from exposure to lead, tetrachloride of ethane, nitrous fumes, and certain explosives, each of which may cause serious and possibly fatal illness; while contact with trinitrotoluol, tetryl, fulminate of mercury, and certain lubricating and cooling fluids used in metal turning may result in the occurrence of troublesome skin affections (dermatitis). The committee recognize that this list is not exhaustive of the industrial diseases which may affect munition workers, but they consider that no useful purpose would be served by dealing with others of less immediate importance. The number of munition workers exposed to these risks, although not large when each disease is taken separately, is in the aggregate considerable; and interference with output would result if protective measures were not adopted. What these measures are is briefly indicated below. The medical aspect of each disease is only reviewed so far as is necessary to explain the reason for the precautions indicated.

LEAD.

2. *Disease and its causes.*—Operatives come in contact with lead and its compounds in a variety of processes in munition factories; in smelting lead and spelter; in making sheet lead and bullets; in file cutting; in hardening and tempering metals; in common tinning; in soldering and plumbing; in the manufacture of accumulators and of india rubber; and in the use of lead paints and red lead. Under industrial conditions lead gains access to the body principally by the inhalation of lead fumes or dust. Lead tends to accumulate in the body, and careful investigations have established that a daily dose of as little as 2 milligrams must be regarded as capable, when inhaled as fume or dust, of setting up chronic poisoning. Lead may also enter the system through the digestive tract, by eating with unclean hands, or by putting pipes or other articles into the mouth while the hands are soiled with lead. Lead is a cumulative poison, that is to say, even small doses absorbed day after day have a tendency to collect in the system and finally to cause illness. The existence of a blue line at the edge of the gums is an indication of lead absorption, and headache, colic, constipation, and marked paleness are early manifestations of poisoning.

3. *Prevention.*—The prevention of inhalation of dust or fumes has been the principle underlying the regulations established by the Home Office under the Factory and Workshop Act, 1901, section 79, for the chief industries concerned with the manipulation of lead and its compounds. Under these regulations the incidence of lead poisoning through the past 15 years of industrial expansion has not only been held in check, but has been reduced by one-half. Inhalation of lead in the form of fumes or dust can only be avoided with certainty by preventing the production of dust (for example, by keeping all lead material damp), and by insuring that lead fumes do not escape into any place in which work is carried on. The nature of certain processes, however, may render the production of dust inevitable or the escape of fumes possible. Under such conditions localized exhaust ventilation should be applied as close as practicable to the point of origin so as to withdraw the dust or fumes from the atmosphere of the workplace. Respirators may be required in a few exceptional cases, but as a protection against dust only a few of the many forms of respirator obtainable are effective, and no one of them is comfortable to wear; while as a protection against fumes no respirator exists which an operative can be asked to wear for prolonged periods.

4. To prevent lead entering the system through the digestive tract the following special steps should be taken:

- (a) Smoking should be prohibited in all places where lead is manipulated.
- (b) No person should be allowed to take a meal or to remain during the times allowed for meals in any room where lead is used.
- (c) Special provision should be made to enable the workers to take their meals elsewhere.
- (d) Special washing facilities should be provided.¹ These will only be effective if a sufficient supply of clean towels, soap, and nailbrushes is always available.

5. The manifestations of poisoning can be detected by a medical man, and their presence indicates that the worker should be trans-

¹The standard adopted under factory regulations is as follows: The washing conveniences should be under cover, and maintained in a cleanly state and in good repair. There should be either—

- (a) A trough with a smooth impervious surface (fitted with a waste pipe without plug) and of such length as to allow at least 2 feet for every five persons, and having a constant supply of warm water from taps or jets above the trough at intervals of not more than 2 feet; or
- (b) At least one lavatory basin for every five persons, fitted with a waste pipe and plug or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on and a supply of hot water always at hand when required for use by persons employed.

ferred to other work. The Home Office regulations require employers to have persons engaged in various lead industries examined periodically by a surgeon who is intrusted with powers of suspension from work. This form of medical supervision has been found to be of such value and has in consequence been so widely adopted even in industries not governed by regulations, that the committee desire to urge its adoption in all factories where the use of lead oxides or other of its many compounds may have recently been introduced in the manufacture of munitions. In the handling of metallic lead, *e. g.*, bullets, the risk of poisoning is very slight, and medical supervision is less important.

TRINITROTOLUOL.

6. *Disease and its causes.*—Trinitrotoluol (also known as trotyl and TNT) is, like dinitrobenzol, a substance the manufacture of which, on account of its toxic nature, is controlled by regulations. The extended use of this material, which has followed the increased demand for high explosive munitions, has brought its poisonous properties into prominence. Operatives employed in its manufacture and in loading it, either pure or mixed with other substances, into munitions have been found affected with unusual drowsiness, frontal headache, eczema, and loss of appetite. Exceptional cases may occur with sudden collapse after a few hours' work on a hot day, but generally the symptoms are at first slight and, if exposure ceases, quickly disappear. If, however, the exposure be continued, the symptoms tend to become more severe and may be associated with cyanosis (ashen gray and livid color of the lips), shortness of breath, vomiting, anemia, palpitation, bile-stained urine, constipation, rapid weak pulse, pains in the limbs, and jaundice; while in a few cases profound jaundice with danger to life has supervened; and even death has resulted.

7. *Prevention.*—Trinitrotoluol, like nitro derivatives of benzine, may be absorbed by inhalation of vapor or dust, through the skin, and through the digestive tract; and at least the following preventive measures should be taken accordingly:

- (a) Every possible step should be taken to prevent the production of dust and the escape of fumes into the air of workplaces. Persons employed in packing trinitrotoluol, or at other processes in which the production of dust is unavoidable, should be called upon to wear respirators. When melted, trinitrotoluol gives off fumes, and arrangements should be made by localized exhaust ventilation for all fumes to be discharged into the outside air without escaping into the work place;

this can be effected by inclosing the vessel containing the melted trinitrotoluol in a bell-shaped hood terminating in an upcast shaft about 20 feet in length, guarded at the top by a cowl. The working opening to the hood should only be of sufficient size to permit necessary manipulations.

- (b) To protect the skin overalls should be worn; the sleeves of the overall should fasten at the neck and the wrist and have no opening in the cuff. Gloves of leather, strongly sewn, have been recommended, and, if worn, the cuff of the glove should be inside, that is under, the sleeve of the overall. Where women are employed head coverings should be worn.
- (c) To prevent absorption through the mouth the same preventive measures should be taken as in the case of lead (see par. 4 above); the provision and maintenance of adequate washing accommodation is specially important. Output has been so urgently required that at some factories work has commenced before building has been completed; at one such factory many cases of troublesome dermatitis (eczema¹) occurred and caused considerable interference with work, but as soon as suitable lavatories were completed the trouble ceased.
- (d) The period of exposure should be reduced to a minimum and should not be prolonged by overtime.

The slow and progressive action of the poison allows further precautions to be taken, and periodical medical examination, with power to suspend from employment any person who is affected should, therefore, always be arranged; indeed this has already been extensively done with beneficial results.

The necessity for adopting preventive measures was recently shown by the death of a woman, aged 22 years, exposed during about 5 weeks' employment in a munitions works, to dust generated in manipulating a powder containing a moderate amount of trinitrotoluol. She left her home, which was 5 miles from the factory, often without sufficient food, at 4.45 a. m.; and no adequate provision was made for her to take food on arrival before commencing work at 6 a. m. Washing conveniences were primitive, cloakroom and overall accommodation was inadequate, and personal supervision was insufficient. At the same factory several other less severe cases of illness occurred. Probably such cases can be avoided by attention to details, in particular by using means to prevent dust and by insuring that sufficient food is taken before work commences.

¹ An application found of value to prevent eczema is a mixture of two parts of castor oil to one part of lanoline; this mixture, which should be rubbed into the skin after washing on leaving work, should be placed in the lavatories for general use.

TETRYL (TETRANITROMETHYLANILIN).

8. *Disease and its causes.*—Manipulation of this explosive produces a light dust, which may cause troublesome eczema. Individuals vary in their susceptibility; some appear to be almost immune, while others can hardly enter a room where tetryl is handled without suffering severely. Observation suggests that this may depend on the varying natural dryness or moistness of the skin of different persons. The parts most frequently affected are the conjunctivæ, the openings of the nostrils, and the chin. The hands and arms are less often affected, and in this the eczema caused by tetryl differs from that due to trinitrotoluol, which usually affects the forearms and hands. Operatives manipulating tetryl may also suffer from headache, drowsiness, and lack of appetite in varying degrees of intensity; but the committee understand that up to the present no case of illness endangering life has come to the notice of the Home Office.

9. *Prevention.*—The principal measures to be taken consist in—

- (a) Avoiding the escaping dust by carrying out manipulations in glass cupboards with armholes for introduction of the hands.
- (b) Providing light gauze veils to protect the faces of the workers.
- (c) Supplying, if veils are not worn, some simple powder (such as a mixture of one part zinc oxide to two parts starch) for applying to the face before beginning work.
- (d) Providing adequate washing accommodation (see footnote on page 74), and encouraging the use after washing of an application for the skin.¹
- (e) Excluding workers who show special susceptibility or idiosyncrasy.

10. Apart from its tendency to cause eczema, tetryl stains the skin and hair; in order to prevent this, overalls and gloves, similar to those recommended for workers manipulating trinitrotoluol (see paragraph 7 above); should be worn, and, where women are employed, suitable head coverings should be used.

FULMINATE OF MERCURY (CNO.)Hg.

11. *Disease and its causes.*—In the manufacture and use of fulminate of mercury there is a liability of mercurial poisoning and eczema. Owing, however, to the small amounts manipulated, the symptoms of mercurialism are seldom marked; but a blue line may be seen on the gums, appetite may be impaired, headache may be

¹ See note on page 76.

present, and there may be nervousness and depression. The last symptom is important, not merely as a sign of illness, but as an indication that the operative should be removed from dangerous work which calls for a steady hand and clear head. Eczema of the hands, forearms, and face occur, and may cause serious disability.

12. *Prevention.*—Measures to prevent these conditions from arising should include—

- (a) Provision of overalls and of adequate washing accommodation.
 - (b) Transference to other work of those specially affected.
- And,
- (c) Where exposure is marked, periodical medical examination:

TETRACHLORETHANE.

13. *Disease and its causes.*—Tetrachlorethane is a noninflammable liquid and a solvent for acetate of cellulose. It has formed an ingredient of the "dope" varnish applied to the canvas coverings and tapes of aeroplane wings, and to aeroplane bodies, in order, by impregnating them with cellulose, to render them impervious to moisture and air. This liquid is volatile at ordinary temperatures; its vapor smells like chloroform, is a powerful anesthetic, and, being twice as heavy as air, tends to sink to the floor. The poisonous effect of the vapor depends not only on the amount of vapor in the air, but also upon the time for which the air is breathed. Inhalation of this vapor, even in small amounts, when spread over prolonged periods, has caused drowsiness, loss of appetite, constipation, and pains in the stomach; and, in more serious cases, jaundice, liver destruction, coma, and death.

14. *Prevention.*—The committee are glad to learn that an apparently effective varnish has been found which does not contain the poisonous chemical, though unfortunately the supply of its ingredients is at present insufficient to meet the demands. Meanwhile strict precautions should be taken to lessen the risk associated with its use:

- (a) The number of workers exposed to the vapor should be reduced to a minimum; all processes of "doping" should be in a separate place where no other work is undertaken. At first, before the poisonous nature of the vapor was recognized, this precaution was not taken and workers employed on other operations suffered in consequence.
- (b) Adequate exhaust ventilation must be arranged for; if the ventilation is to be adequate and sufficient to sweep away the heavy vapor, the entire air contents of the workroom should be extracted (preferably by volume

or propeller fans), at or near the floor level, about 30 times every hour, while for admitting fresh air supply there should be high up in the room numerous hopper openings, the combined superficial area of which should be at least three times that of the area of the exhaust openings.

- (c) Operatives should not be allowed to remain in the work place during meal hours.
- (d) The process of "doping" should as far as possible be alternated with other work.
- (e) The period of exposure should be reduced to a minimum and not prolonged by overtime. Ventilation on the lines suggested above is only adequate to bring the amount of vapor inhaled within safe limits for ordinary hours of work. Undue extension of these hours not only lengthens the exposure, but lengthens it for individuals who being already tired are less able to resist it.
- (f) Periodical medical examination should be provided for, with power to suspend from employment any persons affected.

PERSONAL HEALTH IN RELATION TO INDUSTRIAL POISONS.

15. The poisons so far considered have two points in common, more or less prolonged exposure before symptoms develop and personal susceptibility. Cases of poisoning may occur among men who have worked for a long time previously without any apparently ill effect, while others who suffer on commencing work may later on preserve their health with unaltered conditions. These apparent anomalies probably depend on varying conditions of personal health, an individual in good health resisting a dose to which he may succumb if, for any reason, he is overtired or subnormal. Maintenance of good health, therefore, is even more important for workers exposed to these poisons than for other workers. Two matters are of special importance in this connection:

- (a) Workers should not commence work without having taken food, for evidence shows that hungry and ill-fed workers succumb more readily than others. Such workers should be supplied with at least half a pint of milk or cocoa before starting work in the morning. This practice, the committee are informed, has been followed with excellent results for many years in certain factories where there is danger of lead poisoning. At the present time when women, who as a class are less concerned about their food than men, are being so largely employed, the practice should, in the opinion of the com-

mittee, be adopted for all workers exposed to these poisons. Moreover, study of output indicates that generally in factories less work is done per hour from 6 a. m. to 8 a. m. than after the breakfast interval, and the committee consider this is largely due to workers hurrying to the factory without previously taking food. The establishment in munition factories of the canteen system, as advocated in an earlier memorandum, should provide an effective means for dealing with this matter.

- (b) Workers exposed to poisonous substances should be carefully chosen. Only healthy and temperate persons should be employed.

NITROUS FUMES.

16. The present demand for explosives, nearly all of which are products of nitration, has introduced increased risk of exposure to nitrous fumes, not only in nitrating processes, but also in the manufacture of nitric acid to be used in these processes. A memorandum dealing with the danger from these fumes, especially in relation to the present risk, has recently been issued by the factory department of the Home Office, and the committee consider that advantage may accrue from drawing the attention of employers to this memorandum with which they are in entire agreement:

In the manufacture of nitric acid, and in its use for various purposes, particularly in the manufacture of explosives, danger exists of accidental escape of nitrous fumes into the work places. The full effect of inhaling these fumes is not felt immediately, and unless workers are warned of the danger, they may continue at work and unwittingly inhale a fatal dose.

In such a case the affected person develops an irritating cough which becomes steadily worse, until, three or four hours after exposure, he becomes seriously ill, suffering from marked dyspnea and collapse; sometimes these symptoms have come on after leaving work on the way home. The secretion of mucus now becomes profuse, and vomiting, which helps to clear the air passages, may occur. The congestion of the bronchioles and alveoli progresses, and, if the case survives 48 hours definite pneumonic consolidation may develop. More frequently a fatal issue results in about 30 hours, the patient remaining conscious until near the end.

Every case exhibiting the initial symptoms does not progress to a fatal termination, and recovery has occurred even after marked collapse and dyspnea.

Prevention.—Notices warning those employed of the danger of remaining in an atmosphere containing nitrous fumes should be posted in every place where there is any possibility of these fumes escaping.

Emergency helmets of a pattern which can be easily and quickly put on, and provided with a fresh air supply from without, should be kept in accessible places near at hand, and the efficiency of such helmets should be tested at least once a month.

Respirators such as are efficient to intercept dust are useless against gases, and must not be used.

Treatment.—The following routine may usefully be pursued pending the arrival of a medical man:

Make the patient lie down.

Keep him warm.

See that he has plenty of fresh air.

If he is blue in the face—

(i) administer oxygen; and

(ii) if he has not been sick, give a drink of 1 ounce of salt in 10 ounces of lukewarm water and repeat the dose until he is sick;

(iii) meanwhile send for a doctor.

Persons even apparently slightly affected must not be allowed to walk home until permitted to do so by the doctor.

DERMATITIS.

17. *Disease and its causes.*—The occurrence of serious dermatitis, or eczema, caused by exposure to trinitrotoluol and to tetryl has already been referred to, and similar trouble may result from exposure to fulminate of mercury. Apart, however, from these special substances, eczema is liable to occur among munition workers employed in engineering works, who come in contact with certain fluids used to lubricate and to cool metals. Two forms of inflammation of the skin, which, however, may coexist, result—(1) yellow pustules and boils, and (2) more general inflammation which in marked cases develops into typical weeping eczema. Probably the occurrence of pustules and boils is due to sebaceous glands and hair follicles becoming blocked and infected with oily grime rubbed in by soiled overalls. The more general inflammatory conditions appear to be caused by the direct action of the fluids used.

18. *Prevention.*—Clean overalls, and the provision and use of suitable washing accommodation with hot water laid on, go far to prevent cases of pustules and boils. The committee have observed that reasonable facilities for personal cleaning after work are seldom provided in engineering factories, and desire to say that in their opinion, even apart from questions of health, the provision of such facilities should be considered a necessary part of the equipment of every factory.

Experience has shown that, if lubricating and cooling fluids contain a small amount of some antiseptic, say carbolic acid up to 1 per cent or other coal tar antiseptic, cases of eczema do not occur. The committee have learned with satisfaction that so-called antiseptic lubricants and cooling fluids are rapidly coming into general use in engineering shops, and that cases of eczema are less prevalent than formerly. They consider that against this condition also good washing conveniences are a powerful preventive.

GENERAL.

19. Facilities for the prompt treatment of all cases of sickness and injury are of special importance in factories where poisonous substances are used. The nature and extent of the facilities necessary have already been discussed in the committee's memorandum on "Sickness and injury" (Memorandum No. 10). Careful instructions should be drawn up and issued to every worker and also to every person in charge of a dressing station.

20. Various leaflets and memoranda dealing in greater detail with industrial diseases and their prevention are issued by the factory department of the Home Office. The committee desire to acknowledge the help they have received from Dr. T. M. Legge, senior medical inspector, in drawing up the present memorandum.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*

FEBRUARY, 1916.

TETRACHLORETHANE POISONING.¹

By T. M. LEGGE, M. D., H. M. Medical Inspector of Factories.

Poisoning by chlorine derivatives of ethane and ethylene.—Before the illnesses due to inhalation of tetrachlorethane, of which jaundice has been so prominent a symptom, came to my notice, occurrence of jaundice as a symptom of industrial poisoning had been familiar to me as following on, first, inhalation of arseniureted hydrogen gas in chemical works, and, secondly, absorption of nitro derivatives of benzene in factories for the manufacture of explosives. Poisoning by arseniureted hydrogen, of which some 70 cases have come to the knowledge of the factory department during the last 15 years, is characterized by the rapid development, in the course of a few days, of an intense coppery jaundice, no doubt hæmohepatogenous in character. In the first instance a destruction by the gas of the elements of the blood takes place with subsequent increased formation, from the hæmoglobin liberated, of bile pigments in the liver, which lead to increase in the viscosity of the bile and temporary obstruction of the ducts. Onset of the symptoms is usually within a few hours of exposure. The jaundice observed in cases of absorption of nitro derivatives of benzene is of the same kind and is caused by the hæmolytic action of the compound on the blood with formation of methæmoglobin. I have never seen or heard of jaundice produced industrially from phosphorus.

On thinking over whether there was any other process in my experience which had given rise to jaundice, I recalled having once, on complaint, examined a number of women engaged in an india rubber factory, obtaining from them evidence of gastric derangement and, in addition, from one of them a history of "yellow jaundice." The solution which they were using was a mixture of carbon tetrachloride and chloride of sulphur in equal parts.

The chlorine derivatives of ethane and ethylene have recently been produced by an inexpensive process, and as they are noninflammable, noncombustible, and nonexplosive the reason for their use as solvents of fat, resins, and rubber, in preference to benzene, carbon bisulphide, alcohol, ether, and turpentine, is obvious. Explosions from benzine in industrial premises, as, for example, that of a few years ago at a large oil-cake works at Liverpool, from naphtha, and from carbon bisul-

¹ Great Britain. Factory Inspector's office. Annual report of the chief inspector of factories and workshops for the year 1914. London, 1915. Pp. 107-112.

phide, have been attended with loss of life and much damage to property.

Of these derivatives *trichlorethylene* (C_2HCl_3) is that which has come most into use, mainly for the extraction of oil from seed and for the removal of grease spots in dry cleaning. In one oil-extracting works where the process of extraction was done automatically in closed iron chambers and every effort made to remove the last traces of trichlorethylene before the seed was withdrawn, no case of jaundice had occurred among the seven men employed. The conjunctivæ, however, were muddy and injected, and one of them, six weeks before I saw him, after working a short time was seized with vomiting and removed to the infirmary. The physician's notes were, briefly: "Vomiting; very violent and excited on admission; could give no account of himself; appeared dazed and had both pupils contracted." His condition was put down to epilepsy. Another worker, in charge of the reservoir in the basement, stated that he had been once rendered insensible by the fumes, and one of the principals of the firm suffered from a severe bilious attack the first day he took over the management of the department. So far I have visited but few premises in which trichlorethylene is used in other than small quantities and so can not express further opinion as to its toxic quality. No case of jaundice has come to my knowledge.

A paint containing trichlorethylene, used almost exclusively in the brewing industry for coating the inside of fermenting vats and casks, caused the death of a man engaged in applying it. The paint has the merit of noninflammability. Directions for its use issued by the makers recommend (1) the workman to wear "an india rubber tube, one end of which is fitted to a mouthpiece and the other end secured to a point above and outside the vessel undergoing treatment," of which they supply a special form, and (2) application of a "suction pump to the cleaning-out vent in the bottom of the vessel, whereby the heavier fumes are withdrawn."

Tetrachlorethane ($C_2H_2Cl_4$) is used mainly as an ingredient of the varnish or "dope," as it is called, for covering the wings of aeroplanes to make them impervious to moisture and air. This "dope" consists of powdered acetate of cellulose dissolved in various organic solvents such as acetone, amyl acetate, benzene, carbon tetrachloride, tetrachlorethane and others, in order to bring the cellulose to the needed dilution. Acetone is the best solvent apparently, but the current price of it is about £100 (\$486.65) per ton, whereas tetrachlorethane is only £28 (\$136.26) per ton. And, moreover, tetrachlorethane seems to have the remarkable property of tightening up the fabric which is stretched to form the wing in a way that nothing so far tried can do.

The development in the manufacture of aeroplanes has been rapid, carried on as it is now in at least 27 factories, employing, roughly, some 6,500 workers. In one factory alone 1,500 hands are employed. Perhaps 300 persons—men and women in equal proportions—are engaged in doping operations, but before the recent occurrence of poisoning a far greater number than this was exposed to the fumes, as in only a few factories was the process separated off from the general atmosphere of the usually large shed in which the wood working, fitting, and erecting processes were carried on. Further, in order to keep the fabric dry—considerable importance being attached to this, as the fabric, if moist, tends to rot under the varnish—the air was kept at a temperature of about 65° F., or more, and ventilation intentionally reduced to a minimum unless the air introduced was warmed. The wing surfaces vary in size—from 20 to 30 feet long by 6 to 8 feet wide in biplanes, and perhaps 20 by 10 in monoplanes, thus affording many square yards of evaporating surface. Four to six coats of varnish are applied, each coat being allowed to dry before the next is applied. In order to secure finish two men work simultaneously opposite one another on either side of the plane. Each carries the “dope” mixture in a can in his left hand and brushes it on to the wing supported on trestles with his right. In large factories where the output amounts to, say, three aeroplanes a week, as much as 80 gallons may be used per week, and as the dope is of value in proportion to the rapidity with which it dries, the amount of fume evaporated may be imagined. On the outbreak of the war not only was the personnel largely increased but also overtime was worked in the large factories, the hours being from 6 a. m. to 9 p. m., with half an hour's break for breakfast, one hour for dinner, and half an hour for tea. In the factory where incidence has been greatest there was no available place for the mess room, so meals even had to be taken in the shop, and the sanitary accommodation (sufficient for the needs before the war) became inadequate, plans for extension having to be submitted to the urban district council.

It may be well to deal first with this factory, as Dr. W. H. Willcox and I found it early in December. The premises consisted of one large shed, of a superficial area of about 32,400 square feet, with a double-ridged roof. There were windows in the walls; the main lighting, however, came through the whole length of the ridged roof. Natural ventilation was arranged for by three large lantern openings at intervals along the two ridges. Mechanical ventilation which, it is important to note, played a part in the outbreak, was arranged on a plenum system—a high-pressure fan distributing warmed air near the ground level through well-arranged tapering trunks with subsidiary branch ducts.

"Doping" was carried on by about five men in the part of the shed farthest from the main entrance. The portion of the room where it was done was not screened off from the general atmosphere of the shed, nor was there any attempt at local removal of the fumes. The peculiar smell given off by the "dope" was distinctly perceptible on entering the building. In the vicinity of actual "doping" it was very strong. The head "doper," however, who had done the work for nearly a year, only complained of drowsiness caused by it. Questions addressed by Dr. Willcox and myself to men and women (about half a dozen women only are employed in sewing strips of fabric together) at the benches on the carpenter's landing elicited evidence of recent gastric attacks which, however, had not caused absence for more than a day or two and had been unattended by obvious jaundice. Some of them looked poorly. The accompanying list gives the order in which the cases succeeded one another, the precise occupation, the date of illness, the date of return to work, and subsequent further absence either from renewed illnesses because of the decision of the firm not to reemploy them at that time.

No.	Date started.	Department.	When left.	When returned.	When left (second time).	Remarks.
1	5, 6, 14	Fuselage shop.....	15, 9, 14	.....	.....
2	15, 9, 14	Assembling plane.....	17, 10, 14	2, 11, 14	20, 11, 14	
3	12, 8, 14	Front elevator.....	17, 10, 14	.....	.....
4	12, 8, 14	Spars.....	17, 10, 14	27, 11, 14	30, 11, 14	Left by order.
5	8, 8, 14	Fabric doping.....	24, 10, 14	.....	.....	Died, 25, 11, 14.
6	31, 8, 14	Ailerons gallery.....	27, 10, 14	30, 11, 11	30, 11, 14	Left by order.
7	13, 8, 14	.....do.....	7, 11, 14	.....	.....
8	22, 9, 14	Assembling plane.....	10, 11, 14	.....	.....
9	19, 6, 14	Panel beating.....	11, 11, 14	26, 11, 14	27, 11, 14	Paid off, 30, 11, 14.
10	6, 10, 14	Fitters.....	11, 11, 14	23, 11, 14	30, 11, 14	Left by order.
11	12, 8, 14	Spars.....	12, 11, 14	30, 11, 14	30, 11, 14	Left by order.
12	13, 8, 14	Fuselage shop.....	14, 11, 14	27, 11, 14	.....	Paid off, 27, 11, 14.
13	22, 9, 14	Assembling plane.....	14, 11, 14	.....	.....
14	22, 9, 14	Fabric.....	23, 11, 14	.....	.....
15	22, 8, 14	Assembling plane.....	30, 11, 14	.....	.....
16	26, 8, 14	Fitters.....	30, 11, 14	.....	.....

Incidence was greatest in the neighborhood of the doping area, where 8 of the cases (including the fatal case and the 2 which have proved most severe) were employed. Cases 3, 4, 6, 7, and 11 are also not difficult to account for in the same way. It is more difficult to explain cases 9, 10, and 16, who were working quite 50 yards away. They did not appear to me to have been severe attacks. There is free communication between the erecting shop and the fitters' shop, where they worked, both above the general and private office and by a wide opening between the private office and the main entrance. The vapor of the dope is twice as heavy as air, and it has therefore had a tendency to keep near the floor level. I believe the plenum system of ventilation served simply to stir up the vapor and to distribute it in all parts of the shed.

The "dope" used was that known as emallite No. 1, and contained about 12 per cent of tetrachlorethane. Other varieties contain a considerably higher proportion. I visited the premises where the mixture was prepared. The quantities having been weighed out are placed in revolving drums. While mixing in these revolving drums goes on no smell is noticeable in the room. No chemical action is believed to take place. When the acetate of cellulose has been dissolved the material is emptied into large jugs and transferred from there to barrels, where it is stored.

I examined the three men employed. Work here was commenced two years ago. One man had been employed for the whole two years, another for four months, and the third for four months. None showed any sign of effect from the fume. The short duration of employment of one of the men was due to his taking the place of a workman who enlisted. A volume fan, electrically driven, was placed in the wall of the room in which the drums were placed and was in action at the time of my visit. The foreman spoke of the value of the fan in removing the fumes. Subsequently, on the 4th of December, I visited the premises again and took samples of "dope" No. 1, and of each of the ingredients separately, and delivered them personally to Dr. Willcox at the medical department of St. Mary's Hospital.

I ascertained that another firm manufactured a dope in common use known as cellon. On going there I obtained all the information I wanted. As in the case of emallite, the mixing is done in closed, revolving cylinders; the shed is well open to the air, and no sign of illness in the two men employed has ever been noted. The composition of the dope varied only slightly from that of emallite No. 1, and contained about 11.5 per cent of tetrachlorethane.

I obtained the addresses of the 16 men absent on account of jaundice, and saw 8 of them in their homes. I tried also, whenever possible, to see the medical man in attendance. I arranged for 6 of these subsequently to attend at Dr. Willcox's out-patient department, St. Marys Hospital. The symptoms in all were remarkably uniform. The rapidity with which the attacks followed one another when pressure of work became abnormal—a considerable amount of overtime had been worked since the beginning of August—was remarkable. The jaundice showed itself in about six weeks' time. The symptoms appear to have been accompanied by little, if any, fever. The men complained at first of drowsiness and of a nasty taste in the mouth and of effects on the throat. There was a sickly feeling and marked distaste for food. In at least two of the cases seen by me meals taken to the factory could not be eaten, so that a condition of semistarvation was set up. There was, as a rule, very obstinate constipation, and in some cases vomiting. With the onset of jaundice

the stools became clay colored and the urine thick and very dark in color. Pain over the region of the liver and stomach was a prominent symptom in some. Two of the men seen reported that on recovery from the jaundice they went back to work, but after a few days jaundice returned in a more pronounced form. In very severe cases hæmatemesis or convulsions may occur. Coma supervenes, and death results with suppression of urine. All but 2 of the 8 men seen by me were convalescent. All the cases examined by Dr. Willcox on the 12th of December showed signs of enlargement of the liver. None of the men had obvious anemia, and the condition in this respect, therefore, differs from the hæmatogenous jaundice not infrequent in workers coming into contact with nitroderivatives of benzene, which cause hæmolysis of the red-blood cells. They bore no resemblance to workers coming into contact with anilin or dinitrobenzol.

The post-mortem changes have been most marked in the heart, liver, kidneys, and mesentery. The notes of one typical case, a female aged 19, are as follows:

The skin was intensely jaundiced. The liver was hard and firm; it was very yellow and showed marked congestion; weight $3\frac{1}{2}$ ounces. The kidneys showed marked yellow staining of the cortex, the pyramids being intensely congested. The medulla was yellow and congested. The kidneys weighed each 5 ounces. The heart weighed $7\frac{1}{2}$ ounces. The muscle showed yellow staining; some pink staining of endocardium. Numerous petechiae were present over surface of left ventricle. The small intestine showed intense petechial hemorrhage over the surface. There was marked congestion of the small intestine. The spleen weighed 8 ounces; it was hard and firm. Microscopical examination of the liver showed extensive necrosis, and in the kidney fatty degeneration was present.

Experiments were instituted by Dr. W. H. Willcox,¹ at the request of the Home Office, to test each of the constituents of the dope and the dope itself as regards the toxic action of the vapor on the liver. His report on this aspect of the subject which interested him exceedingly—an interest which has been of the greatest help and value to the factory department—was as follows:

“For each experiment a large glass chamber (desiccator) was used. In the bottom of this were placed daily 10 c. c. of the liquid to be tested. A perforated zinc platform was stretched across the middle of the chamber, i. e., half way up. On this were placed the animals (white rats) to be experimented upon. The top of the chamber was covered with a perforated zinc roof. Rats

¹ An outbreak of toxic jaundice due to tetrachlorethane poisoning, by W. H. Willcox, *Lancet*, Mar. 13, 1915.

were selected as the most suitable animals. The animals were kept in the glass chamber for eight hours a day for a week.

"The liquids tested were dope, tetrachlorethane, acetone, benzene, and methylated spirit, respectively. Two rats were placed in each chamber, five experiments being carried out together.

"The rats thus exposed to dope vapor and tetrachlorethane vapor became very drowsy and slept all day. After removal from the chamber they remained drowsy for some little time, and on some occasions they were quite ataxic in gait, falling over on to their sides. After an hour or more usually they fed and became active. These animals did not gain in weight during the week's treatment.

"In the experiments with acetone, benzene, and methylated spirit the animals were drowsy while exposed to the respective vapors, but on removal from it they immediately became lively and fed well. No ataxic symptoms were observed. All these animals gained markedly in weight during the week.

"After seven days' treatment the animals were killed and post-mortem examinations were made on them by Dr. Spilsbury and myself. The tetrachlorethane rats showed marked changes in the liver to the naked eye, there being fatty degeneration and bile-staining present. The dope rats showed similar changes, but less marked. The rats exposed to the vapor of benzene, acetone, and methylated spirit showed no changes in the liver to the naked eye.

"Careful microscopical examination of the organs showed marked fatty degeneration and cloudy swelling in the liver and kidneys of rats exposed to dope vapor and tetrachlorethane vapor, but no abnormal change in the animals exposed to the other vapors. Rats were also exposed to the action of dope vapor and tetrachlorethane vapor for five weeks. Marked diminution in size of the liver occurred in each case. The liver and kidneys were pale on section. They showed cloudy swelling and fatty degeneration."

The above experiments showed conclusively that tetrachlorethane is a powerful liver poison, and also they showed that dope vapor is a liver poison, and that the poisonous property of dope vapor is due to tetrachlorethane being present in it.

I have visited several of the aeroplane factories and examined all the persons in them employed in doping and certain others working near them. Having already dealt so fully with the conditions in the factory where incidence has been highest, I summarize merely the conditions found in the others. Nearly all the premises were new, cubic space ample, and the conditions for normal work not involving exposure to poisonous fumes excellent. The seaplane works are on the edge of the sea, and the natural thorough ventilation in them was in itself almost sufficient to neutralize the effect of the fumes. Inquiry in one factory brought to light the significant fact that as

long ago as February, 1913, one man employed in doping had died, the symptoms being those of acute yellow atrophy of the liver. Here also a fellow worker, whom I saw, had also suffered at the same time from jaundice and other typical symptoms, although he had not given up work. Work had been carried on in a confined space, and probably with a dope containing high proportion of tetrachlorethane. In another factory a man testing the engine suffered in the middle of the year, and in yet a third I saw a man who had had jaundice in August last—all these cases, therefore, dating from a time anterior to the war pressure.

Altogether I have traced 25 cases, including 4 deaths,¹ in which jaundice has been the prominent symptom; many others have suffered from gastric and intestinal symptoms without jaundice noticeable to themselves or their friends, and from symptoms diagnosed as "influenza" and "tonsillitis."

The fact that the vapor is twice as heavy as air has had noticeable effect in affecting workers engaged at sitting work near the place where doping was carried on. One seamstress died, partly, no doubt, as the result of her relatively lower position. In another factory six men engaged in wire splicing and seated on benches in a portion of the doping room screened off by a low wooden partition exhibited more marked effect than the dopers who were standing.

As soon as the danger was recognized the factory department, in conjunction with the Admiralty and War Office, took prompt action. All firms were asked (1) to carry out doping in a separate shop or portion of a larger shop screened off so as to limit the number of persons exposed to the fumes; (2) to provide exhaust fans at the floor level to remove the vapor which is heavier than air directly into the outside atmosphere; (3) to permit no workmen or women to remain in the doping shop during meal times.

It has interest to follow the steps taken to minimize the danger. The person who experiments with the ingredients with a view to perfecting the dope wears a smoke helmet; that is, a mouthpiece fitting over the nose and mouth and communicating with the outside air by a long, flexible pipe. Through this he inhales fresh air, breathing of the contaminated atmosphere being prevented by a valve through which he exhales only. Workpeople, however, can not be expected to wear such an apparatus, except for short periods for cleaning operations or rescue work. Seeing that the vapor of tetrachlorethane is considerably heavier than air (the specific gravity is 1.6), district inspectors recommended thorough ventilation of the room with mechanical exhaust below the breathing level, drawing

¹ One further death of a woman (with considerable length of employment before exhaust ventilation was installed) occurred in February, 1915.

the air down and away from the workers. As it was thought possible that under certain conditions the vapor arising from the varnish might form an explosive mixture with air, attention had to be directed to this danger in connection with the installation of power for the exhaust ventilation. Locally applied exhaust ventilation was not thought possible at first, owing to the size of the aeroplane wings, the general guiding principle being to introduce air (preferably warmed) at a point on one side of the room considerably above the workers' heads and extract it by volume fans placed at the ground floor opposite the air inlet. In some cases the downward exhaust was arranged through gratings in the floor. As, however, two men are doping at the same time, the one nearest to the fan could not escape inhaling some of the vapor. To avoid this and to reduce still further the amount of vapor in the atmosphere, one firm successfully arranged for actual doping to be done on the wings placed on trestles in long boxes with flap sides, the bottom of the box being connected up with a volume fan. Thus the whole surface of the wing was swept by moving air, which constantly passed to the exhaust.

The use of tetrachlorethane and of other substances such as carbon tetrachloride (which might be expected to have similar detrimental effect on the health) has been entirely dispensed with by one or two firms; others maintain that no substance so far tried gives such flexibility and durability as a dope containing some proportion of tetrachlorethane.

After occurrence of the outbreak in this country, I ascertained that late in 1913 and in the beginning of 1914 the same trouble had been experienced in Germany. In one factory, among 15 persons employed in doping, 12 were affected, of whom 2 had died. The symptoms fell into two clearly defined types. In the one the symptoms had been nausea and vomiting, feeling of general discomfort, pains in the stomach, and marked jaundice with enlarged liver. In one instance basophil granules were observed in the red-blood cells. In the other group, in addition to loss of appetite and nausea, nervous symptoms predominated—marked tremor of the hands, pins-and-needles feeling in the hands and feet, diminution or loss of the knee jerks, headache, pains in the limbs, and excessive sweating. The dope contained from 30 to 50 per cent of tetrachlorethane. In 1911 Prof. K. B. Lehmann made comparative experiments as to the poisonous nature of a number of chlorinated hydrocarbons, among them being tetrachlorethane. Commencement of narcosis was taken as the measure of the poisonous nature. Slight narcosis was caused in cats with a proportion of 5.7 mg. per liter within 4½ hours, and severe narcosis in 5¼ hours. With stronger proportions, the animals were generally clearly ill on the following day. Judging by this

standard of the commencement of narcosis, when compared with other chlorine derivatives of hydrocarbons, tetrachlorethane comes out as much the most poisonous, e. g., nine times as poisonous as carbon tetrachloride and four times as poisonous as chloroform. In experiments on chronic poisoning, the animals exposed to air containing 1 to 2 mg. of tetrachlorethane per liter for four weeks, over a period of 67 hours, showed slight or severe drowsiness and a not inconsiderable diminution in body weight. No post-mortems were made.

Even if, as is to be hoped, use of tetrachlorethane may be eliminated from the dope, I am still of opinion that exhaust ventilation will be necessary to prevent ill effects (dryness of throat, headache, giddiness, amblyopia, and even unconsciousness) from such solvents and diluents as benzene, acetone, and methylated spirit, which must necessarily continue to be used.

DOPE POISONING.¹

Continued incidence of poisoning in aeroplane factories has led to the addition of the main symptom caused by tetrachlorethane—toxic jaundice—to the diseases which, if contracted in a factory, must be notified to the factory department. The occupier [employer] is required to report every such case to the district inspector and to the certifying surgeon, and the medical practitioner in attendance has also to report it to the chief inspector. (S. 73, Factory Act, 1901, and order of Nov. 27, 1915.)

Not every symptom set up by tetrachlorethane, it should be observed, is reportable. The requirement is limited to the serious sign of *jaundice*, and in view of its unmistakable character the difficulty of compliance should be small.²

Tetrachlorethane (of which the specific gravity is twice that of air) is a most powerful cumulative liver poison, even when present in the dope mixture to the extent of only 10 or 12 per cent. Among some 43 cases of jaundice in aeroplane factories which have come to the knowledge of the department there have been 7 deaths (2 males and 5 females). The fatal issue generally has occurred in about a fortnight after the apparently slight initial symptoms had shown themselves.

The size of the aeroplane wings unfortunately makes it impracticable to remove the vapor completely at the point of origin by local exhaust which would carry it off without allowing any to pass into the air of the room. Reliance, therefore, in minimizing the noxious effect has to be placed on dilution of the air so as to keep down the tetrachlorethane and other vapors to a nontoxic proportion. The standard needed for securing this is 30 changes of the air of the doping room per hour. Where this standard has been secured and maintained for all processes in which tetrachlorethane in dope may be used illness, if not altogether prevented, has ceased to cause serious anxiety. On the other hand, where it has fallen short of 20 changes toxic jaundice has not failed eventually to show itself except in the

¹ Great Britain. Factory inspector's office. Form 356, Dope poisoning. Feb., 1916. 4 pp.

² On the other hand, "dope poisoning," i. e., any illness attributable to the ingredients of the dope, has been added to the schedule of diseases to which section 8 of the Workmen's Compensation Act, 1906, applies.

few factories where use of dope has been so intermittent as never to have exposed the workers to a toxic dose.

The means of ventilation must be mechanical, preferably by volume or propeller fans with free discharge to the open air. Owing to the high specific gravity of the vapor the fans should be fixed at the floor level or below this level where space allows the construction of large ducts under the floor. Air inlets of the hopper type, the total area of which should be not less than three times the discharge area of the fans, should be provided at the side of the room opposite the fans at a height of about 10 feet above the floor level. Exceptionally, however, where the fresh air is supplied by a satisfactory plenum system or direct from the erecting shop over a partition of sufficient height, screening the doping room from the rest of the shop, such air inlets may be unnecessary.

Owing to varying conditions of construction in different factories it is impossible to standardize methods of ventilation for doping rooms, but in new works or extension of existing plant plans of proposed ventilating arrangements should be submitted to the inspector for dangerous trades, Home Office, before the work is put in hand.

At the commencement of the war several cases occurred among persons employed in fabric making, erecting fittings, etc., before exhaust ventilation and separation of the process of doping from others was recognized as indispensable. These two conditions have now been secured for doping the wings, but recent experience has shown that insufficient attention has been paid in some factories to the necessity of exhaust ventilation in *all processes in which tetrachlorethane dope is constantly used*. This applies especially to *taping*—now sometimes found carried on in the general erecting shop without any precautions—to which operation the three last fatal cases have been mainly due. Notwithstanding the comparatively small amount of dope used the close application required brings the face right into the fumes. And it is the same with the fuselage and other components—struts and landing gear. One attack was traced to the doping on one occasion of especially large wings in the general erecting shop because (it was alleged) the doping room proper could not accommodate them. There was a tendency in some premises before the great development of the industry was fully realized, to make the doping room too small. This should be avoided in future construction, but the risk involved by such a procedure as that described makes it incumbent on the occupier to improvise for any exceptional occasion a special exhaust system.

Pending the introduction of an efficient substitute for tetrachlorethane, it is most important that occupiers should (in addition to provision and maintenance of a high standard of exhaust ventilation)

consider and apply as far as they can the following further suggestions for safeguarding the health of the workers, which are the outcome of experience gained in various works.

- (1) Exclusion of other work from the doping room.

The need for this has already been pointed out.

- (2) Alternation of employment.

Considerable periods of overtime or long spells in doping or taping have been noted as having preceded some of the fatal attacks. Obviously, as poisoning is a matter of dosage, and the effect of tetrachlorethane is cumulative, the object aimed at by ventilation is defeated if hours of workers are prolonged beyond that for which the ventilation has been designed. In factories where alternation of employment has been arranged, *e. g.*, two days doping and two in other work, or one week in and one week out, improvement in health has resulted. And when such an arrangement is adopted occasional necessary overtime might, it is suggested, be undertaken by those on the out turn rather than by those who have already worked a full day in doping.

In addition to the alternation referred to, in one factory the women engaged in doping are made to spend half an hour morning and afternoon in the open air; so that no spell of work in contact with the fumes lasts longer than two hours.

- (3) Periodic medical examination.

A fortnightly medical examination has served useful purpose, both in reassuring the workers and also in enabling those showing premonitory symptoms to be suspended or transferred to other work. The objective signs, however, which the surgeon has to guide him are few, and he can be materially assisted by information from the foreman or matron as to the state of health of the workers in the intervals between his examinations. After each visit the surgeon should state in writing the names of those (if any) whom he considers should be—

(a) suspended as definitely suffering from dope poisoning, necessitating absence from work until they are quite well, or

(b) transferred temporarily to other work as a precautionary measure on account of equivocal signs.

Medical supervision on these lines has been adopted on their own initiative or on suggestion from the factory department in several aeroplane works, and the same course should be pressed in all where doping is continuous. It is important that it should be carried out by a medical practitioner who is

familiar with the nature of the work and the symptoms to which it may give rise, preferably by the certifying surgeon, as he is in touch with the department and is thus kept informed of the latest observations on the subject. A health register and instructions as to the conduct of the examination will be sent by the medical inspector to the medical man whom you appoint for the purpose as soon as notice of his name is received here.

A worker suffering from effects of dope should be excluded from all contact with it until he is quite well, a medical certificate to that effect being obtained. Instances are known in which premature resumption led to recurrence of symptoms in an aggravated form.

Instruction to workers.—Certain apparently small points have been noticed which have a bearing on liability to attack. Some instruction to new workers as to how they can best avoid inhalation of fumes without interfering with work is called for, especially bearing in mind the youthfulness of some of them.

- (i) Doping should be commenced at the end of the wing nearest to the exhaust fans, and should proceed backward from that point.
- (ii) In some factories the wings, as soon as the doped surface is "tacky," are carried to a drying room or closed chamber (separately ventilated), thus diminishing largely risk from inhalation of fumes. Where no such arrangement exists, the wings should be placed to dry in a position between the workers and the exhaust draft, but not so as to obstruct the fans.
- (iii) After doping, the safest position for the worker is that nearest to the fresh-air inlets, but frequently men and women are seen standing close to the exhaust and therefore breathing the air which is most highly charged with the noxious vapor, the reason being that either the flat top of the outlet duct has been found a convenient place to keep dope pots, brushes, etc., or the light is better there than at the far side. Shortsightedness, unless corrected by glasses, should debar from taping if not from doping.
- (iv) Work should not be commenced on an empty stomach, and where tetrachlorethane is an ingredient of the dope a worker "must not be allowed to take a meal or to remain during the times allowed to him for meals in any room in which such substance is used." (Factory act,

1901, S. 75.) Hence the need for provision of a properly equipped meal room on lines suggested by the health of munition-workers committee.¹

Even if, as is hoped, discovery of an efficient substitute enables use of tetrachlorethane to be eliminated from the dope, exhaust ventilation will still be necessary to prevent the effects (fortunately much less noxious) from such solvents and diluents as benzene, acetone, and methylated spirit, which must necessarily continue to be used.

¹ Memorandum on industrial canteens, 1915, Cd. 8133, price 1d (2 cents).
92103°—Bull. 221—17—7

VENTILATION AND LIGHTING OF MUNITION FACTORIES AND WORKSHOPS.

[Memorandum No. 9.]

I.—INTRODUCTION.

1. At the present time a large number of new munition factories and workshops are being erected, altered, or enlarged. If the purpose of this extended provision is to be fully attained it is of the utmost importance that in the planning of the buildings everything possible should be done to secure that the work is carried on under the conditions most favorable to the maintenance of the health and physical energy of the workers. It must be borne in mind that however free the industry itself may be from unfavorable conditions, overtime and night work inevitably place a serious strain on the worker. The factory acts are concerned to secure in existing factories the minimum necessary in ordinary times, but present conditions and circumstances have brought into prominence problems which deserve special consideration in the building of new factories and the enlargement of old ones. The solution of these problems must largely depend on the particular circumstances of each case, and in the present memorandum the committee have set out certain considerations and suggestions, which they hope may prove of assistance to those immediately responsible for the satisfactory ventilation and heating of old factories, and for the planning of new factories and workshops.

II.—VENTILATION.

2. It has long been recognized that efficient ventilation of factories and workshops is essential for the maintenance of the health and comfort, and therefore of the efficiency and capacity, of the workers, and general regulations to secure this result are contained in the Factory Acts. The inquiries of the committee, however, have led them to believe that the attention paid to ventilation and to the closely associated problem of heating is in the majority of workshops insufficient; the ends to be aimed at are frequently misunderstood, and the means of securing them in consequence ill directed or altogether neglected. At the present time the importance of proper and effective methods of ventilation is often intensified not only by the

increase in number of workers, but by the continuous occupation of shops by day and night; there is under these conditions no interval in which natural ventilation can restore a vitiated atmosphere, and each shift succeeds to the bad conditions left by its predecessor.

3. The object which ventilation seeks to secure is twofold—namely, the removal of foul, exhausted or polluted air and the supply of fresh air in its place—that is, (1) air which is pure and clean for the workers to breathe, and (2) an atmosphere which is stimulating and refreshing. Air which is entirely pure from the chemical point of view may afford an atmosphere of a most depressing character which is highly detrimental to physical efficiency. It is not enough to aim only at clean air, as has been often customary in the past, or only at a stimulating atmosphere. In any consideration of ventilation both objects must be constantly in mind.

4. *Clean air.*—The impurities which are liable to be added to the air inside the workshop are—

- (i) *Carbonic acid*, given off in the breath of human beings and by fires, gas lights or any other form of open combustion. The increase in the amount of carbonic acid is accompanied by a parallel diminution in the oxygen of the air. The chemical changes produced in this way are not perceptible by the senses and there is no reason to suppose that they are, even under the most defective systems of ventilation to be found in factories, in any substantial degree harmful in themselves. Since, however, they are capable of easy and accurate measurement they are recognized as a useful index of the prevalence of more harmful impurities. It should not be assumed that a low percentage of CO_2 necessarily indicates a satisfactory atmosphere.
- (ii) *Various ill-defined volatile substances* arising from human beings, from the skin and the alimentary canal, especially when personal cleanliness is absent and sweating is profuse. The sum of these conditions gives the familiar “smell of humanity”; the substances are probably harmless in themselves, but they excite a feeling of discomfort in many persons and, in the more refined and cleanly individuals, one of disgust, which is detrimental to comfort and efficiency.
- (iii) *Bacteria* arising from human beings form a more definite and a more directly harmful sort of impurity. There is no doubt that the common catarrhal conditions (colds, sore throats, “influenza”) are for the most part spread from an infected individual to his neighbors by

organisms which are carried in the expired air with droplets of moisture especially during coughing and sneezing, though also during ordinary breathing and speaking. These diseases are often regarded as trivial in character; it appears likely, however, that if any correct estimate of lost time and diminished output owing to "colds" could be obtained, these would prove to be the most important infectious source of industrial inefficiency. Of diseases more serious as regards life as well as health, tuberculosis of the lungs is undoubtedly often disseminated in a like manner.

- (iv) *Industrial processes* give rise to a variety of impurities, dust, and fumes. Some of the most common of these impurities are injurious because they are unpleasant, e. g., the smell of hot oil, of various varnishes, and the like. Others are directly harmful, e. g., fumes from stoves, smoke, dust, etc., and a further group are of the nature of poisons, e. g., fumes of lead, of brass, or of tetrachlorethane. The last-named conditions occur only in exceptional cases, and their appropriate treatment presents problems of local ventilation which are special to each case (*see Appendix*¹). Reference should be made to the committee's Memorandum, No. 8, on "Special industrial diseases."

It is evident that the kinds of impurity present in any particular instance will vary widely with the prevalent conditions; a shop with a few clean men and many unhooded furnaces will present impurities chiefly of an inorganic kind, while many dirty men in a crowded machine shop will foul the air with organic impurity. Given normal conditions of personal and workshop cleanliness, the remedy is in all cases the same, and impurities of all kinds can be removed by an effective system of general ventilation which secures that the inside of the shop is well flushed with outside air. Small crowded shops evidently require more flushing with outside air than large sheds with a sparse population, and in very large and spacious shops the impurity of air may seldom reach a degree which is noticeably injurious.

5. *Simulating atmosphere.*²—The proposition which at first sight arises from these considerations is that a workshop may have so

¹ Page 107.

² Whether a workshop has an atmosphere which is satisfactory in this sense may generally be judged by the sensations, especially on first entering from the outside air. More accurate information may be obtained by the study of the particular way in which a "stuffy" atmosphere may be made "fresh." The ordinary thermometer measures the temperature of the air; the wet-bulb thermometer determines the humidity and gives an important measure of the facility with which the body can be cooled by sweating. These instruments, however, give only very imperfect data as to the cooling and skin-stimulating

large a cubic capacity in relation to the number of workpeople and the kind of process in operation that it does not require any definite ventilation. This is wholly false. In large shops there is a mass of stagnant atmosphere which is obviously depressing and relaxing, and fails entirely to provide the stimulating effect of cool air in gentle motion, which is provocative of the best physical and mental exertion. This exhilarating influence of atmosphere depends essentially upon the cooling of the skin by moving air, and it is necessarily closely connected with questions of temperature and heating. It is a matter of common experience that on the whole, cold air is more stimulating than warm, and is more conducive to physical effort. It is also within everyone's experience that damp warm air is more relaxing than dry air at the same temperature; the contrast between a rainy, windless, "stuffy," summer day and a day, perhaps actually far hotter, of blazing sunshine, with a brisk wind is familiar enough. Every-day observation further suggests that the relaxing effect of a warm, damp atmosphere is much reduced if moving air is brought to play on the body, e. g. by riding on the top of a bus, and that change of skin temperature is one of the essential features of what we call a fresh, pleasant air. These considerations are fully borne out by direct experimentation in the laboratory, and the desirable atmosphere is characterized by being:

- (a) Cool rather than hot;
- (b) Dry rather than damp;
- (c) Diverse in its temperature in different parts, and at different times, rather than uniform and monotonous; and (which is intimately connected with this diversity)
- (d) Moving rather than still.

The explanation of the familiar advantages of such an atmosphere seems to lie in the cooling and varying stimulation of the skin of

properties of any atmosphere, and it is necessary to have in addition some measure of the rate at which a warm body will lose heat.

In the observations made for the committee the rate of cooling has been investigated by means of the Kata thermometer (purchaseable from J. Hicks, 8, Hatton Garden, E. C.). A large bulbed spirit thermometer (of standard size) is used; this is heated in hot water, and the rate of cooling measured by taking the time which the meniscus takes to drop from 100° F. to 95° F. while the instrument is suspended in the atmosphere. This gives the dry reading, and shows the rate of cooling due to radiation and convection. To take the wet reading the bulb of the Kata thermometer is covered with a damp muslin glove and the operation repeated, giving the rate of cooling when evaporation is added to radiation and convection. The rate of cooling at body temperature is recorded by means of a factor (determined for each Kata thermometer) in mille calories per square centimeter per second. The number of seconds occupied in the fall from 100° to 95° is divided into the factor.

In addition to the readings of the Kata thermometer those of the wet and dry bulb thermometer were taken. The records show how with the same wet and dry bulb readings, the rate of cooling may be strikingly different. The Kata thermometer, like the human body, notes the rate of change, while the thermometer notes a given state or the result of change. Thus the Kata thermometer takes count of the movement of the air and indicates conditions of comfort.

the exposed parts of the body. Putting the hands or the head under a cold-water tap removes most of the unpleasant sensations of being overheated, which follow violent exertion in hot damp air. The concentration of a current of air on too small a part of the body only causes what is generally known as a draught. It is a common experience that a slightly opened window causes a draught, whereas a widely opened window does not.

6. The close connection between temperature and the stimulating factors of an atmosphere renders it necessary to take also into consideration the question of warmth and cold in workshops. For a shop to be too hot is disadvantageous from every point of view, but the stimulation of too cold an air may be more than counterbalanced by the physical depression which results, and it is not difficult in cold weather for efficiency to deteriorate because the worker becomes uncomfortably chilled. It is hardly desirable to attempt any definition of the "best" temperature, since this must be subject to wide variations with the character of the work and the habit of the worker. It is evident that sedentary workers require a warmer atmosphere than those engaged in more violent labor, and attempts to obtain conditions satisfactory for both classes in the same shop will probably end in suiting neither. It may, however, be suggested that where the air is stagnant the temperature should not exceed about 60° F.; though it may be somewhat higher where the air is kept in motion.

The following examples are given in illustration of the results obtained. The first set of readings are for a bright pleasant day in May, and the other four are for typical shops as a contrast of types of "bad" and "good" shops. A comparison of the first, second, and third sets of readings shows that with the same temperature widely different rates of cooling may exist.

RATE OF COOLING AT BODY TEMPERATURE IN MILLECALORIES PER SQ. CM. PER SEC.

	Wet bulb.	Dry bulb.	Radiation, convection, evaporation.	Radiation, convection.	Evaporation.
(1) Bright, pleasant day in May, out of doors.....	60	68	27.2	7.5	19.7
(2) Brass foundry (good).....	60	72	24	7.3	16.7
(3) Machine shop (bad).....	61	72	15	4.6	10.4
(4) Cartridge annealing and cleaning (bad).....	64.5	80.5	17.5	3.0	14.5
(5) Cartridge annealing and cleaning (good).....	64.5	80.0	24.0	9.0	15.0

7. The problem of heating and ventilation will therefore appear in various forms according to the variations in local conditions—the cubic capacity and the shape of the workroom, the nature of work, the number of workers, the situation in relation to other buildings and hills and valleys, topographical position, season of year, climate,

etc. It is of the utmost importance that those responsible for planning the means of ventilation of any building should realize that each workshop provides a separate problem and that there is no uniform and stereotyped method which will give satisfactory results everywhere. It is impossible here to consider the innumerable combinations of circumstances which arise, but two broad groups may be mentioned.

- (a) A common case is where the air in the shop tends to be too hot or too stagnant, and, indeed, the observations of the committee would lead them to believe that this is one of the most frequent defects found in munition works. The production of heat depends in general on the same sources as those which produce carbonic acid and other impurities—human beings, lights, machinery, and furnaces. About four-fifths of the total energy expended by an active man appears in the form of heat,¹ and the friction of moving machinery also contributes. In sunny weather the “greenhouse effect” of a glass roof is an important factor. The atmosphere is further deteriorated by the moisture given off by the workers, and it may be by hot water used in some industrial process.
- (b) In cold weather, especially in shops where little heat is produced and the occupation is relatively sedentary, the problem is to maintain such a degree of ventilation as will keep the air pure and at the same time to have a comfortably warm atmosphere. This can be done only by the use of artificial heat. To shut off the ventilation and allow the shop to warm up with the heat naturally produced within it can not be too strongly condemned. Where possible it is better that additional clothing should be used. Heat produced by workers is always, and that arising from artificial lighting or processes of manufacture nearly always, accompanied by a proportionate quantity of impurities which are injurious and which must be got rid of. The human

¹ In sedentary occupations a still larger proportion appears as heat. Now an adult gives off from his body per hour about enough heat to raise 2,000 cubic feet of air from 60° to 70° F. Supposing that half of the heat is lost by radiation to walls and roofs, it would require the incoming of about 2,000 cubic feet of outside air at 50° F. per hour per man to keep the temperature from rising above 60° F. If the outside air were at 60° F., more than 20,000 cubic feet per hour per man would have to come in. Such extensive ventilation is a good deal more than would be requisite to maintain the air at a high degree of chemical purity, and under such circumstances the carbonic acid test for a satisfactory atmosphere is wholly fallacious. If, however, physical efficiency is to be maintained, the rise of temperature must be controlled. The exaggerated conditions prevailing in stokeholds of steamships have been successfully dealt with by the introduction of fresh air by means of a powerful fan.

impurities are especially objectionable since cold weather commonly coincides with the special prevalence of catarrhs and a special abundance of their causative bacteria. At the same time the ventilation required is clearly less than in hot weather, and it will suffice if clean air is obtained with such degree of movement and variability as will prevent it from being stagnant.

8. The means by which satisfactory natural ventilation is to be attained are, as has been already mentioned, subject to local considerations in every case, and general lines alone can be indicated here.

- (a) Local sources of impurity and heat production should be dealt with by the provision of hoods, exhausts, flues, etc.; smoke and fumes from neighboring workshops and chimneys may require attention. Workers should be so arranged in relation to each other that they do not cough and sneeze in one another's faces.
- (b) Definite openings communicating with the outside air should be provided in every workshop, and the committee would again-emphasize the fact that the largest shop requires some system of ventilation. The form and nature of such openings can not be defined in a general way, but it appears to the committee that the average machine shop and all similar one-story shops should be provided with louvers along the roof ridges and in many cases also with narrow openings where the roof meets the walls. Such louvers should be permanently open, and will generally ensure that the atmosphere will at least not be grossly bad.
- (c) Such fixed openings do not, however, allow of the flexibility required to meet varying internal and external conditions, and should be supplemented by the use of doors, windows (which will open) and fans. Fans are especially valuable to meet emergencies and abnormal conditions, and provide for a thorough cleaning of the air during meal times.

III.—HEATING.

9. Means of heating are usually restricted by practical considerations to some system of steam or hot-water pipes. The ideal form is no doubt by radiant heat and the committee have found that rather old-fashioned stoves scattered about a shop may give good results and they have observed the excellent and invigorating conditions which prevail in many smithies and forges. Gas-heated radiators,

in which the burned gas escapes into the shop, are not permissible. The plan by which warmed air is pumped into the shop—commonly known as the “plenum system”—tends to create an atmosphere of a highly relaxing and depressing character. It affords a striking example of how chemically pure air may by its uniformity and monotony constitute an atmosphere in which good work is hardly possible. The means of ventilation should be kept separate from that of heating and the “plenum system” should only be used to pump in cool air in summer.

10. The most complete installation for ventilation and heating may be rendered ineffective by injudicious management or failure in proper and continuous maintenance. Rapid changes of climate, different times of day, varying circumstances of use and occupation, all require appropriate treatment. If, for example, the windows are shut because it is a cold morning there is a probability that they will usually not be opened again till the shop is much too hot. Such mismanagement is frequently due to the fact that it is the prescribed duty of no one in particular to observe the prevailing conditions and put in operation the appropriate appliances for the supply of air and heat. The committee are of opinion that the ventilation and heating of each shop or group of shops should be in the charge of some responsible person specially detailed for the purpose and they recognize that the effective maintenance of ventilation depends in large degree upon the vigilance of the workers. It is for the management to provide the means, it is for the employee to aid in their use and application. The effective maintenance of ventilation is becoming increasingly important owing to the large number of women now employed in munition works, since women are especially susceptible to the effect of defective ventilation.

11. The preceding paragraphs are primarily concerned with factories and workshops in which the nature of the work or the character of the material employed involve no special danger to the health of the worker. The serious problems of localized exhaust ventilation in shops where dust or poisonous fumes are evolved is the subject of a special memorandum (*see* Appendix) and the committee do not desire to add anything on the subject except to emphasize the extreme importance of taking all possible steps to protect the health of the workers.

IV.—LIGHTING.

12. This question has been treated with thoroughness and care in the Report of the Departmental Committee on Lighting in Factories and Workshops,¹ which has recently been published, and little more

¹ First Report of Departmental Committee on Lighting in Factories and Workshops, 1915 (Cd. 8,000).

is necessary than to refer briefly to the main conclusions of that report.

The essentials of good lighting are there summarized as:

- (a) Adequacy.
- (b) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.
- (c) The placing or shading of lamps so that light from them does not fall directly on the eyes of an operator when engaged on his work or when looking horizontally across the workroom.
- (d) The placing of lights so as to avoid the casting of extraneous shadows on the work.

13. Natural lighting is to be preferred to artificial lighting on grounds of health as well as of economy. Where it can be arranged, roof lighting is generally to be preferred to lateral lighting. In a good system of roof lighting the illumination is very uniform. In modern factories where lateral lighting is employed a large part of the walls are devoted to windows, but it is evident that there is a limit to the width of the room, beyond which the illumination falls below what is adequate; what this width is will depend partly on the nature of the work to be done in the shop and partly on the extent to which the light is impeded by outside obstacles such as neighboring buildings or inside obstacles such as machinery.

14. The effect of light-colored walls and white ceilings on the general brightness of the room and in affording an effective background to dark objects should not be overlooked. In some cases the natural lighting may be improved by deflecting vertical light into the room by means of reflectors or prismatic glass or by whitening the surface of an external wall or building which obstructs the light. The position of permanent working points should be so adjusted in relation to the windows and to internal obstructions of whatever kind as to secure, so far as practicable, adequate daylight for each.

15. The necessity for the regular cleaning of windows on the inner and outer surfaces can not be too much insisted on. Not only do dirty windows prevent a large proportion of daylight from entering the shop, but the daylight period of work is considerably shortened and needless expenditure on artificial lighting incurred in consequence. At the present time the anti-air raid darkening regulations have much intensified this loss of natural light. In the construction of shops care should be taken to render the outsides of windows easily accessible for cleaning. In many existing shops access is so difficult as to make cleaning almost impossible.

16. The question of artificial lighting is of special importance at the present time when night work is general and when women and

boys are employed in large numbers. Bad lighting affects output unfavorably, not only by making good and rapid work more difficult, but by causing headaches and other effects of eyestrain; the difficulties of supervision, which are always considerable, are further increased if the general lighting of the workshops is insufficient.

A factory may be instanced where in one shop the ceiling was uniformly whitened and illuminated by arc lights which were shaded from the workers. The shop was illuminated by an agreeable diffuse light which cast no shadows. To produce the best effect the entire top surface can be covered with sheets of metal and enameled white. Such a method of lighting may prove to be more costly in upkeep, but it has compensatory advantages in promoting the health of the workers and thus may prove to be economical in the long run. In an adjoining shop the lighting was carried out by electric lamps, each suitably shaded to throw light down on the lathe and not on the eyes of the workers. In still another shop of the same factory fish-tail gas burners were in use, the lighting by such means being very poor and quite unshaded. Owing to the impoverished illuminating power of gas its use without incandescent mantles is to be condemned. Excellent lighting is obtained by the use of incandescent mantles and gas under pressure. The lamps in lofty shops can be placed high up so that they shed a diffuse light without directly throwing a glare into the workers' eyes.

17. Attention should be paid to the lighting of the passages and immediate surroundings of the factory as well as to that of the workshops themselves. In the report of the departmental committee, standards of lighting for factories are suggested, and though the figures given are the minima considered necessary, they may, at any rate, prove of assistance in suggesting the relative amount of light necessary in different parts of the factory.

Signed on behalf of the committee.

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*
JANUARY, 1916.

APPENDIX.

LOCALIZED EXHAUST VENTILATION.

The essentials of localized exhaust ventilation are (a) a duct along which a flow of air is maintained in a definite direction and (b) a localized opening or openings in this duct through which sufficient air is admitted to allow the flow of air to be maintained. The air so admitted carries with it any dust or fumes the removal of which is desired; and this action may be made effective for the purpose of removing from the atmosphere of work places of (1) dust, (2) heated fumes such as arise from melting scrap lead and other poisonous materials, or (3) volatile vapors such as are evolved when dope varnish evaporates. The principles underlying effective action differ for each of these purposes.

1. The removal of dust is best effected by an air current produced by mechanical power, preferably by a pressure fan, and so arranged as to prevent the dust particles escaping from the place where they are produced into the general atmosphere. For this purpose the openings in the ducts should termi-

nate in hoods shaped so as to envelop, as far as practical, the seat of origin of the dust. In the case of dust from a revolving wheel, the hood and duct should be placed to intercept the dust which is thrown tangentially from the wheel and to catch dust which would otherwise fall to the ground; the dust then comes under the influence of the air current in the hood and is drawn into the duct, while the air current itself is assisted by the air thrown off by the wheel. Where dust is created by manual labor, the operative should stand or sit facing the opening of the hood, so that the current of air draws the dust away from him.

2. The removal of heated fumes may usually be effected without using mechanical power, but to attain this end the duct should be vertical, of ample diameter and height, and surmounted by a suitable wind cowl, while the lower end should open gradually into a bell-mouthed hood. The lower end of the hood should envelop and extend below the place where the heated fumes originate. The opening to the hood should only be large enough to permit of necessary manipulations. The errors usually found in this form of exhaust ventilation are (i) the opening to the hood may be too large, and air currents in the work place carry the fumes away before they come under the influence of the draft; (ii) owing to the sides of the hood too nearly approaching the horizontal, the area within the hood may be too small; (iii) the height of the upcast shaft or vertical duct may be insufficient; and (iv) provision may not be made to avoid down draft due to wind.

3. Volatile vapors such as those given off when aeroplane wings are varnished are difficult to localize. If, as is usually the case when noxious vapors have to be dealt with, the vapor is heavier than air, the openings to the duct must be at the ground level and as near as practicable to the place where the vapor is given off. The air current must be so arranged that large volumes of air are drawn away, and ample openings for incoming air must be arranged high up in the workroom.

A factor essential to any form of localized exhaust ventilation is the distribution and size of openings for incoming air in the workroom generally. To obtain an interchange of air and so secure general ventilation, these openings should be placed as far as possible from the exhaust openings, preferably on the opposite side of the workroom; and to avoid drafts, such openings should comprise an area three times that of the exhaust openings. The supply of incoming air may, in some cases, be insured by the use of a pressure fan driving in air through well-distributed openings.

In practice the efficiency of exhaust plants is frequently found impaired by lack of attention to details: (i) The hood to collect dust may be too small, in which case dust flying from a wheel is not intercepted; (ii) the shape of the hoods may be faulty, in which case dust accumulates on areas having an inclination toward the throat less than the angle of rest of the dust, or, in the case of heated fumes, the expanding gases rebound and escape from the hood like smoke from a badly constructed domestic chimney; (iii) the duct opening may be so small that dust collects there and blocks the opening; (iv) the inlets to the work place may be insufficient to admit freely the amount of air required, in which case the air flow in the ducts is slowed, and if a fan is being used power is wasted in driving the fan; (v) bends in the ducts if too sharp impede the flow of air; (vi) where dust is being dealt with, dust-settling chambers of insufficient size or with insufficient openings may have been provided; (vii) insufficient attention may have been paid to the plant erected; hoods detached from ducts, holes broken into ducts, and ducts blocked with every kind of debris have

been found in well-planned installations and in places where considerable power is being expended to drive exhaust fans.

Generally speaking, where a keen draft, as for the removal of dust, is required, pressure fans should be employed; since these fans, though requiring more power to drive, can work against considerable pressure, smaller ducts may be used. Where, on the other hand, large volumes of air are to be removed, volume fans can be more economically employed; but with such fans attention to the sectional area of the ducts is of great importance; the ducts must never be constricted at any point; the total area of the openings must be greater than that of the fan, and all sharp bends in the ducts must be avoided; further, the delivery side of the fan must not be impeded or so placed as to be exposed to the action of wind.

Nearly every work place where localized exhaust ventilation is required presents special problems of its own, for the solving of which technical advice may be necessary, but adherence to the principles above enumerated will effect great improvement. In particular, wherever an exhaust system has been installed the duty should be placed on some responsible person of testing and reporting to the management at stated intervals on the efficiency and maintenance of the installation.

THE EFFECT OF INDUSTRIAL CONDITIONS UPON EYE-SIGHT.

[Memorandum No. 15.]

1. The committee have found it necessary to give special attention to the effect of munition work on the eyesight of the workers. As a result of their inquiries they have received numerous communications from various authorities and individuals interested in this important matter. Speaking generally, there has been a considerable increase at the hospitals in the number of eye cases among munition workers, partly due to the increase in the number of such workers and partly due to their inexperience of metal and engineering works. The result has been not only personal suffering and inconvenience, but also a serious loss of time and a reduction of output. It must be remembered that the eyes are among the hardest worked of all the organs of the body, and that they are extremely sensitive to external conditions. It is, therefore, not surprising that a number of special eye diseases and injuries from accidents to the eyes have come to be associated with the particular processes of certain industries. Yet many of these diseases and injuries are preventable. A few instances communicated to the committee may be quoted.

About 15,000 cases of eye injuries are seen annually at the Birmingham Eye Hospital, and about 1,500 at the Coventry Hospital. The majority of the cases are slight, but even in these at a conservative estimate the loss of time to each man averages half a day; that is to say, that in one district alone from 500 to 700 days' work are lost annually from these trivial accidents.

At the present time at the Moorfields Eye Hospital there are probably not less than 20 men per diem from engineering shops who come to have small foreign objects, usually metal or emery, removed from the eye. A large proportion of these cases come from munition and armament factories, say in all 100 per week. Each man will lose not less than three days from this, in most cases, preventable accident, representing 300 days' work, or, say 40 men idle per week from this cause.

At the Royal Eye Hospital, Manchester, "it is estimated that small chip-pings of metal in the eye cause absence from work on an average for three days, and more serious cases would probably average ten days."

At the Northumberland, Durham and Newcastle Eye Infirmary there has been an increase in the number of patients in 1914 and 1915, and this is largely due to the number of people engaged on munition

work. For example, in 1914, 2,491 eye cases were referred for treatment from the Elswick Works; in 1915 there were 4,973 similar cases.

Lastly, at the Royal Eye Hospital, London, it is stated that "a large and increasing number of munition workers are being treated daily in the casualty department, chiefly for slight accidents, foreign bodies, etc. We have not hitherto kept a special record of munition workers, but I am assured by the nurses that they number from one-half to two-thirds of the cases treated."

The following letter from one of the honorary surgeons of the Wolverhampton Eye Infirmary illustrates the nature of the problems under review:

The number and character of the cases dealt with at the Wolverhampton Eye Infirmary has not been appreciably affected by the extension of munition work, the number of out-patients having increased by a small number only; out-patients in 1913, 8,491; in 1915, 8,544. The number of foreign bodies impacted has increased; 1913, 2,796; 1915, 3,083; but this is due to the workers coming for skilled removal and not trusting their fellow workers to remove them as they did formerly. There has been no increase in eye diseases, and it is impossible to say whether eyestrain has increased or not, the number of cases treated being practically the same in 1913 and 1915. The chief causes of eye injury in engineering and other munition areas are due to impacted and other perforating bodies, lathe work and grinding being the most prolific in producing them. There is a slight increase in infective traumatic ulcers, but this is not sufficient to cause comment. Workers being chiefly troubled by having foreign bodies impacted are usually away from work until they have had them removed, and the average time in these cases would be half a day; the more serious cases would average about two to three weeks.

There have been no difficulties in regard to treatment. The wearing of goggles, though objected to by the workers, has for a long time been urged by the medical staff as a protection against injury. A few cases have been seen lately of acute conjunctivitis due to chemical irritation, but they have quickly recovered when the workers kept away for a few days. A pair of close-fitting goggles like those worn by motorists would be a great protection in these cases where irritating chemical gases are in evidence.

2. Industrial work may cause impairment of eyesight in three chief ways:

- (a) Injuries due to exposure to intense heat or industrial poisons.
- (b) Accidents due to flying particles, etc.
- (c) Eyestrain due to uncorrected errors of refraction or other causes.

3. *Effect of intense heat, etc.*—The effect exerted upon the eyesight by certain industrial poisons used in munition works, such as lead, is in the bulk small, and the influence of prolonged exposure to intense heat and light may take so long a period to manifest itself

(e. g., glassmakers' and furnace workers' cataract) that the damage which may result is not likely to appear during the period of the war. These two occupational influences upon eyesight, therefore, hardly call for consideration here, nor is it within our province to deal with the serious eye injuries which occur among stonemasons, miners, etc. The immediately irritative effect associated with such work as acetylene welding will be referred to later.

4. *Accidents*.—It has been estimated that in normal times in any general group of industrial accidents, over 5 per cent must be ascribed to eye injuries, and that on this basis in 1913 over 8,000 more or less severe eye injuries occurred in the factories of the United Kingdom. The views expressed by ophthalmic surgeons and others indicate that eye injuries in munition work are relatively more frequent than in normal times, and that for engineering factories these cases probably represent about 7 per cent of all accidents, a total which may, however, be greatly exceeded and even reach 20 per cent. Authorities are unanimous in considering that such accidents are largely preventable.

An important trades-union association has stated that, although the percentage (nearly 7 per cent) of eye injuries to the total number of accidents is not appreciably greater than before the war, yet the total number of accidents for this year (1916) to date is nearly 50 per cent greater than for the corresponding period last year, and the suggestion is made that a greater number of slight eye injuries are resulting because the major portion of munition work, so far as machinery is concerned, is lathe-turning, when the turnings break or fly off, striking the operator.

From the reports sent to the committee by hospital surgeons it appears that accidents are mainly due to particles of metal which enter the eye; that the majority of these accidents are slight in character and should give rise to no permanent damage, but that there is a certain proportion of serious accidents which cause permanent injury. "The causes of eye injury are due largely, if not mainly, to the bursting of emery wheels, steel splinters, etc.," says the report of an eye hospital at Liverpool, which records that between three and four times as many cases per annum have been treated since the war began. To the damage which results from injuries sufficiently serious to come under observation and be included in statistical inquiries must be added the much more grave conditions arising from infection following upon "fires" or other trivial eye injuries. Account must also be taken of the time lost and temporary inconvenience suffered from a much larger number of slight causes which may only incapacitate the sufferer for short periods, perhaps half a day. In so far as immediate reduction of output is concerned, these slight cases have probably a greater effect than the more serious injuries.

Speaking of these cases, an ophthalmic surgeon in Glasgow writes: "In most instances the actual physical damage is slight, and the worker will be able to resume his duties in a few hours, or utmost in one or two days, if only the injury to the eye be promptly and skillfully treated. If, on the other hand, the injury be neglected or if it be treated by anyone who is unskillful or careless, sepsis will almost certainly occur; and all experience teaches that infection of the wound is a far greater danger than the actual physical damage to the ocular structures. The occurrence of sepsis at once transforms a very trivial injury to the cornea into a suppurative keratitis, which may run a prolonged course, lead to more or less impairment of sight, and in serious cases even destroy the eye."

5. *Eyestrain*.—Broadly speaking, this may be due to defects of vision or to the nature or conditions of the work. It may be accentuated by the age, fatigue, or unsatisfactory physical health of the worker, by near distance work, insufficient or excessive illumination, abnormal position, or long hours. Operators employed on munition work should possess and maintain a certain standard of visual acuity if they are to perform satisfactorily the work expected of them. This standard, though it may vary for different processes, should never fall much below that of normal useful vision. For fine work the eyesight should be approximately normal. Notwithstanding the important bearing which good eyesight must have upon output, the question is not to-day receiving adequate attention at the hands of those whose duty it is to obtain this output. Instances have come under the notice of the committee of headaches and eyestrain resulting from (a) inadequate light, both artificial and natural; (b) artificial lights adequate in amount but so placed as to throw a glare on the eyes of the workers; and (c) employment of workers (whose eyesight should be aided by suitable glasses) to carry out fine work without first testing their eyesight. Eyestrain, including headache, may be one manifestation of general fatigue. It is thus likely to become more marked when long hours are worked, when night shifts are necessary, or when workers are undernourished, anemic, or of poor general physique.

6. The lighting of factories has so recently been dealt with in detail in the report of the committee on lighting in factories and workshops that no further reference is here needed. But the question of supervision of the eyesight of workers employed on fine work calls for special comment. At one factory where a medical investigation of women workers was carried out on behalf of the committee, the reporter states that "although the general conditions of employment are satisfactory and the management has given considerable thought to the comfort of the employees, in one process which involved fine

work, out of seven girls one suffered from severe, and the other six from occasional, frontal headache attributable to eyestrain. One girl wore glasses obtained from an optician nine years previously. It would be an advantage if all girls before being employed on this process had their eyes medically examined." From another factory it is reported that "in contrasting the eye conditions found in the different workshops the worst effects were found in the fuse department, where the fine process involved close attention. Here 8 per cent of the workers had been obliged to obtain glasses since starting the work, 12 per cent found sight difficult at night, another 7 per cent complained of eyestrain, and 2 per cent found eyestrain increasing in severity. Besides these, 10 per cent appeared to have latent eyestrain, as shown by severe eyestrain and conjunctivitis, and they should have their eyes tested." Another medical reporter remarks that "great carelessness was displayed among those whose ocular defects required attention. Repeatedly I called attention to the necessity of having these adjusted and arranged with the managers to allow individuals so affected leave of absence, but no advantage was taken of the opportunity." The diseased conditions arising from eyestrain or accidents are numerous and include not only the presence of foreign bodies, metal dust, or steel splinters in the eye, but various forms and degrees of inflammation, ulceration, myopia, astigmatism, and visual deterioration.

PREVENTION AND TREATMENT.

7. Many conditions likely to cause temporary or permanent damage to the eyesight of munition workers are admittedly preventable, while the prompt and effective treatment of the injury when it has occurred will reduce suffering, hasten recovery and lessen the chance of permanent injury. The following letter received by the committee is of interest in this connection:

Of recent months the great increase in the numbers of those attending the eye department of the Glasgow Royal Infirmary suffering from injury to the eye has been very noticeable. For the most part the injuries have been trivial and due to foreign bodies, but there have also been cases of penetrating wounds; the latter, however, have been few in comparison with the marked increase in the number of patients applying at the out-patient department on account of slight accidents or diseases.

If such ailments are attended to promptly they ought to heal rapidly and leave no trace. The workman, therefore, ought not to be off duty for more than a few days, but if on the other hand infection of the wound has occurred before he seeks skilled help, he may be absent from work for several weeks. It is, in the great majority of cases, the subsequent infection of the wound rather than the actual physical injury that is most to be dreaded, and the fate of an injured eye depends upon the treatment it receives within the first few hours following the accident.

Most of these accidents would be prevented if the workman would wear suitable protective glasses, and disastrous results would be very few if the workman understood that he ought to report every injury to the eye, no matter how trivial, immediately on its occurrence, and if arrangements were made whereby he could receive expert medical assistance as speedily as possible. These conditions might easily be fulfilled if the nurse in attendance at the munition works was instructed to send all patients suffering from injury to the eye direct to an ophthalmic clinic and never attempt to do more in these cases than give first aid.

8. *Methods of prevention* consist, first, of general measures designed to improve the physical health of the workers and so enable them to resist the effects of fatigue and, secondly, of special measures intended to avoid undue strain on the eyesight or to reduce the liability to accident to a minimum.

General measures, such as the suitable lighting of factories, the provision of canteens, adequate time for sleep and rest, have been dealt with in other memoranda and need no further reference here. Special arrangements necessarily vary in different cases and should be under the general supervision of the medical officer of the factory. The following suggestions are made:

9. *Examination of eyesight.*—When operatives are being engaged for fine work which calls for close attention, the eyesight of each should be tested by the medical officer, or, if he is not available, the nurse or welfare supervisor should apply simple eye tests¹ for the purpose of discovering those whose vision is not normal. All who fail to reach the standard adopted should be sent to the medical officer or to an ophthalmic surgeon or eye hospital to be fully examined and, if necessary, supplied with glasses. When workers are examined for glasses the nature of the work to be performed should be specified whenever possible. In many people and particularly those past middle life, the glasses which give the best acuteness of distant vision would not enable the owner also to do fine work at short range and vice versa. Workers who complain of frequent headache, pain in the eyes, or show signs of conjunctivitis should also be tested in this way.

10. *Eye guards and goggles.*—Under certain conditions the eyes should always be guarded from flying particles of metal. To be effective, an eye guard—

- (a) Should prevent particles reaching the eyes from in front, from either side or from below. Practically nothing enters from above.

¹ Each eye should be tested separately, and the following standard is suggested as a minimum: 6/9 in both eyes (Snellen's types), though 6/12 in one of the eyes may be sufficient in some cases; and the ability to read standard type 0.45 at 1 foot distance. The necessary standard types can be procured from any optician.

- (b) Should be light and comfortable, and allow free play of air so that moisture does not condense on the transparent medium.
- (c) Should not impede vision, or become obscured by the impact of particles.
- (d) Should be strong and cheap.

The fact that no particles are likely to enter from above is important, because the upper part of the goggle may be left open and so allow of ventilation. A closed screen not only becomes hot and uncomfortable, but the transparent medium, usually glass, may be obscured by condensation of moisture. Where fine work has to be executed, there must be clear vision, and for this purpose no medium is better than glass. The objection has been raised that glass broken by a flying particle may be driven into the eye and cause a worse injury than if it were not present. It is stated, however, that "injuries to eyes by glasses or spectacles broken by a foreign body are very rare. It is a very exceptional accident, and a considerable sized foreign body would be necessary to inflict it, and the damage to the eye would probably not be less if no spectacles or protecting glass were in use. Glass such as is used for shooting goggles, of sufficient strength to withstand the impact of pellets of shot, should be employed." An American shop bulletin states that "in no instance was an eye even slightly injured by flying glass where the lens was broken by a flying chip." The main objection to glass, or indeed to any other transparent medium, is that after a time it becomes pitted and obscured. For this reason eye guards should be so made that the glass can be easily removed and cleaned or replaced.

Two forms of eye guard have been designed to meet the requirements stated above. One has the advantage that spectacles required to correct any error of refraction can be worn behind it. The other is composed of a strip of leather with detachable eyepieces pierced with holes for ventilation.

At one factory it has been found possible almost to eliminate accidents due to flying nails, which are particularly serious, by corrugating or scoring the heads of the hammers used.

Where there is exposure to bright light, as in the process of acetylene welding, the glass of the goggles should be tinted or specially prepared to obscure the chemically active rays at or beyond the violet end of the spectrum, otherwise troublesome irritation and conjunctivitis result. Dark-blue glass is usually employed for this purpose.

11. *Treatment of accidents.*—First-aid treatment is all that can be rendered effectively in the factory, but as the subsequent history of the case depends so largely on the way in which first aid is applied every precaution should be taken to avoid increasing the injury by well-meant but misdirected efforts to give relief. Many factories

are now provided with ambulance stations or surgeries, and where this is the case all eye injuries should be sent direct to the surgery, no treatment being attempted in the workshop. If a doctor is on the premises, the case should be referred to him at once. If the injury is not serious, and he is not available, the nurse in charge of the surgery should render first aid and subsequently refer the patient to his own doctor or a hospital. It is most desirable that even apparently slight injuries should be seen by a doctor. At any factory where eye injuries are common the nurse should have had some ophthalmic training.

12. If there is no ambulance station or nurse, first aid can only be given by a fellow workman who should be instructed as to the routine treatment which may suitably be applied. He should be forbidden to exceed these instructions in any way, otherwise, though he may be successful in removing an offending particle, infected ulcers may follow the operation or he may even perforate the cornea. First aid is mainly needed to relieve pain, and should as a rule be limited either to the use of eye drops¹ which may be applied from a suitable bottle, or to a pad and bandage. A camel's hair brush kept in the appropriate solution may be provided for the removal of visible particles which are not impacted or embedded, but its use should not be encouraged. After relief from pain the patient should be sent at once to a doctor or a hospital.

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*
OCTOBER, 1916.

¹ A leaflet issued in 1915 by the Home Office contains information on this point.

**TREASURY AGREEMENT AS TO TRADE-UNION RULES
AFFECTING RESTRICTION OF OUTPUT—CONFERENCE
AT THE BRITISH TREASURY, MARCH 17, 18, AND 19, 1915.**

In opening the conference proceedings, the chancellor of the exchequer made the following statement:¹

“ You know that the position is a serious one. You know it by the speech delivered by Lord Kitchener in the House of Lords, I think on Monday last. In every country engaged in the war they have discovered that the expenditure of war material is considerably in excess of any anticipation ever made by the general staff; so that, even in the best-prepared countries, the pressure is beyond anything that anyone ever expected.

“ I have no doubt you have read the account of the battle which took place last week, which gives you a very good idea of what the increase in the output of munitions means, not merely from the point of view of success, but from the point of view of the lives which you save if an army is well equipped. The position for the attack was prepared by the most tremendous concentration of artillery fire that has probably been witnessed upon any given point during the whole of this war.

“ What was the effect of that? It was not merely to insure success, but, what was equally important, its effect was to save the lives of British soldiers in the attack that was made. The French told me in France when I was there that by a concentration of fire upon a particular point they were able to achieve their purpose with one-tenth of the loss of life which they otherwise would have needed to accomplish that object.

“ That is why it is not merely urgent that we should get an increased output; it is urgent that we should accelerate it. Every month that there is delay in the output may mean two or three months added to the duration of the war, with all its horrors.

“ The Government have, therefore, decided to take action—absolutely unprecedented action—in organizing the industries of this country for the purpose of increasing the output, in order to give support to our gallant countrymen when they advance to the attack against the enemy.

¹ Trades-Union Congress, Forty-seventh Annual Report, 1915, p. 220 et seq.

"What does it mean? I do not want to use the term 'taking over' without explaining that it is capable of an interpretation which I do not wish to put upon it.

"By taking over a works we do not mean to establish an admiral or a general in command of the works, turning adrift those who are managing them at the present moment; that is an impossible task.

"We mean to assume control of works which are now being exclusively devoted to that purpose. There are certain works which are not adapted for that kind of control, but there are others which are, and the great works which are now being used for the purpose of the production of munitions of war are eminently works of that kind.

"Above all, we propose to impose a limitation of profits, because we can quite see that it is very difficult for us to appeal to labor to relax restrictions and to put out the whole of its strength unless some condition of this kind is imposed.

"The workmen of the country, I am perfectly certain, are prepared to put their whole strength into helping the war, so long as they know that it is the State that is getting the benefit of it, and that it does not merely inure to the profit of any particular individual or class.

"If we are merely to take over the works and assume control and guarantee profits within that limit, you will realize that means that the employer has not quite the same interest as he has now in limiting expenditure. Therefore we might be face to face not merely with the employees making demands upon the State which we for the moment might regard as unreasonable, but we might find the employers in combination with them, and therefore we should have employers and employed combining to bring pressure upon the State, and we should not be in a position to deal with it unless we had a complete understanding in advance.

"That is exactly what we want. Before we undertake the control and direction of these works, and undertake the responsibility for them, we must have a complete understanding with the employers and employed.

"What understanding can be asked for? The understanding we must get with the employers is an understanding with regard to the limitation of profits; that we must get, and an understanding, of course, that whatever the State wants done there shall be done. I do not dwell upon those two points; those are matters which I shall have to put before the employers when the time comes, but these are the points I wish to put before the representatives of the workmen.

"For the moment we are liable to have important work interrupted by labor disputes. As I have said before, it is not a question of who is to blame there. The question is, How is the interruption

of work to be prevented while you are settling the dispute? That is the matter which it is important to us to consider.

"Speaking on behalf of the Government, we do not say that the workmen ought never to complain, or that the workmen ought never to ask for an increase of wages; that is not our point. Our point is that during the time the questions at issue are being adjudicated upon the work shall go on.

"The first proposition, therefore, which I shall put before you for your consideration is this: 'With a view to preventing loss of production caused by disputes between employers and workpeople, no stoppage of work by strike or lockout should take place on work for Government purposes.

"'In the event of difficulties arising which fail to be settled by the parties directly concerned, or by their representatives, or under any existing agreement, the matter shall be referred to an impartial tribunal nominated by His Majesty's Government for immediate investigation and report to the Government with a view to a settlement.' All this is purely during the continuation of the war, and does not bear on anything that might happen after war.

"There are three suggestions which I put forward for the settlement of disputes. The first is that a single arbitrator, agreed upon by the parties or appointed by the Board of Trade, should adjudicate—that is the first one.

"The second one is the committee on production. I think that consists of Sir George Askwith, Sir Francis Hopwood, and Sir George Gibb. The third proposition is that a court of arbitration shall be set up, upon which labor is represented equally with the employers. Those are the three methods I put before you for your consideration.

"That is my first proposition. I should like, on behalf of the Government, to establish an understanding with labor that in works which are turning out munitions and equipments for the war, where there is a dispute occurring, there shall be no dropping of tools, but that some means shall be established by which the dispute shall be settled without any interruption of the work.

"The second point is a very difficult and a very delicate one to handle, as I know. I am very glad at this point to be able to give you good news from the Clyde. There are some of you here who know it, but there are others who, perhaps, have not heard it. I believe there has been a ballot on the Clyde, which began about a week ago, and I understand that although the ballot is scarcely completed the result is overwhelmingly in favor of accepting the Government's proposals for arbitration in the matter.

"The second proposition is the suspension, where necessary during the war, of restrictions of output. Here again I want to make it

perfectly clear that I am only discussing this suspension during the war.

“There is the question of the number of machines which one man is permitted to attend to; there is the question of the employment of semiskilled labor, where under normal conditions you could not assent to it; and there is the question of the employment of female labor.

“In France there is a vast amount of work being done by women and by girls in the ammunition factories. In that country they have suspended all these rules and regulations for the time being, because they realize that the security of their country depends upon it.

“There are two alternatives before this country, and they are alternatives which must be presented to every class here. At the end of this war we shall either be the vassals of the German military caste (drunk with success) or we shall have broken militarism forever.

“It is because I realize as a democrat how very important that is, that I am making this appeal to the leaders of the workmen to assist us to organize our industries.

“The president of the Board of Trade and myself will make exactly the same appeal to the employers—that it is important for us to mobilize to the last the whole of our resources, so that we shall be able as a nation, perfectly united, to march to a victory which is essential, I can assure, to human liberty.”

The following trade-union representatives were appointed by and from the conference to act as an advisory committee to assist in drafting the proposed scheme: Messrs. A. Henderson, M. P., J. T. Brownlie (engineers), A. Wilkie, M. P. (shipwrights), J. Hill (boilermakers), W. Mosses (patternmakers), F. Smith (cabinet-makers), and C. W. Bowerman, M. P. (Parliamentary Committee Trades-Union Congress).

PROPOSALS AGREED UPON AS RESULT OF THE CONFERENCE.

I.

During the war period there shall in no case be any stoppage of work upon munitions and equipments of war or other work required for a satisfactory completion of the war.

All differences on wages or conditions of employment arising out of the war shall be dealt with without stoppage in accordance with Paragraph II.

Questions not arising out of the war should not be made the cause of stoppage during the war period.

II.

Subject to any existing agreements or methods now prevailing for the settlement of disputes, differences of a purely individual or local character shall, unless mutually arranged, be the subject of a deputation to the firm

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representing the workmen concerned; and differences of a general character affecting wages and conditions of employment arising out of the war shall be the subject of conferences between the parties.

In all cases of failure to reach a settlement of disputes by the parties directly concerned, or their representatives, or under existing agreements, the matter in dispute shall be dealt with under any one of the three following alternatives as may be mutually agreed, or, in default of agreement, settled by the board of trade:

- (a) The committee on production.
- (b) A single arbitrator agreed upon by the parties or appointed by the board of trade.
- (c) A court of arbitration upon which labor is represented equally with the employers.

III.

An advisory committee representative of the organized workers engaged in production for Government requirements shall be appointed by the Government for the purpose of facilitating the carrying out of these recommendations and for consultation by the Government or by the workmen concerned.

IV.

Provided that the conditions set out in Paragraph V are accepted by the Government as applicable to all contracts for the execution of war munitions and equipments, the workmen's representatives at the conference are of opinion that during the war period the relaxation of the present trade practices is imperative, and that each union be recommended to take into favorable consideration such changes in working conditions or trade customs as may be necessary with a view to accelerating the output of war munitions or equipments.

V.

The recommendations contained in Paragraph IV are conditional on the Government requiring all contractors and subcontractors engaged on munitions and equipments of war or other work required for the satisfactory completion of the war to give an undertaking to the following effect:

Any departure during the war from the practice ruling in our workshops, shipyards, and other industries prior to the war, shall only be for the period of the war.

No change in practice made during the war shall be allowed to prejudice the position of the workpeople in our employment or of their trade-unions in regard to the resumption and maintenance after the war of any rules or customs existing prior to the war.

In any readjustment of staff which may have to be effected after the war, priority of employment will be given to workmen in our employment at the beginning of the war who are serving with the colors, or who are now in our employment.

Where the custom of a shop is changed during the war by the introduction of semiskilled men to perform work hitherto performed by a class of workmen of higher skill, the rates paid shall be the usual rates of the district for that class of work.

The relaxation of existing demarcation restrictions or admission of semiskilled or female labor shall not affect adversely the rates customarily paid for the job. In cases where men who ordinarily do the work are adversely

affected thereby the necessary readjustments shall be made so that they can maintain their previous earnings.

A record of the nature of the departure from the conditions prevailing before the date of this undertaking shall be kept, and shall be open for inspection by the authorized representative of the Government.

Due notice shall be given to the workmen concerned, wherever practicable, of any changes of working conditions which it is desired to introduce as the result of this arrangement, and opportunity of local consultation with men or their representatives shall be given if desired.

All differences with our workmen engaged on Government work arising out of changes so introduced, or with regard to wages or conditions of employment arising out of the war, shall be settled without stoppage of work, in accordance with the procedure laid down in Paragraph II.

It is clearly understood that, except as expressly provided in the fourth paragraph of Clause V, nothing in this undertaking is to prejudice the position of employers and employees after the war.

D. LLOYD GEORGE.

WALTER RUNCIMAN.

ARTHUR HENDEBSON,

Chairman of Workmen's Representatives.

WM. MOSSES,

Secretary of Workmen's Representatives.

TRADE-UNIONS REPRESENTED AT THE CONFERENCE.

Friendly Society of Iron Founders.	National Union of Railwaymen.
British Steel Smelters' Association.	Parliamentary Committee Trades-Union Congress.
Amalgamated Society of Engineers.	Boot and Shoe Operatives' Society.
Federation of Engineering and Shipbuilding Trades.	United Machine Workers' Association.
National Transport Workers' Federation.	Associated Iron and Steel Workers of Great Britain.
General Union of Textile Workers.	National Amalgamated Union of Labor.
Amalgamated Society of Carpenters and Joiners.	The Workers' Union.
Boilermakers and Iron and Steel Shipbuilders' Society.	Amalgamated Toolmakers.
Ship Constructors and Shipwrights' Association.	Shipbuilding Trades Agreement Committee.
National Amalgamated Sheet Metal Workers.	General Federation of Trade-Unions.
United Operative Plumbers' Association.	Electrical Trades-Union.
Gasworkers and General Laborers' Union.	Associated Blacksmiths and Iron Workers.
General Union of Carpenters and Joiners.	Associated Ironmolders of Scotland.
United Patternmakers' Association.	National Amalgamated Cabinetmakers.
National Amalgamated Furnishing Trades Association.	Steam Engine Makers' Society.
National Amalgamated House and Ship Painters and Decorators.	General Union of Braziers and Sheet Metal Workers.
	Scottish Painters' Society.
	Sheet Iron Workers and Light Platers' Society.
	National Brass Workers.

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The invitation to your committee¹ to be represented at the Treasury Conference was in the following terms:

BOARD OF TRADE,

7, Whitehall Gardens, London, S. W., March 12, 1915.

SIR: I am directed by the Board of Trade to invite the parliamentary committee of the Trades-Union Congress to send three representatives to a conference at the Treasury on Wednesday, March 17, at 11 a. m., to consult with the chancellor of the exchequer and the president of the Board of Trade on certain matters of importance to labor arising out of the recent decision of the Government embodied in the Defense of the Realm (Amendment) Act, to take further steps to organize the resources of the country to meet naval and military requirements.

I am, sir, your obedient servant,

H. LEWELLYN SMITH.

The SECRETARY, TRADES-UNION CONGRESS PARLIAMENTARY COMMITTEE.

MUNITIONS OF WAR ACT (JULY 2, 1915).

PART I.

SETTLEMENT OF LABOR DIFFERENCES.

1.—(1) If any difference exists or is apprehended between any employer and persons employed, or between any two or more classes of persons employed, and the difference is one to which this part of this act applies, that difference, if not determined by the parties directly concerned or their representatives or under existing agreements, may be reported to the Board of Trade, by or on behalf of either party to the difference, and the decision of the Board of Trade as to whether a difference has been so reported to them or not, and as to the time at which a difference has been so reported, shall be conclusive for all purposes.

(2) The Board of Trade shall consider any difference so reported and take any steps which seem to them expedient to promote a settlement of the difference, and, in any case in which they think fit, may refer the matter for settlement either in accordance with the provisions of the first schedule to this act or, if in their opinion suitable means for settlement already exist in pursuance of any agreement between employers and persons employed, for settlement in accordance with those means.

(3) Where a matter is referred under the last foregoing subsection for settlement otherwise than in accordance with the provisions of the first schedule to this act, and the settlement is in the opinion of the Board of Trade unduly delayed, the Board may annul the reference and substitute therefor a reference in accordance with the provisions of the said schedule.

(4) The award on any such settlement shall be binding both on employers and employed and may be retrospective; and if any employer, or person employed, thereafter acts in contravention of, or fails to comply with, the award, he shall be guilty of an offense under this act.

PROHIBITION OF LOCKOUTS AND STRIKES IN CERTAIN CASES.

2.—(1) An employer shall not declare, cause, or take part in a lockout, and a person employed shall not take part in a strike, in connection with any difference to which this part of this act applies, unless the difference has been reported to the Board of Trade, and 21 days have elapsed since the date of the report, and the difference has not during that time been referred by the Board of Trade for settlement in accordance with this act.

(2) If any person acts in contravention of this section, he shall be guilty of an offense under this act.

DIFFERENCES TO WHICH PART I APPLIES.

3. The differences to which this part of this act applies are differences as to rates of wages, hours of work, or otherwise as to terms or conditions of or affecting employment on the manufacture or repair of arms, ammunition, ships, vehicles, aircraft, or any other articles required for use in war, or of the metals, machines, or tools required for that manufacture or repair (in this

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act referred to as munitions work); and also any differences as to rates of wages, hours of work, or otherwise as to terms or conditions of or affecting employment on any other work of any description, if this part of this act is applied to such a difference by His Majesty by proclamation on the ground that in the opinion of His Majesty the existence or continuance of the difference is directly or indirectly prejudicial to the manufacture, transport, or supply of munitions of war.

This part of this act may be so applied to such a difference at any time, whether a lockout or strike is in existence in connection with the difference to which it is applied or not:

Provided, That if in the case of any industry the Minister of Munitions is satisfied that effective means exist to secure the settlement without stoppage of any difference arising on work other than on munitions work, no proclamation shall be made under this section with respect to any such difference.

When this part of this act is applied to any difference concerning work other than munitions work the conditions of labor and the remuneration thereof prevailing before the difference arose shall be continued until said difference is settled in accordance with the provisions of this part of this act.

PART II.

CONTROLLED ESTABLISHMENTS.

4. If the Minister of Munitions considers it expedient for the purpose of the successful prosecution of the war that any establishment in which munitions work is carried on should be subject to the special provisions as to limitation of employers' profits and control of persons employed and other matters contained in this section, he may make an order declaring that establishment to be a controlled establishment, and on such order being made the following provisions shall apply thereto:

- (1) Any excess of the net profits of the controlled establishment over the amount divisible under this act, as ascertained in accordance with the provisions of this act, shall be paid into the exchequer.
- (2) Any proposal for any change in the rate of wages, salary, or other emoluments of any class of persons employed in the establishment, or of any persons engaged in the management or the direction of the establishment (other than a change for giving effect to any Government conditions as to fair wages or to any agreement between the owner of the establishment and the workmen which was made before the 23d day of June, 1915), shall be submitted to the Minister of Munitions, who may withhold his consent within 14 days of the date of the submission:

Provided, That if the Minister of Munitions so directs, or if the minister's consent is withheld and the persons proposing the change so require, the matter shall be referred for settlement in accordance with the provisions of the first schedule to this act, and the consent of the arbitration tribunal, if given, shall in that case have the same effect as the consent of the Minister of Munitions.

If the owner of the establishment or any contractor or subcontractor employing labor therein makes any such change, or attempts to make any such change, without submitting the proposal for the change to the Minister of Munitions or when the consent of the minister has been withheld, he shall be guilty of an offense under this act.

- (3) Any rule, practice, or custom not having the force of law which tends to restrict production or employment shall be suspended in the estab-

ishment, and if any person induces or attempts to induce any other person (whether any particular person or generally) to comply, or continue to comply, with such a rule, practice, or custom, that person shall be guilty of an offense under this act.

If any question arises whether any rule, practice, or custom is a rule, practice, or custom which tends to restrict production or employment, that question shall be referred to the Board of Trade, and the Board of Trade shall either determine the question themselves or, if they think it expedient or either party requires it, refer the question for settlement in accordance with the provisions contained in the first schedule to this act. The decision of the Board of Trade or arbitration tribunal, as the case may be, shall be conclusive for all purposes.

- (4) The owner of the establishment shall be deemed to have entered into an undertaking to carry out the provisions set out in the second schedule to this act, and any owner or contractor or subcontractor who breaks or attempts to break such an undertaking shall be guilty of an offense under this act.
- (5) The employer and every person employed in the establishment shall comply with any regulations made applicable to that establishment by the Minister of Munitions with respect to the general ordering of the work in the establishment with a view to attaining and maintaining a proper standard of efficiency and with respect to the due observance of the rules of the establishment.

If the employer or any person so employed acts in contravention of or fails to comply with any such regulation, that employer or person shall be guilty of an offense under this act.

- (6) The owners of an establishment shall have power, notwithstanding anything in any act, order, or deed under which they are governed, to do all things necessary for compliance with any provisions of this section, and any owner of an establishment shall comply with any reasonable requirements of the Minister of Munitions as to information or otherwise made for the purposes of this section, and, if he fails to do so, shall be guilty of an offense under this act.

Where in any establishment munitions work is carried on in some part of the establishment but not in other parts, the Minister of Munitions may, if he considers that it is practicable to do so, treat any part of the establishment in which munitions work is not carried on as a separate establishment, and the provisions of this act shall take effect accordingly.

SUPPLEMENTARY PROVISIONS AS TO THE LIMITATION OF THE PROFITS OF A CONTROLLED ESTABLISHMENT.

5.—(1) The net profits of a controlled establishment shall be ascertained in accordance with the provisions of this section and rules made thereunder, and the amount of profits divisible under this act shall be taken to be an amount exceeding by one-fifth the standard amount of profits.

(2) The standard amount of profits for any period shall be taken to be the average of the amount of the net profits for the two financial years of the establishment completed next before the outbreak of the war, or a proportionate part thereof.

(3) If in any case it appears or is represented to the Minister of Munitions that the net profits or losses of all or any other establishments belonging to the same owner should be brought into account, or that the average under this sec-

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tion affords or may afford an unfair standard of comparison or affords no standard of comparison, the minister may, if he thinks just, allow those net profits or losses to be brought into account, or substitute for the average such an amount as the standard amount of profits as may be agreed upon with the owner of the establishment.

The Minister of Munitions may, if he thinks fit, and shall, if the owner of the establishment so requires, refer the matter to be determined by a referee or board of referees appointed or designated by him for the purpose, and the decision of the referee or board shall be conclusive on the matter for all purposes.

(4) The Minister of Munitions may make rules for carrying the provisions of this section into effect, and these rules shall provide for due consideration being given in carrying out the provisions of this section as respects any establishment to any special circumstances such as increase of output, provision of new machinery or plant, alteration of capital or other matters which require special consideration in relation to the particular establishment.

VOLUNTARY UNDERTAKING TO WORK FOR MINISTER OF MUNITIONS.

6.—(1) If any workman in accordance with arrangements made by the Minister of Munitions with or on behalf of trade unions enters into an undertaking with the Minister of Munitions that he will work at any controlled establishment to which he may be assigned by the minister, and be subject to the penalty imposed by this act if he acts in contravention of or fails to comply with the undertaking, that workman shall if he acts in contravention of or fails to comply with his undertaking be guilty of an offense under this act.

(2) If any employer dissuades or attempts to dissuade a workman in his employment from entering into an undertaking under this section, or retains or offers to retain in his employment any workman who has entered into such an undertaking after he has received notice from the Minister of Munitions that the workman is to work at some other establishment, that employer shall be guilty of an offense under this act.

PROHIBITION OF THE EMPLOYMENT OF PERSONS WHO HAVE LEFT WORK IN MUNITION FACTORIES.

7.—(1) A person shall not give employment to a workman, who has within the last previous six weeks, or such other period as may be provided by order of the Minister of Munitions as respects any class of establishment, been employed on or in connection with munitions work in any establishment of a class to which the provisions of this section are applied by order of the Minister of Munitions, unless he holds a certificate from the employer by whom he was last so employed that he left work with the consent of his employer or a certificate from the munitions tribunal that the consent has been unreasonably withheld.

(2) If any workman or his trade-union representative complains to a munitions tribunal in accordance with rules made with respect to those tribunals that the consent of an employer has been unreasonably withheld that tribunal may, after examining into the case, if they think fit, grant a certificate which shall, for the purposes of this section, have the same effect as a certificate from the employer.

(3) If any person gives employment in contravention of the provisions of this section, he shall be guilty of an offense under this act.

RULES AS TO BADGES.

8.—(1) The Minister of Munitions may make rules authorizing the wearing of badges or other distinctive marks by persons engaged on munitions work or other

work for war purposes, and as to the issue and return of any such badges or marks, and may by those rules prohibit the use, wearing or issue of any such badges or of any badges or marks indicating or suggesting that any person is engaged on munitions work or work for war purposes except as authorized by those rules.

(2) If any person acts in contravention of or fails to comply with any such rules he shall be guilty of an offence under this act.

APPLICATION OF PART II TO DOCKS USED BY ADMIRALTY.

9. This part of this act shall apply to any docks used by the Admiralty for any purposes connected with the war as it applies to establishments in which munitions work is carried on, with the substitution in relation to any such docks or persons employed in any such docks of the Admiralty for the Minister of Munitions.

PART III.

* * * * *

POWER TO REQUIRE INFORMATION FROM EMPLOYERS.

11.—(1) The owner of any establishment in which persons are employed shall, if so required by the Minister of Munitions, give to the minister such information, in such form and in such manner, as the minister may require as to—

- (a) the numbers and classes of persons employed or likely to be employed in the establishment from time to time;
- (b) the numbers and classes of machines at any such establishment;
- (c) the nature of the work on which any such persons are employed or any such machines are engaged from time to time;
- (d) any other matters with respect to which the minister may desire information for the purpose of his powers and duties;

and the minister may arrange with any other Government department for the collection of any such information.

(2) If the owner of any establishment fails to comply with this section he shall be guilty of an offence under this act.

PUNISHMENT FOR FALSE STATEMENTS, ETC.

12. If any employer, or the owner of any establishment or any workman, for the purpose of evading any provision of this act, makes any false statement or representation, or gives any false certificate, or furnishes any false information, he shall be guilty of an offence under this act.

PAYMENT OF MEMBERS OF ARBITRATION AND MUNITIONS TRIBUNALS, ETC.

13. There shall be paid out of moneys provided by Parliament to any person being a member of an arbitration tribunal, munitions tribunal, or board of referees under this act, or being a referee under this act, and to any other officers required in connection with any such tribunal or board, such remuneration and traveling or other expenses (including compensation for loss of time) as the Minister of Munitions or Board of Trade, as the case may be, with the sanction of the Treasury, may determine.

PENALTIES.

- 14.—(1) Any person guilty of an offense under this act—
- (a) shall, if the offense is a contravention of or failure to comply with an award, be liable to a fine not exceeding £5 for each day or part of a day during which the contravention or failure to comply continues, and, if the person guilty of the offense is an employer, for each man in respect of whom the contravention or failure takes place; and
 - (b) shall, if the offense is a contravention of the provisions of this act with respect to the prevention of lockouts, be liable to a fine not exceeding £5, in respect of each man locked out, for each day or part of a day during which the contravention continues; and
 - (c) shall, if the offense is a contravention of the provisions of this act with respect to the prohibition of strikes, be liable to a fine not exceeding £5 for each day or part of a day during which the contravention continues; and
 - (d) shall, if the offense is a contravention of or failure to comply with any regulations in a controlled establishment or any undertaking given by a workman under Part II of this act, be liable in respect of each offense to a fine not exceeding £3; and
 - (e) shall, if the offense is a contravention of or failure to comply with any other provisions of this act, be liable in respect of each offense to a fine not exceeding £50.
- (2) A fine for any offense under this act shall be recoverable only before the munitions tribunal established for the purpose under this act.

MUNITIONS TRIBUNALS.

15.—(1) The munitions tribunal shall be a person, appointed for the purpose by the Minister of Munitions, sitting with two or some other even number of assessors, one half being chosen by the Minister of Munitions from a panel constituted by the Minister of Munitions of persons representing employers and the other half being so chosen from a panel constituted by the Minister of Munitions of persons representing workmen; and the Minister of Munitions may constitute two classes of munitions tribunals, the first class having jurisdiction to deal with all offenses and matters under this act, the second class having jurisdiction, so far as offenses are concerned, to deal only with any contravention of, or failure to comply with, any regulation made applicable to a controlled establishment or any undertaking given by a workman under Part II of this act.

The Admiralty shall be substituted for the Minister of Munitions under this provision as the authority to appoint and choose members of a munitions tribunal to deal with offenses by persons employed in any docks declared to be controlled establishments by the Admiralty.

(2) The Minister of Munitions or the Admiralty shall constitute munitions tribunals as and when occasion requires.

(3) Rules may be made for regulating the munitions tribunals or either class of munitions tribunals so far as relates to offenses under this act by a secretary of state, and so far as relates to any other matters which are referred to them under this act by the Minister of Munitions, and rules made by the secretary of state may apply, with the necessary modifications, any of the provisions of the summary jurisdiction acts or any provisions applicable to a court of summary jurisdiction, which it appears expedient to apply, and any provisions so applied shall apply to munitions tribunals accordingly.

* * * * *

(4) A person employed or workman shall not be imprisoned in respect of the nonpayment of a fine imposed by a munitions tribunal for an offense within the jurisdiction of a tribunal of the second class, but that tribunal may, without prejudice to any other available means of recovery, make an order requiring such deductions to be made on account of the fine from the wages of the person employed or workman as the tribunal think fit, and requiring the person by whom the wages are paid to account for any sums deducted in accordance with the order.

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RULES TO BE LAID BEFORE PARLIAMENT.

17. Any rule made under this act shall be laid before each house of Parliament forthwith, and, if an address is presented to His Majesty by either house of Parliament within the next subsequent 21 days on which that house has sat next after any such rule is laid before it praying that the rule may be annulled, His Majesty in council may annul the rule, and it shall thenceforth be void, but without prejudice to the validity of anything previously done thereunder.

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INTERPRETATION.

19. In this act, unless the context otherwise requires—

- (a) The expression "lockout" means the closing of a place of employment, or the suspension of work, or the refusal by an employer to continue to employ any number of persons employed by him in consequence of a dispute, done with a view to compelling those persons, or to aid another employer in compelling persons employed by him, to accept terms or conditions of or affecting employment.
- (b) The expression "strike" means the cessation of work by a body of persons employed acting in combination, or a concerted refusal or a refusal under a common understanding of any number of persons employed to continue to work for an employer in consequence of a dispute, done as a means of compelling their employer or any person or body of persons employed, or to aid other workmen in compelling their employer or any person or body of persons employed, to accept or not to accept terms or conditions of or affecting employment.

SHORT TITLE AND DURATION.

20.—(1) This act may be cited as the Munitions of War Act, 1915.

(2) This act shall have effect only so long as the office of Minister of Munitions and the Ministry of Munitions exist:

Provided, That Part I of this act shall continue to apply for a period of 12 months after the conclusion of the present war to any difference arising in relation to the performance by the owner of any establishment of his undertaking to carry out the provisions set out in the second schedule to this act, notwithstanding that the office of Minister of Munitions and the Ministry of Munitions have ceased to exist.

SCHEDULE I.

1. Any difference, matter, or question to be referred for settlement in accordance with the provisions of this schedule shall be referred to one of the three following arbitration tribunals:

- (a) The committee appointed by the first lord of the Treasury known as the committee on production; or

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- (b) A single arbitrator to be agreed upon by the parties or in default of agreement appointed by the Board of Trade; or
- (c) A court of arbitration consisting of an equal number of persons representing employers and persons representing workmen with a chairman appointed by the Board of Trade.

2. The tribunal to which the reference is made shall be determined by agreement between the parties to the difference, or in default of such agreement by the Board of Trade.

3. The Arbitration Act, 1889, shall not apply to any reference under the provisions of this schedule.

SCHEDULE II.

1. Any departure during the war from the practice ruling in the workshops, shipyards, and other industries prior to the war shall only be for the period of the war.

2. No change in practice made during the war shall be allowed to prejudice the position of the workmen in the owners' employment, or of their trade unions in regard to the resumption and maintenance after the war of any rules or customs existing prior to the war.

3. In any readjustment of staff which may have to be effected after the war priority of employment will be given to workmen in the owners' employment at the beginning of the war who have been serving with the colors or who were in the owners' employment when the establishment became a controlled establishment.

4. Where the custom of a shop is changed during the war by the introduction of semiskilled men to perform work hitherto performed by a class of workmen of higher skill, the time and piece rates paid shall be the usual rates of the district for that class of work.

5. The relaxation of existing demarcation restrictions or admission of semi-skilled or female labor shall not affect adversely the rates customarily paid for the job. In cases where men who ordinarily do the work are adversely affected thereby, the necessary readjustments shall be made so that they can maintain their previous earnings.

6. A record of the nature of the departure from the conditions prevailing when the establishment became a controlled establishment shall be kept, and shall be open for inspection by the authorized representative of the Government.

7. Due notice shall be given to the workmen concerned wherever practicable of any changes of working conditions which it is desired to introduce as the result of the establishment becoming a controlled establishment, and opportunity for local consultation with workmen or their representatives shall be given if desired.

8. All differences with workmen engaged on Government work arising out of changes so introduced or with regard to wages or conditions of employment arising out of the war shall be settled in accordance with this act without stoppage of work.

9. Nothing in this schedule (except as provided by the fourth paragraph thereof) shall prejudice the position of employers or persons employed after the war.

MUNITIONS OF WAR (AMENDMENT) ACT, 1916. [JAN. 27, 1916.]

POWER TO DECLARE GOVERNMENT FACTORIES, ETC., CONTROLLED ESTABLISHMENTS.

1. The Minister of Munitions may by order declare any establishment or establishments belonging to or under the control of His Majesty or any Government Department in which munitions work is carried on to be a controlled establishment or controlled establishments, as the case may be, and thereupon the provisions of the Munitions of War Act, 1915¹ (hereinafter referred to as "the principal act"), and this act relating to controlled establishments shall apply to such an establishment or establishments subject to such modifications and exceptions necessary to adapt those provisions to such an establishment or establishments as may be specified in such order.

AMENDMENT OF SECTION 1 OF PRINCIPAL ACT.

2. Subsection (2) of section 1 of the principal act shall have effect as if after the words "in any case in which they think fit may" there were inserted the words "and in the case where the difference is a difference between an employer and persons employed which appears to the Board of Trade a bona fide difference and which the Board have failed to settle by such steps as aforesaid, shall within 21 days from the date of the report."

AMENDMENT OF SECTION 6 OF PRINCIPAL ACT.

3. (1) Where a workman has entered into an undertaking with the Minister of Munitions under section 6 of the principal act and was at the time of entering into that undertaking in the employment of any employer, then if that employer within the period of six weeks from the date of the undertaking dismisses that workman from his employment he shall be guilty of an offense under the principal act and shall be liable to a fine not exceeding £5 unless he proves that there was reasonable cause for dismissing the workman.

(2) It is hereby declared that where the fulfillment by any workman of any contract is interfered with by the necessity on his part of complying with an undertaking entered into by him under section 6 of the principal act, that necessity is a good defense to any action or proceedings taken against that workman in respect of the nonfulfillment of the contract so far as it is due to the interference and he shall be entitled to enter into such an undertaking notwithstanding the existence of such a contract.

(3) Section 6 of the principal act shall apply to a workman who had before the passing of the principal act entered into an undertaking of the nature mentioned in that section in like manner as if the undertaking had been entered into in pursuance of that section.

OFFENSES BY EMPLOYERS IN CONNECTION WITH MUNITIONS WORKERS ASSIGNED TO THEM.

4. Where a person who has been temporarily released from naval or military service for the purpose of employment on or in connection with munitions work, or a workman who has entered into an undertaking with the Minister of Munitions under section 6 of the principal act, or to whom that section is applied by this act, has been assigned to any employer, and that employer has entered into an undertaking with the Minister of Munitions as to the class or description of work on or in connection with which the person or workman

so assigned to him is to be employed, then, if the employer acts in contravention of or fails to comply with any of the provisions of the undertaking, he shall be guilty of an offense under the principal act and liable to a fine not exceeding £5.

AMENDMENT OF SECTION 7 OF PRINCIPAL ACT.

5. (1) Section 7 of the principal act shall have effect as if for subsections (1) and (2) of that section the following two subsections were substituted:

“(1) A person shall not give employment to a workman who has within the last previous six weeks, or such other period as may be provided by order of the Minister of Munitions as respects any class of establishment, been employed on or in connection with munitions work in any establishment of a class to which the provisions of this section are applied by order of the Minister of Munitions, unless he holds a certificate from the employer by whom he was last so employed or from a munitions tribunal that he is free to accept other employment.

“(2) If any workman or his trade-union representative complains to a munitions tribunal, in accordance with rules made with respect to those tribunals, that an employer has unreasonably refused or neglected to issue such a certificate as aforesaid, that tribunal may, after examining into the case, if it thinks fit, itself issue such a certificate or order the issue of such a certificate by the employer.”

(2) Where a workman employed on or in connection with munitions work in any establishment of a class to which the provisions of section 7 of the principal act are for the time being applied by an order made thereunder is dismissed or discharged by his employer the employer shall forthwith give him such a certificate as aforesaid, and if he fails to do so, a munitions tribunal may, in addition to issuing or ordering the issue to him of such a certificate, order the payment to him by the employer of such sum, not exceeding £5, as the tribunal may think fit, unless the tribunal is of opinion that the workman was guilty of misconduct for the purpose of obtaining dismissal or discharge.

This subsection shall apply to a workman who applies for a certificate on the ground that he has for a period of more than two days been given no opportunity of earning wages, or who leaves his employment on account of conduct on the part of the employer, or any agent of the employer, which would justify the immediate termination by the workman of his contract of service in like manner as if he had been dismissed or discharged by his employer.

(3) Where a contract of service with a workman employed on or in connection with munitions work in any establishment of a class to which the provisions of section 7 of the principal act are for the time being applied by an order made thereunder is terminated by dismissal, and less than one week's notice, or wages in lieu of notice, has or have been given, the employer shall, subject to the provisions of this subsection, within 24 hours of giving notice of dismissal to the workman, report the matter in such manner as may be prescribed by rules made by the Minister of Munitions, and such rules shall provide for the determination by a munitions tribunal (in case of difference) of the amount, if any, and not in any case exceeding £5, which is to be paid by the employer to the workman in lieu of notice, and for the payment of the sum so determined to the workman, unless the tribunal is of opinion that, owing to the discontinuance or temporary nature of the employment or misconduct of the workman, the employer had reasonable cause for dismissing the workman without a week's notice: *Provided*, That nothing in this subsection shall apply to workmen engaged in ship repairing or to any class of workmen

exempted in the prescribed manner on the ground that the circumstances of their employment were such that the provisions of this subsection ought not to apply to them.

(4) The provisions of section 7 of the principal act which prohibit the giving of employment to workmen in the circumstances mentioned in that section shall not apply so as to prevent the giving of employment to a workman in a controlled establishment to which he has been assigned by the Minister of Munitions in pursuance of section 6 of the principal act.

(5) In determining whether the grant of a certificate has been unreasonably refused for the purposes of section 7 of the principal act as amended by this section, a munitions tribunal shall take into consideration the question whether the workman has left or desires to leave his work for the purpose of undertaking any class of work in which his skill or other personal qualifications could be employed with greater advantage to the national interests, and whether the employer has failed to observe the conditions laid down in the fair-wages clauses required by resolution of the House of Commons to be inserted in Government contracts, and whether the workman has left or desires to leave his work because he has recently completed a term of apprenticeship or period of learning his trade or occupation and desires to obtain a full standard rate of wages applicable to fully qualified workmen in his trade or occupation.

(6) The Minister of Munitions may make rules for carrying section 7 of the principal act as amended by this section into effect, and in particular may by such rules provide—

- (a) for the issue, form, custody, duration, delivery up, and replacement in case of loss or destruction, of certificates;
- (b) for the issue of certificates to persons not engaged on or in connection with munitions work;
- (c) for prohibiting the insertion in a certificate issued by an employer of any matter other than the prescribed particulars;

and may provide for any breach of such rules being punishable as an offense under the principal act with a fine not exceeding five pounds [\$24.33].

(7) This section shall not come into operation until such date as may be fixed by the rules made thereunder.

RATES OF WAGES OF WOMEN EMPLOYED ON MUNITIONS WORK.

6. (1) Where female workers are employed on or in connection with munitions work in any establishment of a class to which the provisions of section 7 of the principal act as amended by this act are for the time being applied by an order made thereunder, the Minister of Munitions shall have power by order to give directions as to the rate of wages, or (subject, so far as the matter is one which is dealt with by the Factory and Workshops Acts, 1901 to 1911, to the concurrence of the Secretary of State) as to hours of labor, or conditions of employment of the female workers so employed.

(2) Any directions given by the Minister of Munitions under this section shall be binding on the owner of the establishment and any contractor or subcontractor employing labor therein and the female workers to whom the directions relate, and any contravention thereof or noncompliance therewith shall be punishable, in like manner as if the order in which the direction is contained was an award made in settlement of a difference under Part I of the principal act.

(3) No direction given under this section shall be deemed to relieve the occupier of any factory or workshop from the obligation to comply with the provisions of the Factory and Workshops Act, 1901 to 1911, or of any orders or regulations made thereunder, or to affect the liability of any person to be pro-

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ceeded against for an offense under the Employment of Children Act, 1903,¹ so, however, that no person be twice punished for the same offense.

RATES OF WAGES OF SEMISKILLED AND UNSKILLED LABOR IN CONTROLLED ESTABLISHMENTS.

7. The Minister of Munitions shall have power by order to give directions as to the rate of wages, hours of labor, or conditions of employment of semi-skilled and unskilled men employed in any controlled establishment on munitions work being work of a class which, prior to the war, was customarily undertaken by skilled labor, or as to the time rates for the manufacture of complete shell and fuses and cartridge cases in any controlled establishment in which such manufacture was not customary prior to the war; and any direction so given shall be binding on the owner of the establishment, and any contractor or subcontractor employing labor therein, and the workers to whom the directions relate, and any contravention thereof or noncompliance therewith shall be punishable in like manner as if the order in which the direction is contained was an award made in settlement of a difference under Part I of the principal act.

ESTABLISHMENT OF SPECIAL ARBITRATION TRIBUNALS.

8. (1) The Minister of Munitions may constitute special arbitration tribunals to deal with differences reported under Part I of the principal act which relate to matters on which the Minister of Munitions has given or is empowered to give directions under the last two preceding sections, and the Board of Trade may refer any such difference for settlement to such tribunal in lieu of referring it for settlement in accordance with the first schedule to the principal act.

(2) The Minister of Munitions may also refer to a special arbitration tribunal so constituted, for advice, any question as to what directions are to be given by him under the said sections.

(3) The tribunal to which matters and questions relating to female workers are to be referred under this section shall include one or more women.

EXTENSION OF DEFINITION OF MUNITIONS WORK.

9. (1) The expression "munitions work" for the purposes of the principal act and this act means—

(a) the manufacture or repair of arms, ammunition, ships, vessels, vehicles, and aircraft, and any other articles or parts of articles (whether of a similar nature to the aforesaid or not) intended or adapted for use in war, and of any other ships or vessels, or classes of ships or vessels, or parts of ships or vessels, which may be certified by the Board of Trade to be necessary for the successful prosecution of the war; and of any metals, machines, or tools required for any such manufacture or repair, and of the materials of any class specified in an order for the purpose by the Minister of Munitions, required for or for use in any such manufacture or repair as aforesaid; and

(b) the construction, alteration, or repair of works of construction and buildings for naval or military purposes, and of buildings in which munitions work is or is intended to be carried on, and the erection of machinery and plant therein, and the erection of houses for the accommodation of persons engaged or about to be engaged on munitions work; and

(c) the construction, alteration, repair, or maintenance of docks and harbors, and work in estuaries in cases where such construction,

¹ 8 Edward 7, c. 45.

alteration, repair, maintenance, or work is certified by the Admiralty to be necessary for the successful prosecution of the war; and

- (d) the supply of light, heat, water, or power, or the supply of tramways facilities in cases where the Minister of Munitions certifies that such supply is of importance for the purpose of carrying on munitions work, and the erection of buildings, machinery, and plant required for such supply; and
- (e) the repair of fire engines and any other fire-brigade appliances in cases where the Minister of Munitions certifies that such repair is necessary in the national interest.

(2) In section 3 of the principal act there shall be added after the words "affecting employment on," in both places where those words occur, the words "or in connection with," and in the same section the words "the manufacture or repair of arms, ammunition, ships, vehicles, aircraft, or any other articles required for use in war, or of the metals, machines, or tools required for that manufacture or repair in this act referred to as" shall be repealed.

(3) This section shall not come into operation until the time fixed by rules made under section 5 of this act as the date for the commencement of that section.

AMENDMENT OF SECTION 9 OF PRINCIPAL ACT.

10. At the end of section 9 of the principal act the following proviso shall be inserted:

"Provided, That the power of making an order applying section 7 of this act to any dock shall rest with the Minister of Munitions and not with the Admiralty."

AMENDMENT OF SECTION 4 OF PRINCIPAL ACT.

11. Subsection (2) of section 4 of the principal act shall be read as if the words "or to any agreement existing before the establishment became a controlled establishment, between the owner of the establishment and an employee with regard to any periodical increase of remuneration" were inserted after the words "nineteen hundred and fifteen."

EXPLANATION OF TERM "WORKMAN."

12. For removing doubts it is hereby declared that the expressions "workman" and "workmen," wherever they occur in the principal act and this act, include not only persons whose usual occupation consists in manual labor but also foremen, clerks, typists, draftsmen, and other persons whose usual occupation consists wholly or mainly in work other than manual labor.

AMENDMENT OF SECTION 16 OF PRINCIPAL ACT.

13. Subsection (4) of section 15 of the principal act shall be read as if the words "of the second class" were struck out.

PUNISHMENT FOR FALSE STATEMENTS, ETC.

14. For section 12 of the principal act the following section shall be substituted:

"12. If any person makes any false statement or representation, or gives any false certificate, or furnishes any false information—

"(a) for the purpose of evading any provision of this act; or

"(b) in any proceedings before any munition tribunal, arbitration tribunal, referee, or board of referees under this act or the rules made thereunder; or

“(c) to the Minister of Munitions or any officer employed by him, for the purpose of obtaining or retaining employment, or of obtaining or retaining the services of any workman;
or if any person, alters or tampers with a certificate given under section 7 of this act, or personates or falsely represents himself to be a person to whom such a certificate has been given, or allows any other person to have possession of any such certificate issued for his use alone, he shall be guilty of an offense and liable on conviction under the Summary Jurisdiction Acts to imprisonment with or without hard labor for a term not exceeding three months or to a fine not exceeding fifty pounds” [\$243.33].

RESTRICTIONS ON CHANGE FROM UNION TO NONUNION LABOR.

15. Where nonunion labor is introduced during the war into any class of work in a controlled establishment in which it was the practice prior to the war to employ union labor exclusively, the owner of the establishment shall be deemed to have undertaken that such introduction shall only be for the period of the war, and if he breaks or attempts to break such an undertaking he shall be guilty of an offense under the principal act and liable to a fine not exceeding fifty pounds [\$243.33]; but, subject as aforesaid, such introduction shall not be deemed to be a change of working conditions.

EXTENSION OF SECTION 11 OF PRINCIPAL ACT.

16. (1) In subsection (1) of section 11 of the principal act, which specified the matters in respect of which owners of establishments in which persons are employed are, if required by the Minister of Munitions, to give information, the following paragraph shall be inserted after paragraph (c):

(cc) The cost of production of the articles produced or dealt with in the establishment, and the cost of the materials used for such production, and the names and addresses of the persons by whom such materials were supplied or who are under contract to supply them.

(2) If any person, except as authorized by the Minister of Munitions, discloses or makes use of any information given under section 11 of the principal act, as amended by this or any subsequent enactment, he shall be guilty of a misdemeanor and on conviction be liable to imprisonment, with or without hard labor, for a term not exceeding two years, or to a fine, or to both imprisonment and a fine.

POWERS OF INSPECTORS.

17. (1) An inspector appointed by the Minister of Munitions for the purposes of the principal act shall have power to enter at all reasonable times the premises of any establishment (other than a private dwelling house not being a workshop) for the purpose of ascertaining whether it is desirable to put in force as respects any establishment or any person employed therein any of the powers of the Minister of Munitions, whether under the principal act or otherwise, or for the purpose of obtaining any information in connection with the supply of munitions and to make such examination and inquiry as may be necessary for any such purpose, and the owner of the establishment and every person engaged in the management or direction of the establishment shall furnish to any such inspector all such information, and shall produce for inspection all such registers, wages books, and other similar documents as the inspector may reasonably require.

(2) If any person willfully delays or obstructs an inspector in the exercise of any power under this section or fails to give such information or to produce

such documents as aforesaid, he shall be guilty of an offense under the principal act, and shall be liable to a fine not exceeding ten pounds [\$48.67].

(3) Every inspector shall be furnished with a certificate as to his appointment, and on applying for admission to any premises for the purposes of this section shall, if so required, produce such certificate.

PROVISIONS AS TO OFFENSES.

18. (1) All offenses which are by or under this act made offenses under the principal act, other than those for which the maximum fine exceeds five pounds (\$24.33), shall be deemed to be offenses with which munitions tribunals of the second class have jurisdiction to deal.

(2) Rules under section 15 of the principal act shall provide—

(a) that in proceedings before a munitions tribunal the chairman shall, before giving his decision, consult with the assessors, and in all cases where the assessors are agreed he shall, except as respects questions which appear to the chairman to be questions of law, give effect to their opinion in his decision;

(b) that where the person or persons by or on behalf of whom or against whom the complaint is made in any proceedings before a munitions tribunal is or are a female worker, or two or more female workers, the assessor or one of the assessors chosen from the panel of persons representing workmen shall be a woman.

(3) Decisions of munitions tribunals shall be subject to appeal to such judge of the High Court as may be appointed by the Lord Chancellor for the purpose on any ground which involves a question of law or a question of mixed law and fact, or on any other ground that may be prescribed in rules made by the Lord Chancellor, in such cases and subject to such conditions and in such manner as may be specified in such rules, and whether by means of the statement of a special case for the opinion of the judge or otherwise; and those rules may provide for such appeals in any classes of cases specified therein being heard and determined in a summary manner and for the fixing, remission, or reduction of any fees and scales of costs, and as to the manner in which effect is to be given to the decision of the judge, and the decision of the judge on any such appeal shall be final and binding on all munitions tribunals.

(4) In the case of a company being guilty of an offense under the principal act, every director, manager, secretary, or other officer of the company who is knowingly a party to the contravention or noncompliance constituting the offense shall also be guilty of the offense and liable to the like fine as the company.

(5) In subsection (3) of section 15 of the principal act, after the words "so far as relates to offenses," there shall be inserted "and the enforcement of orders."

MINOR AMENDMENTS OF PRINCIPAL ACT.

19. In subsection (3) of section 5 of the principal act, after the words "affords no standard of comparison," there shall be inserted the words "or that no such average exists," and after the words "if he thinks just, allow," there shall be inserted the words "or require"; and in paragraph 9 of the second schedule to the principal act, for the word "fourth," there shall be substituted the word "third."

ARRANGEMENTS WITH OTHER DEPARTMENTS.

20. The Minister of Munitions may make arrangements with any other Government department for the exercise and performance by that department of any of his powers and duties under the principal act or this act which appear

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to him to be such as could be more conveniently so exercised and performed, and in such case the department and the officers of the department shall have the same powers and duties for the purpose as are by the principal act and this act conferred on the Minister of Munitions and his officers.

ADMISSIBILITY IN EVIDENCE OF CERTIFICATES BY BOARD OF TRADE.

21. For the purposes of proceedings under section 2 of the principal act, a certificate of the Board of Trade, purporting to be signed by the president or a secretary or assistant secretary of the Board of Trade, or by a person authorized for the purpose by the president, that a difference to which Part I of the principal act applies has or has not been reported to the Board, and, in cases where such a difference has been reported, as to the date on which it was reported, shall be admissible as evidence of the facts therein stated.

COSTS IN VEXATIOUS PROCEEDINGS.

22. (1) Where a munitions tribunal dismisses any case under the principal act, or this act, and it appears to the tribunal that the proceedings were vexatious or frivolous, the tribunal shall, unless it sees good cause to the contrary, award costs to the person against whom the complaint is made, and the costs so awarded shall, unless good cause to the contrary appears, include such sum as compensation for the expenses, trouble, and loss of time incurred in or incidental to the attendance of the person against whom the complaint is made before the tribunal as to the tribunal may seem just and reasonable.

(2) Where a referee or board of referees to whom a matter has, under subsection (3) of section 5 of the principal act, been referred by the Minister of Munitions on the requirement of the owner of an establishment considers that the requirement was unreasonable, the referee or board of referees may order that any costs payable by the owner of the establishment shall be paid out of the amount of profits divisible under the principal act.

EXCLUSION OF ARBITRATION ACT, 1889 (52 AND 53 VICT., C. 49).

23. The Arbitration Act, 1889, shall not apply to any reference to any referee or board of referees under the principal act or this act or the rules made thereunder.

EFFECT OF REVOCATION OF ORDERS.

24. Where the Minister of Munitions makes an order revoking any order previously made by him under section 4 of the principal act, the order so revoked shall, if that order has not been in operation for more than three months and was made under a misapprehension and the revoking order so directs, be treated for all or any of the purposes thereof as if it had never had effect.

PROVISION AS TO RULES.

25. Rules and Regulations made under the principal act as amended by this act shall not be deemed to be statutory rules within the meaning of section 1 of the Rules Publication Act, 1893.¹

DURATION OF PRINCIPAL ACT.

26. In subsection (2) of section 20 of the principal act, which relates to the duration thereof, the words "Part I of" shall be repealed.

SHORT TITLE.

27. This act may be cited as the Munitions of War (Amendment) Act, 1916, and shall be construed as one with the principal act, and the principal act and the act may be cited together as the Munitions of War Acts, 1915 and 1916.

**THE MUNITIONS TRIBUNALS (PROVISIONAL) RULES, 1915,
DATED JULY 12, 1915, FOR CONSTITUTING AND REGULATING
MUNITIONS TRIBUNALS IN ENGLAND AND WALES, MADE IN PURSUANCE OF SECTION 15 OF THE
MUNITIONS OF WAR ACT, 1915.**

PROVISIONS APPLICABLE TO TRIBUNALS OF THE SECOND CLASS.

1. A munitions tribunal of the second class (hereinafter referred to as a local munitions tribunal) shall consist of a person (hereinafter referred to as the chairman) appointed for the purpose by the Minister of Munitions sitting with assessors drawn respectively from an employers' panel and from a workmen's panel constituted by the Minister of Munitions in accordance with these rules and duly summoned to serve on such local munitions tribunal.

2. A local munitions tribunal shall have jurisdiction to deal only with complaints that any person has acted in contravention of or failed to comply with regulations made applicable to the controlled establishment in which he is either an employer or is employed or an undertaking into which a workman has entered under section 6 (1) of the Munitions of War Act, 1915¹ (hereinafter referred to as the act), and complaints that an employer has unreasonably withheld his consent under section 7 of the act.

3. A local munitions tribunal shall be constituted in accordance with the regulations set out in the first schedule hereto, being regulations made under Part II, of the National Insurance Act, 1911,² with reference to courts of referees, adapted for the purposes of the act.

4. Any complaint with which a local munitions tribunal is competent to deal shall be made by any person aggrieved or by or on behalf of the Minister of Munitions in writing to the chairman of the local munitions tribunal appointed for the district in which the matter arose, or to some other person appointed by him for the purpose.

5. If no sitting of a local munitions tribunal shall previously have been fixed at which such complaint may conveniently and expeditiously be heard, the chairman shall cause assessors to be summoned to attend a special meeting of the tribunal in accordance so far as may be with the rota. Notice of the sitting shall be given wherever practicable not less than one week in advance.

6. Where the complaint relates to an offense under the act:

- (1) The chairman, or some other person appointed as aforesaid, shall (if satisfied that there is a prima facie case) issue a notice in the form set out in the second schedule hereto or such other form as a secretary of state may determine to the person or persons in respect of whom the complaint is made, to appear before the tribunal at such place and time as the chairman may appoint. A notice posted as a registered letter by or on behalf of the chairman to the last known place of abode of such person or persons shall be deemed to have been duly served.

¹ 5 and 6 George, c. 5, 54; see p. 125.

² 1 and 2 George c. 5, 55.

- (ii) The chairman or some other person appointed as aforesaid, shall send to the person who has made the complaint notice of the time and place of the hearing.
- (iii) No person shall be fined for an offense under the act unless he has appeared before the local munitions tribunal or the tribunal is satisfied that he has had a reasonable opportunity of so appearing.
- (iv) The tribunal shall for the purpose of adjudicating upon any such complaint have power to take evidence upon oath.
- (v) So far as is consistent with the provisions of the act and any rules made thereunder, the provisions of the summary jurisdiction acts¹ and the criminal justice administration act, 1914,² with regard to requiring the attendance of any persons before a court of summary jurisdiction and with regard to the recovery of fines otherwise than by imprisonment, shall apply to proceedings under the act as though the local munitions tribunal were a court of summary jurisdiction, and as if the chairman were a justice of the peace or other magistrate having jurisdiction in the place where the court sits, a complaint were an information laid upon oath, a notice to appear were a summons duly issued and served, and an offense under this act were an offense punishable on summary conviction.
- (vi) Where a fine has been imposed on a person employed or a workman by a local munitions tribunal, that tribunal may make an order requiring such deductions to be made on account of the fine from the wages of such person employed or workman as the tribunal think fit and requiring the person by whom the wages are paid to pay to the clerk to the tribunal or other person appointed for the purpose by the Minister of Munitions any sums so deducted.

7. Where the complaint relates to the withholding of consent by an employer under section 7 of the act:

- (i) The chairman or some other person appointed as aforesaid shall (if satisfied that there is a prima facie case) issue a notice in the form set out in the third schedule hereto, or such other form as the Minister of Munitions may determine, to the person or persons in respect of whom the complaint is made, to appear before the tribunal at such place and time as the chairman may appoint.
- (ii) Notice of the time and place of sitting of the local munitions tribunal to which this complaint will be reported or referred shall be sent to the person by whom the complaint was made so that it would reach him in the ordinary course of post not less than 24 hours before the sitting of the tribunal, and such person shall be entitled to attend such sitting during the consideration of his case, provided that with the consent of such person the case may be considered by a local munitions tribunal notwithstanding that notice has not been given to him in accordance with this rule.
- (iii) In any case in which it appears that the evidence of any person is necessary to the decision of the case, the chairman may direct that such person or persons be summoned to attend the tribunal, and expenses in respect of such attendance shall be allowed on a scale approved by the treasury.

¹ "The summary jurisdiction acts" means in relation to England and Wales, the Summary Jurisdiction Act, 1848 (11 and 12 Vict., c. 43), and the Summary Jurisdiction Act, 1879 (42 and 43 Vict., c. 49), and any act past or future amending those acts or either of them. See Interpretation Act, 1889 (52 and 53 Vict., c. 63), s. 13 (7) (10).

² 4 and 5 George, c. 5, 58.

8. No party to any proceeding before a local munitions tribunal shall be represented by counsel or solicitor.

PROVISIONS APPLICABLE TO TRIBUNALS OF THE FIRST CLASS.

9. A munitions tribunal of the first class (hereinafter referred to as a general munitions tribunal) shall consist of a person (hereinafter referred to as the chairman) appointed for the purpose by the Minister of Munitions sitting with assessors drawn respectively from an employers' panel and from a workmen's panel provided for the purpose by the Minister of Munitions and may be constituted generally or for any district specified by the Minister of Munitions.

10. A general munitions tribunal shall have jurisdiction to deal with all offenses under this act and any other matters therein specified, but shall not deal with any matter with which a local munitions tribunal is competent to deal unless such matter arises in connection with a matter with which a local munitions tribunal is not competent to deal or is for any reason referred to the general munitions tribunal by the Minister of Munitions.

11. Any complaint relating to any matter with which a local munitions tribunal is not competent to deal shall be made in writing by any person aggrieved or by or on behalf of the Minister of Munitions or by any person acting on the instructions, general or special, of the Minister of Munitions to the chairman of a general munitions tribunal appointed for the district in which the matter arose or to the Minister of Munitions who shall forthwith refer the case to a general munitions tribunal.

12. Where the complaint relates to an offense under the act the provisions of Rule 6 shall apply, subject to the following modifications:

(i) The words "General munitions tribunal" shall be substituted for the words "Local munitions tribunal" wherever they occur.

(ii) The chairman, or some other person appointed by him for the purpose, shall (if satisfied that there is a prima facie case) issue a notice in the form set out in the fourth schedule hereto or such other form as a secretary of state may determine to the person or persons in respect of whom the complaint is made, to appear before the tribunal at such place and time as the chairman may appoint.

(iii) Any person upon whom a fine of £20 [\$97.33] or more has been imposed by a general munitions tribunal may appeal to a court of quarter sessions in the same manner as if he were appealing from the conviction of a court of summary jurisdiction.

(iv) Subclause (v) shall be read as if the words "otherwise than by imprisonment" were struck out except as regards offenses within the jurisdiction of a local munitions tribunal.

13. Where the complaint relates to the withholding of consent by an employer under section 7 of the act the provisions of Rule 7 shall apply as though the words "General munitions tribunal" were substituted for the words "Local munitions tribunal."

PROVISIONS APPLICABLE TO BOTH CLASSES OF TRIBUNALS.

14. No case shall be heard, tried, or adjudged except in open court.

15. The chairman shall consult with his assessors before giving his decision.

16. The question of costs shall be in the absolute discretion of the chairman, who may order the same to be paid by any party or parties to the proceedings in such manner as he shall direct, and may either assess the amount thereof himself or may refer the same for assessment to any other person appointed by

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the Minister of Munitions for the purpose. An order for costs may be enforced by the tribunal in the same way as a fine.

17. The Minister of Munitions shall appoint for each tribunal a clerk, to whom all fines shall be paid; fines shall be paid by him into the Exchequer.

18. Every tribunal shall keep a register of complaints made to them and proceedings taken by them under the act, and shall furnish the Minister of Munitions with duplicates thereof when required by him to do so.

19. Subject as aforesaid, the procedure of a munitions tribunal shall be such as a Secretary of State or the Minister of Munitions may determine.

20. The Interpretation Act, 1889,¹ shall apply for the purpose of the interpretation of these rules as it applies to the interpretation of an act of Parliament.

21. These rules may be cited as the munitions (tribunals) rules, 1915, and shall come into force as from the 12th day of July, 1915.

Signed as far as relates to offenses by

JOHN SIMON,
One of H. M. Secretaries of State.

HOME OFFICE, *Whitehall, S. W.*

Signed as far as relates to other matters by

D. LLOYD GEORGE,
Minister of Munitions.

MINISTRY OF MUNITIONS,
6 Whitehall Gardens, S. W.
JULY 12, 1915.

SCHEDULE 1.

1. Unless the Minister of Munitions shall otherwise direct, the members of panels of persons representing employers and workmen constituted under section 90 of the National Insurance Act, 1911, for their respective districts, shall, if willing to serve, be the panels for the purposes of local munitions tribunals for the same districts.

2. The term of office of the chairman and of the members of the panels shall be such period as the Minister of Munitions may direct.

3. Casual vacancies on the panels, whether of employers or workmen, may be filled by the Minister of Munitions, and any person employed to fill a vacancy shall hold office until the expiration of the period during which the person in whose place he is appointed would have held office: *Provided*, That the Minister shall not be bound to fill any casual vacancy unless he thinks fit so to do, and a panel shall not be deemed to be improperly constituted by reason only that a casual vacancy on the panel has not been filled.

4. Each member of the panel shall, so far as practicable, be summoned to serve in turn upon the local munitions tribunal from a rota, prepared in advance. Such summons shall be by notice given not less than one week in advance wherever practicable: *Provided*, That where a meeting of a local munitions tribunal takes place immediately before or after a meeting of a court of referees for the same district the members of the employers' and workmen's panels summoned to serve as members of such court of referees may be summoned to serve also as assessors on such tribunal.

5. The chairman shall be appointed by the Minister of Munitions, and no person who is either an employer or a workman in any trade or group of trades

to which the provisions of Part II of the act apply shall be qualified for appointment as chairman.

6. In the event of any member of a panel being unavoidably prevented from attending a sitting of a local munitions tribunal at the time when he is summoned in accordance with the rota, any other member of the panel may be summoned in his place.

7. A supplementary local munitions tribunal may be constituted for any district at any time by the Minister of Munitions, and members of the panel for that district may be summoned to attend such tribunal by one clear day's notice, if practicable.

COMPULSORY ARBITRATION IN MUNITIONS INDUSTRY IN FRANCE.

As a result of strikes in several French munition factories in the Paris district following upon demands for increased wages, the French Minister of Munitions, on January 17, 1917, issued a report and decree providing for the establishment of permanent boards of conciliation and arbitration composed of equal numbers of representatives of employers and of workers, for the immediate investigation and adjustment of collective disputes.

Immediately upon notice of a dispute the establishment is placed under military control, and any cessation of work is prohibited under severe penalties. The decree provides for an immediate hearing, and if conciliation fails a decision of the board as arbitrator within 24 hours after the hearing. In the case of the failure of the board to agree, a referee must be appointed without delay and a decision rendered within 24 hours after a hearing. In case of difficulty in agreeing upon appointment of a referee, the Minister of Munitions may himself designate a referee or may himself render a decision upon the matters in dispute. The decision of the arbitration board or of the referee becomes effective immediately upon its approval by the Minister of Munitions, and if any employer or the employees refuse to comply with the decision the establishment or the employees shall be immediately placed under military control.

The text of the decree follows:

TEXT OF DECREE OF MINISTER OF MUNITIONS OF JANUARY 17, 1917, FOR REGULATION OF DISPUTES IN MUNITIONS FACTORIES.

ARTICLE 1. Employers, workmen, and salaried persons in private establishments, factories, and enterprises engaged in the manufacture of armaments, munitions, and war materials, shall, in case of a dispute of a collective nature relating to conditions of labor, not be permitted to break the contract of labor, nor to stop or cease work before having submitted the questions in dispute to conciliation and arbitration, such as are provided for in the following articles.

ART. 2. There shall be established under the supervision of the Minister of Munitions, in such districts as shall be determined by him for this purpose, a permanent board of conciliation and arbitration composed of an equal number of representatives of employers and workers, but not less than two of each class. These representatives are to be exempt from military duty.

ART. 3. The collective differences shall be stated by a declaration made to the Controller of Labor, either by the employer or his representative or by a workman bearing a written authorization, free of stamp duty, signed by at least 20 other workmen.

ART. 4. The Controller of Labor shall notify the Board of Conciliation and Arbitration, provided for in article 2, and advise the Minister of Munitions, who shall designate a representative of his office to appear before the committee for the hearing.

The committee shall assemble at the local mayor's office without undue delay, hear the parties one or more times, and if terms of conciliation are not reached by them, it shall issue, within 24 hours after the last hearing its decision as arbitrator which shall be placed on record and signed by each member of the committee.

ART. 5. If a unanimous decision can not be rendered by the arbitrators, they shall designate one or more referees. If an agreement is not reached as to this appointment, the Minister of Munitions has the authority either to designate referees or to referee the dispute himself.

ART. 6. The referee or referees summoned without delay by the Controller of Labor, shall hear the arbitrators and the parties, and within 24 hours after the hearing shall render their decision in a written report.

The decision of the arbitration board provided for in articles 4 and 5 shall be in force as soon as it has been officially approved by the Minister of Munitions or by his order, and been posted in the workrooms by the employer or, if he fails to do so, by the Controller of Labor, at the expense of the employer.

ART. 7. If the Minister himself acts as referee, his decision shall be published and becomes effective in the same manner.

ART. 8. If the employer refuses to conform to the decision of the arbitration board, the industrial establishment shall be placed under military control in accordance with articles 58 and 60 of the law of July 3, 1877, amended by the laws of March 5, 1890, July 17, 1898, April 17, 1901, March 27, 1906, and July 23, 1911.

ART. 9. If the decision of the arbitration board orders the payment to the workmen, in accordance with the decree of August 10, 1899, of sums, supplementary to the wages, or otherwise, and if the employer refuses to conform to such order, the administrative personnel of the industrial establishment shall be placed, in virtue of the disposition above mentioned, under military control for the purpose of effecting the necessary payments.

The sums necessary to make these payments shall be advanced by the Ministry of Munitions, to be subsequently retained from sums due to the employer by the State.

ART. 10. Should there be workmen refusing to comply with the arbitrator's decision, they shall be placed under military control in accordance with article 5, paragraph 8, or of articles 58 and 60 of the law of July 3, 1877, before cited.

ART. 11. Whenever the Controller of Labor is served with a notice of a collective dispute, he shall immediately give notice of it to the district military authority.

From the time of the notification of the Controller of Labor of the dispute until the posting of the decision of the arbitration board the above-named military authority shall place under military control (in conformity with articles 58 and 60 of the law of July 3, 1877, amended by the laws of March 5, 1890, July 17, 1898, April 17, 1901, March 27, 1906, and July 23, 1911) the entire directing administrative personnel and the working force of the establishment, so that order and continuity of production may be maintained.

ART. 12. The provisions of the arbitral decision, rendered for one or more establishments or for one or more classes of workers, may, by decision of the Minister of Munitions, be made applicable in the district affected, to all or a portion of the other establishments in this district or to other occupational groups which may be found in comparable conditions.

ART. 13. The provisions of this decree are not applicable to mobilized persons, for whom the conditions of work shall continue to be determined by the Controller of Labor, in conformity with the normal and current conditions in the specific occupations in the district.

U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

ROYAL MEEKER, Commissioner

BULLETIN OF THE UNITED STATES } . . . { WHOLE NUMBER 222
BUREAU OF LABOR STATISTICS }

MISCELLANEOUS SERIES: NO. 14

WELFARE WORK IN
BRITISH MUNITION FACTORIES

REPRINTS OF THE MEMORANDA
OF THE BRITISH HEALTH OF
MUNITION WORKERS COMMITTEE



APRIL, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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BULLETIN OF THE U. S. BUREAU OF LABOR STATISTICS.

WHOLE NO. 222.

WASHINGTON.

APRIL, 1917.

WELFARE WORK IN BRITISH MUNITION FACTORIES.

INTRODUCTION.

The British Health of Munition Workers Committee was appointed in the middle of September, 1915, by the Minister of Munitions, with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labor, and other matters affecting the personal health and physical efficiency of workers in-munition factories and workshops."

The composition of the committee is as follows:

Sir George Newman, M. D., chairman.

Sir Thomas Barlow, Bart., K. C. V. O., M. D., F. R. S.

G. Bellhouse, Factory Department, Home Office.

Prof. A. E. Boycott, M. D., F. R. S.

J. R. Clynes, M. P.

E. L. Collis, M. B., Factory Department, Home Office.

W. M. Fletcher, M. D., F. R. S., secretary of Medical Research Committee.

Leonard E. Hill, M. B., F. R. S.

Samuel Osborn, J. P., Sheffield.

Miss R. E. Squire, Factory Department, Home Office.

Mrs. H. J. Tennant.

E. H. Pelham, secretary.

The committee took evidence in various industrial centers from employers, representatives of workers, and other interested persons, and made numerous special studies and investigations. In addition, members have visited a large number of factories and workshops, and discussed matters with the management, with foremen, and with individual workers. With this information, and having the advantage of the special knowledge and experience already possessed by members of the committee, it has published up to the present time (April, 1917) 15 memoranda, dealing with one or more of the subjects intrusted to it.

As these memoranda are the work of a committee especially qualified by technical knowledge and special experience, and as they contain many suggestions and recommendations made with the purpose

of securing maximum output over a period of months, or even years, and at the same time safeguarding the health and physical efficiency of the workers, it is believed that their reproduction at this time may be of value in a similar way to industry and labor in this country. The memoranda have been arranged in three groups, the related subjects being brought together, and are reprinted as bulletins of the United States Bureau of Labor Statistics under the following titles:

(The list here given contains only the memoranda of the Health of Munition Workers Committee. Each of the bulletins, however, includes also other official and nonofficial material dealing with related subjects. The contents of Bulletins 221 and 223 are given in full at the end of this bulletin.)

BULLETIN NO. 221, HOURS, FATIGUE, AND HEALTH IN BRITISH MUNITION FACTORIES.

Sunday Labor (Memorandum No. 1). November, 1915. 6 pp.
[Cd. 8132.]

(Summarized in MONTHLY REVIEW of the U. S. Bureau of Labor Statistics, May, 1916, pp. 66, 67.)

Hours of Work (Memorandum No. 5). January, 1916. 9 pp.
[Cd. 8186.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 77-79.)

Statistical Information Concerning Output in Relation to Hours of Work (Memorandum No. 12). (Report by H. M. Vernon, M. D.) August, 1916. 11 pp. [Cd. 8344.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 105-119.)

Industrial Fatigue and its Causes (Memorandum No. 7). January, 1916. 11 pp. [Cd. 8213.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 79-81.)

Sickness and Injury (Memorandum No. 10). January, 1916. 10 pp. [Cd. 8216.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 88-90.)

Special Industrial Diseases (Memorandum No. 8). February, 1916. 8 pp. [Cd. 8214.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 83-88.)

Ventilation and Lighting of Munition Factories and Workshops (Memorandum No. 9). January, 1916. 9 pp. [Cd. 8215.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 81-83.)

The Effect of Industrial Conditions Upon Eyesight (Memorandum No. 15). October, 1916. 8 pp. [Cd. 8409.]

(Summarized in MONTHLY REVIEW, April, 1917, pp. 538-540.)

BULLETIN NO. 222, WELFARE WORK IN BRITISH MUNITION FACTORIES.

Welfare Supervision (Memorandum No. 2). December, 1915. 7 pp. [Cd. 8151.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 68, 69.)

Industrial Canteens (Memorandum No. 3). November, 1915. 7 pp. [Cd. 8133.]

(Summarized in MONTHLY REVIEW, May, 1916, pp. 69, 70.)

Canteen Construction and Equipment (Memorandum No. 6). (Appendix to No. 3.) January, 1916. 7 pp. and plates. [Cd. 8199.]

(Summarized in MONTHLY REVIEW, June, 1916, p. 91.)

Investigation of Workers' Food and Suggestions as to Dietary (Memorandum No. 11). (Report by Leonard E. Hill, F. R. S.) August, 1916. 11 pp. [Cd. 8370.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 56, 57.)

Washing Facilities and Baths (Memorandum No. 14). August, 1916. 8 pp. [Cd. 8387.]

(Summarized in MONTHLY REVIEW, January, 1917, pp. 150, 151.)

BULLETIN NO. 223, EMPLOYMENT OF WOMEN AND JUVENILES IN GREAT BRITAIN DURING THE WAR.

Employment of Women (Memorandum No. 4). January, 1916. 10 pp. [Cd. 8185.]

(Summarized in MONTHLY REVIEW, June, 1916, pp. 74-76.)

Juvenile Employment (Memorandum No. 13). August, 1916. 8 pp. [Cd. 8362.]

(Summarized in MONTHLY REVIEW, December, 1916, pp. 92-97.)

In the present bulletin there is first presented a summary of the more important suggestions and recommendations of the committee. This is followed by a statement relating to the legal regulation of welfare work in Great Britain and reproducing the text of the provisions for securing the welfare of workers in factories and workshops, as set forth in Part II of the Police, Factories, etc. (Miscellaneous Provisions) Act, 1916. An article on the value of welfare supervision to the employer by B. Seebohm Rowntree, director of the welfare department of the British Ministry of Munitions, is also included. The five memoranda in regard to welfare work are then reproduced in full.

SUMMARY OF THE COMMITTEE'S CONCLUSIONS.

In its study of *Welfare supervision* among munition workers, Memorandum No. 2, the committee found that "almost more important than the immediate or technical environment in which work is carried on and the length of hours during which the workers are employed" are four chief influences which affect industrial efficiency, namely, questions of housing, transit, canteen provision, and individual welfare of the employees. The committee suggests that the influx of workers in certain districts has seriously overtaxed housing accommodations; that many workers, because of inability to obtain housing accommodation near the factory, are compelled to travel to

and from work, occasioning much loss of time; that the provision of facilities for obtaining a hot meal at the factory is often inadequate, especially for night workers; and, finally, that without special arrangement by which the management may deal with the numerous problems of labor efficiency and the personal welfare of the employees, there can not fail to be diminished output, discontent, and unsmooth working.

It is stated that welfare supervision has already been undertaken in a number of munition factories and testimony of managers is given commending the services rendered by welfare supervisors. In one factory, where men only are employed, an educated man devotes all his time to matters concerning welfare, in particular supervising safety appliances, organizing first-aid staffs and canteen accommodation, and in cases of injury and sickness visiting the workers at their homes. Instances of the successful work of women supervisors are mentioned, and employers stated to the committee that the presence of a capable woman of broad sympathies has in itself provided the best and quickest aid to the solution of many of the problems affecting women's labor by which they are assailed. The committee suggests that helpful oversight is especially needed in the case of women and girls if the highest and most enduring efficiency is to be attained, and recommends for this purpose the appointment of a competent woman of experience and sympathy, tactful and sensible in her dealings with others, who should concern herself with the various questions and issues raised in respect of the conduct of forewomen toward women workers, of the character and behavior of fellow women workers, of the maintenance of suitable and sufficient sanitary accommodation, of the worker's own state of health, of her capacity to withstand the physical strain and stress of work, and of her power to endure long hours, overtime, or nightwork. Welfare supervision in factories where not less than 500 men and 100 boys are employed is strongly urged.

The duties of welfare supervision as outlined by the committee include the following:

1. To be in close touch with the engagement of new labor or, when desired, to engage the labor.
2. To keep a register of available houses and lodgings, to inform the management when housing accommodation is inadequate, and to render assistance to workers seeking accommodation.
3. To ascertain the means of transit used and the length of time spent in traveling; to indicate the need of increased train, tram, or motor service; or to suggest modification of factory hours to suit existing means of transit.
4. To advise and assist workers in regard to feeding arrangements; to investigate the need for provision of canteen facilities or any inadequacy in the provision already made; and to supervise the management of such canteens.

5. To investigate records of sickness and broken time arising therefrom; and in cases of sickness to visit, where desired, the homes of workers.

6. To investigate and advise in cases of slow and inefficient work or incapacity arising from conditions of health, fatigue, or physical strain.

7. To consider, particularly for delicate and young workers, all questions of sanitation and hygiene affecting health and physical efficiency, and to supervise the conditions of nightwork, Sunday work, long hours, and overtime.

8. To advise on means of recreation and educational work.

9. To investigate complaints and assist in the maintenance of proper discipline and good order.

10. To keep in touch with responsible organizations having for their object the promotion of the welfare of the worker.

In its memorandum on *Industrial canteens* (Memorandum No. 2) the committee sets forth the proposition that productive output in regard to quality, amount, and speed is largely dependent upon the physical efficiency and health of the workers, which in turn are dependent upon nutrition, and that a dietary containing a sufficient proportion and quantity of nutritive material, suitably mixed, easily digestible, and obtainable at a reasonable cost is essential. The conviction is expressed that "in the highest interest of both employer and worker proper facilities for adequate feeding arrangements should be available in or near, and should form an integral part of, the equipment of all modern factories and workshops." Many employers, it is pointed out, have established industrial canteens, and this practice "has abundantly justified itself from a business and commercial point of view," and in the opinion of the committee "the time has come for a large extension of this method of solving the problem" of supplying suitable food at a low price for large numbers of persons at specified times. Speaking generally, the accommodation provided accords with one or other of the following types:

(1) An available room for the workers to eat their prepared food; (2) a room furnished with a "hot plate" or "warming cupboard" or provided with hot water; (3) a refreshment barrow to perambulate the workshops at appointed hours (particularly useful for light refreshments during long spells of night shifts); (4) a fixed refreshment bar or buffet; (5) a dining room supplying cheap hot and cold dinners; and (6) such dining room associated with an institute or club with facilities for rest and recreation.

In order to insure effective results from the establishment of industrial canteens, certain essential conditions are suggested and outlined, including accessibility and attractiveness, form, construction, and equipment, food and dietaries with suggested prices, prompt service, convenient hours, methods of payment for meals, and management.

The report indicates that substantial advantages, both to employers and workers, have followed the establishment of effective and well-managed canteens. Marked improvement in the health and physical condition of workers, a reduction of sickness, less absence and broken time, less tendency to alcoholism, and increased efficiency and output, a saving of time of the workmen, greater contentment, and better midday ventilation of the workshops are some of the benefits noted.

Memorandum No. 6, dealing with *Canteen construction and equipment*, is issued as an appendix to Memorandum No. 3, *Industrial canteens*. It contains detailed suggestions and specifications for the selection of a site and the erection of these buildings, including methods of ventilation, lighting, and heating, external and internal material to be used, cooking apparatus, and kitchen and catering equipment.

Supplementing Memoranda Nos. 3 and 6, Memorandum No. 11 gives the result of an *Investigation of workers' food and some suggestions as to dietary*, by Leonard E. Hill, one of the members of the committee. Believing that it was desirable in the interest of efficiency to make an examination of the value and character of the food consumed by munition workers and to suggest dietaries that may be expected adequately to restore expended energy, the author of this memorandum conducted an analysis of specimen meals provided for munition workers at the plants, as well as those provided in hotels, and also of meals brought by workers from their homes. An effort was made to determine the percentage of protein, fat, and carbohydrate in the samples and the number of calories¹ furnished by each of these essentials which are required to replace the energy expended and for the repair and growth of the body. Emphasis is laid upon the value of eating fresh fruit, such as apples, oranges, and bananas, and of avoiding the highly stimulating foods and of refraining from eating between meals or at frequent intervals.

Fortunately, the cheaper foods (bread, margarine, porridge, milk, herrings, cheese, beans, onions, cabbages, oranges, and the cheapest cuts of meat) provide all the requisite nourishment and probably better health than is derived from more highly flavored and expensive foods which only artificially stimulate the appetite.

It is stated that about 15 per cent of the energy expended is derived from protein and about 80 per cent from fats and carbohydrates combined; also, that the energy required by a man engaged in fairly light munition work is about 3,500 calories. Where calculations are based, as they are in this memorandum, on food as eaten, the minimum canteen diet may be taken to be about 3,000 calories per

¹ The calorie is the unit of energy value and is the amount of heat required to raise 1 kilogram (4½ pints) of water through 1° centigrade (1.8° F.).

day, when balanced among the three classes of foodstuffs in the proportion of 100 grams each of protein and fat and 400 grams of carbohydrates. An average adult woman worker seems to require from 80 to 90 per cent of that required by men workers.

The investigation showed "that the average canteen dinner is a good one, containing, as it should, an energy value of about 1,000 calories well distributed among the amounts of protein, fat, and carbohydrates." The cost of the meals analyzed ranged from 5d. (10.1 cents) to 1s. 5d. (34.5 cents). The analysis of meals brought by workers from their homes showed a range in amount of calories from 683.4 in case of a man on the night shift to 1,719 in the case of a boy 15 years of age on the night shift. As respects meals served in women's restaurants, the memorandum gives an example of a "sensible meal supplied at a small cost" (12.2 cents), consisting of roast mutton, boiled potatoes, cabbage, and sirup roll, and furnishing 687 calories; and also "an example of the unsatisfying meals which pale-faced young women may often be seen consuming in popular cafés," consisting of roll, butter, milk, sugar, stewed prunes, and sirup, and furnishing only 397 calories, at a cost of 14.2 cents.

In order to afford assistance to caterers for munition workers a series of daily dietaries is included.

In Memorandum No. 14, on *Washing facilities and baths*, the committee emphasizes the fact that cleanliness is not only beneficial to the health and personal efficiency of workers engaged on processes in which poisonous materials are manipulated or where heat, dust, or dirt are present to an unusual degree but it also bears an important relation to good health and working efficiency of all workers, and urges the importance of providing opportunities for washing so that workers may be clean and tidy when they leave their places of employment. Evidence before the committee seems to have clearly established the desire of many operatives, especially those engaged in heavy engineering processes, for improved lavatory and washing accommodations. It was found that where washing facilities have been provided sufficient attention is seldom paid to the details of construction, with the result that lavatories quickly fall into disrepair. This can be avoided, it is believed, if the installation is made to conform to the following requirements: Simple in construction and arrangement; strong and durable; sufficient and suitable in accommodation, so that a large number can wash together or in a short time; economical in space; so constructed that it can be easily cleaned; provided with ample supply of cold and hot water; so situated in the factory as to be fairly available for all for whom it is provided.

Nailbrushes secured by chains, so that they can not be removed, should be provided; soap, preferably in liquid or powdered form,

should be placed in small boxes above the washing trough; and clean, dry towels, renewed or washed daily, should be supplied to each worker, though it is suggested that a roller towel may be provided for every three workers but should be renewed or washed daily, or provided for every nine workers if it is renewed or washed after each meal and at the close of the day's work.

In addition to ordinary washing accommodations the committee suggests the desirability of providing bathing facilities in many industries, especially those in which workers are exposed to great heat and excessive dust or are brought into contact with poisonous material. For men a shower or douche bath is recommended as being simple and inexpensive; for women a horizontal spray at the level of the shoulders is suggested. The number of these baths should be sufficient to enable workers to have a bath at any time without appreciable delay; privacy should be insured; construction should be so carried out as to facilitate the maintenance of absolute cleanliness; pure water at a temperature of about 100° F. should be used; soap in the form of a tablet sufficient for one bath should be provided; where necessary there should be provision for drying the clothes of workers.

The committee emphasizes the importance of care in the maintenance of these baths and lavatories, and suggests that this should be made the definite duty of an appointed officer acting under the welfare supervisor, "who should keep the lavatory clean, control the supply of nailbrushes and soap, and arrange that dry, clean towels are available."

LEGAL REGULATION OF WELFARE WORK IN GREAT BRITAIN.

In the early part of the present year the British Ministry of Munitions established a welfare department, charged with the general responsibility of securing a higher standard of conditions for all woman and girl workers in munition factories through welfare supervision, and Mr. B. Seebohm Rowntree, a manufacturer well known for his social studies, "Poverty," "Land and Labor," and "Unemployment," was appointed director. More recently, by the Police, Factories, etc. (Miscellaneous Provisions) Act, 1916, bearing date of August 3, 1916, important powers were conferred upon the Home Secretary to secure the welfare of workers in factories and workshops by the issue of orders regulating such matters as arrangements for preparing or heating and taking meals, supply of drinking water and protective clothing, ambulance and first-aid provision, supply and use of seats in workrooms, facilities for washing, accommodation for clothing, and supervision of workers. A notable pro-

vision of the law is the requirement that no contribution shall be exacted from the workers, "except for the purpose of providing additional benefits which, in the opinion of the secretary of state, could not reasonably be required to be provided by the employer alone, and unless two-thirds at least of the workers affected * * * assent."

The abolition of the certifying surgeons' investigations of accidents is in accordance with the recommendations of the British departmental committee on accidents made in 1911. That part of the law relating to welfare work and to investigations of accidents follows:

PART II.—FACTORIES AND WORKSHOPS.

7. *Provisions for securing welfare of workers in factories and workshops.*—

(1) Where it appears to the secretary of state that the conditions and circumstances of employment or the nature of the processes carried on in any factory or workshop are such as to require special provision to be made at the factory or workshop for securing the welfare of the workers or any class of workers employed therein in relation to the matters to which this section applies, he may by order require the occupier to make such reasonable provision therefor as may be specified in the order, and if the occupier fails to comply with the requirements of the order or any of them, the factory or workshop shall be deemed not to be kept in conformity with the Factory and Workshop Act, 1901.

(2) The following shall be the matters to which this section applies:

Arrangements for preparing or heating and taking meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers.

(3) Orders may—

(a) Be made for a particular factory or workshop, or for factories or workshops of any class or group or description.

(b) Be made contingent in respect to particular requirements upon application being made by a specified number or proportion of the workers concerned and may prescribe the manner in which the views of the workers are to be ascertained.

(c) Provide for the workers concerned being associated in the management of the arrangements, accommodation, or other facilities for which provision is made, in any case where a portion of the cost is contributed by the workers; but no contribution shall be required from the workers in any factory or workshop, except for the purpose of providing additional or special benefits which, in the opinion of the secretary of state, could not reasonably be required to be provided by the employer alone, and unless two-thirds, at least, of the workers affected in that factory or workshop, on their views being ascertained in the prescribed manner, assent.

(4) If, in the case of any order proposed to be made for a particular factory or workshop, the occupier, or, in the case of an order for factories or workshops of a particular class or group or description, the majority of the occupiers of factories or workshops of that class or group or description, dispute the reasonableness of the requirements in the proposed order or any of them, the objection shall be referred for settlement to a referee selected in accordance with rules made under this section, but the secretary of state may so refer any objection though not made by a majority of the occupiers if he thinks desirable.

(5) Save as otherwise expressly provided in the order, the occupier of a factory or workshop shall not make any deduction from the sum contracted to be paid by him to any workman or receive any payment from any workman in respect of any provision made in pursuance of an order under this section, and, if he makes any such deduction or receives any such payment, he shall be guilty of an offense against the Truck Act, 1831, and shall be liable to the penalties imposed by section 9 of that act as if the offense were an offense mentioned in that section.

(6) The secretary of state may make rules as to the time within which, and the manner in which, notice of objection to any order may be made, and as to the selection of and the procedure before, a referee and the cost of the proceedings before a referee (including the remuneration of the referee).

(7) Any order made under this section may be revoked at any time in whole or in part by the secretary of state, without prejudice to the making of a further order.

(8) This section shall not apply to domestic factories or workshops.

(9) The secretary of state may by a special order made in accordance with the provisions of section 126 of the Factory and Workshop Act, 1901, extend the matters to which this section applies to matters other than those mentioned in this section.

8. *Abolition of investigations of accidents by certifying surgeons.*—(1) After the expiration of one month from the passing of this act it shall cease to be the duty of certifying surgeons to investigate the nature and cause of death or injury caused by accidents in factories and workshops or in premises to which the provisions of the Factory and Workshop Acts, 1901 to 1911, relating to accidents, are applied, or to send to the inspector of the district reports thereof:

Provided, That nothing in this section shall affect subsection (3) of section 73 of the Factory and Workshop Act, 1901, relating to the investigation by certifying surgeons of diseases occurring in factories and workshops:

Provided also, That it shall continue to be the duty of the certifying surgeon to investigate and report upon cases of injury caused by exposure to gas, fumes, or other noxious substances or due to any other special cause specified in instructions of the secretary of state as requiring investigation, and the secretary of state shall issue instructions defining the causes of injury to which this provision is to apply and requiring the inspector of the district to refer to the certifying surgeon all such cases reported to him. It shall also be the duty of the certifying surgeon to investigate and report upon any case of injury which the inspector of the district in pursuance of any general or special instructions of the secretary of state may refer to him for that purpose. The certifying surgeon shall have, for the purpose of the investigation in any such case, the same powers and shall be entitled to receive the same fee as he would if the case had been a case to which section 73 applies.

(2) As from the same date the enactments mentioned in the schedule to this act shall be repealed to the extent mentioned in the schedule to this act.

9. *Construction of Part II.*—This part of this act shall be construed as one with the Factory and Workshop Acts, 1901 to 1911. * * *

13. *Short title.*—This act may be cited as the Police, Factories, etc. (Miscellaneous Provisions) Act, 1916. [Aug. 3, 1916.]

VALUE OF WELFARE SUPERVISION TO THE EMPLOYER.¹

BY B. SEEBOHM BOWNTREE, DIRECTOR OF WELFARE DEPARTMENT, BRITISH MINISTRY OF MUNITIONS.

The editor asked me to write a few notes, based on personal experience during 20 years, on the value to the employer of what has come to be known as "Welfare supervision."

Some employers tell you they do not know what this phrase means. This is only because it is a new name for something which has been carried on to a greater or lesser extent ever since there were factories. Welfare supervision is simply the creation in a factory of those conditions which enable each individual worker to be and do his or her best.

So long as factories were very small there was no need of any special organization to secure this end; the master knew each of his men personally, and if he was wise he saw that each was put to the work best fitted for him and worked under conditions which enabled him to do his utmost both for his employer and himself. But as factories grew larger and larger this personal relation was crowded out. The employer no longer knew his workers even by name. They came to be impersonal "factory hands" to him, who were treated in the mass, without individual consideration. Even when he honestly desired to do well by them it was increasingly difficult for any worker who had some personal grievance to get it remedied, and too little care was taken to suit the work to the worker and surround him with conditions tending to the utmost efficiency.

Gradually it became clear that this state of things was unsatisfactory from every point of view and many employers appointed special officers simply to reestablish the personal relation between themselves and the workers, which still exists in many small factories. The special officers undertaking this work bear different names in different factories; but perhaps the most usual title is that of "welfare supervisor," which was adopted by the Health of Munition Workers' Committee when writing on the subject in relation to munition factories. Both men and women welfare supervisors have been appointed, though the latter greatly outnumber the former, and it is of welfare supervision among women that the editor has more especially asked me to write.

It is a subject which has been brought into some prominence through the recent action of the Minister of Munitions in determining that welfare supervisors shall be appointed in every national munition factory where women or young persons are employed.

¹ Reprinted from an article entitled "Making a success of the woman worker," in *System* (London Edition) for June, 1916, through the courtesy of the publishers, A. W. Shaw Co., Chicago, Ill.

Some employers may think that welfare supervision is merely a fad. This, however, is quite a mistaken view. It is not only good from the worker's standpoint, but it is thoroughly sound business from the standpoint of the employer. As a matter of fact, it is stupid to treat workers in the mass, and only through lack of insight do we fail to realize its stupidity.

For it must be remembered that a manufacturer's equipment is of two kinds—human and mechanical. What should we think of an employer who treated his machinery in the mass? As a matter of fact he watches his mechanical equipment with extraordinary care. It is continually tested to find if there is any overstrain. A man goes round with an oil can all day long to see that there is no unnecessary friction anywhere. Periodical inspections of the plant are made. And finally you have the engineer doing nothing else but seeing after the welfare of the machines. It is recognized, in a word, that each machine must be dealt with separately.

Now, human beings are infinitely more complex and more delicate than machines. Notwithstanding this "hands" are taken on with but scant consideration of the particular work for which they are best suited, and little effort is made to interest them in what they are going to do or to create in them a desire to succeed. A sensitive girl may be engaged by a rough-tempered foreman and put to work without a word of encouragement in a great room full of strangers under the supervision of a nagging overlooker. Although she may never have been in a factory before she is expected from the first day to work a 12-hour shift, sometimes in a very bad atmosphere, and often but scanty provision is made to enable her to get a good meal in the middle of the day amid comfortable and restful surroundings. Need we wonder at it if her work is inefficient? A girl will never do the best for her employer or for herself under such conditions.

If only employers would treat their employees with as much consideration as they do their machines they would have less difficulty in getting satisfactory output.

The editor has put to me some specific questions as to everyday difficulties. I will seek to answer them seriatim, along the lines I have indicated.

First of all, how long can women work efficiently?

It is impossible to lay down any hard and fast rules as to the number of hours girls can work with advantage. It depends upon the severity of the labor, the conditions under which the workers live at home, the transit facilities, the atmospheric conditions in the factory, and the wages paid. But, broadly speaking, I think that the demand of the workers for a 48-hour week is based upon reason. The advantage of going below it is doubtful, and I am pretty sure

that, as a rule, there is little, if any, use in going much above it, except for short periods. Generally speaking, then, I should say the employer is wise who works his women and girls for 8½ hours per day from Monday to Friday, and for 5 hours on Saturday. I question whether it ever pays to keep on working girls for more than 54 hours a week. As for the 60-hour week, it is most unsatisfactory.

A short break of, say, 10 minutes in the middle of the morning is a distinct advantage. There is much evidence to show how great a relief it is to the workers, many of whom come away from home with no breakfast, or an inadequate one, and are thus enabled to get a little lunch. In some munition factories milk is being sold to the workers during this break, which is an excellent plan. In many they are allowed to go to the canteen for tea or other refreshments.

I am asked whether it is desirable for women to work at night. Certainly not; but if for any reason—as, for instance, the exigencies of war time—it is absolutely necessary, then it is far better to work women on 3 shifts of 8 hours than to work two shifts of 12 hours.

Next comes the question of canteens. Are they worth while? The Americans recognize much more fully than we do the advantages of good canteen arrangements in the works. We have all heard that “a man can be neither a statesman, a philosopher, a poet, nor a lover unless he has had something to eat during the last 48 hours.” This is doubtless true, but it is just as true that unless girls in a factory can get a comfortable midday meal they can not be expected to do a good afternoon’s work. I have heard many employers speak of comfortable mess rooms as luxuries and fads, and of a good canteen as involving a capital expenditure which brings in no return.

Nothing is further from the truth. Employers know perfectly well that if they themselves lunch hurriedly on badly cooked and unnutritious food their work suffers, and what is true of them is true of their workers. If we want them to do a good afternoon’s work we should give them a restful dinner hour and see that nutritious food is available. There is some truth in a remark I once heard that “left to herself a woman always tends to live upon cake,” and this is a danger which should be guarded against in the canteens.

Another of the general conditions which a wise employer will carry out in his factory is to see that the ventilation of his workrooms is good, that they are adequately warmed, that the air is fresh, and that they are well lighted. We are quite alive to the importance of these things in our own offices. When the air is stuffy we find that our brains are sluggish, and we open the window. If we are too cold or too hot, and if the sun is shining in our eyes, or the artificial lights are too strong or too weak, we remedy the defect, because it interferes with our work.

Yet we wander through our workrooms, seeing such defects multiplied indefinitely, and wholly fail to realize that the workers are just as sensitive as we are, and that it is extremely bad business to handicap them by irritating conditions. Indeed, we grumble at the Home Office inspectors and call them faddists because they insist upon a certain minimum in the way of ventilation and lighting.

Turning from general conditions, which a wise welfare supervisor will constantly be watching, I should like to say a few words with regard to the more personal side of her work. Employers hardly recognize the importance of a girl's first introduction to our factories. It may make all the difference if, instead of being hurriedly engaged by a foreman, her first interview is with the welfare supervisor. The latter, after ascertaining her qualifications and deciding to employ her, can have a talk with her about her future and try to interest her in it, making her feel both that the firm intends to do "the square thing" by her, and that she must do "the square thing" by the firm. After this, for a time at least, the welfare supervisor should keep closely in touch with the newcomer, visiting her at the end of a day or two to see how she is getting on, and inquiring whether she has any difficulty that can be removed, and after this paying her periodical visits so long as may be necessary.

Great care must, of course, be taken in the selection of the supervisor. She should have a real love for girls, and be methodical and of businesslike habits, and she should in the best sense of the word be a lady. The term is no doubt ambiguous, but it does connote certain qualities of tact, gentleness, and honor, and a dignity seldom asserted and seldom challenged.

For it will be her business to keep in touch with all the girls under her charge. They should feel that she is their friend. One of the great difficulties in even the best organized establishments is to secure perfect justice in the treatment of every worker. Although the general rules may be perfectly fair and reasonable, there must always be a few exceptional cases in which a worker may have a real grievance. Yet it may be impossible for her to put the point to her overlooker. On the other hand, she will not be afraid to explain her particular grievance to a sympathetic welfare supervisor. By this means the management may frequently gain information as to these petty tyrannies and the like which occasionally lower the efficiency of a workroom in apparently mysterious fashion.

There is a rule, I believe, at a certain factory in America that no worker may start in the morning if she has any grievance or cause of irritation against the management. The employee who suffers under a sense of injury will never be able to do herself justice, argue the management. Consequently any such grievances are cleared up first thing in the morning, before the operative starts work.

There are a number of causes which may adversely affect the efficiency of women workers which a welfare supervisor can remove. For instance, a girl may be worried by ill health at home. This worry will prevent her from attaining her normal output. But a chat with the welfare supervisor will often lead to some means being found for relieving the strain upon the girl's mind. This may take the form of a suggestion from the supervisor that the firm might make a small advance to meet the abnormal expenses of the household if the case proves to be genuine. On the other hand, the mere fact that someone at the works has sympathized with the girl about her home trouble will make her feel herself to be a member of the factory family.

It would be difficult to enumerate all the direct and indirect influences which such a worker exercises over a factory. But one thing is certain. Her work not only increases the efficiency of the girls under her charge, but it tends to attract a better type of worker. Many employers can show how they have been able to obtain girls with better education and from better homes through the work of welfare supervisors at the factory. Now rough, unskilled labor is seldom cheap in the long run. And everything that tends to increase the personal responsibility and the efficiency of employees will help to give him a higher rate of output.

A good illustration of the advantage of treating employees individually instead of in the mass is in the means adopted to reduce the amount of broken time—and this is work in which a welfare supervisor may be of great assistance.

The following effective way of keeping a grip on the time broken by individuals has been adopted in a large factory, with excellent results. An attendance chart was arranged on which is entered each day every absentee. In the first column the worker's number is written, in the second her name, and against each name a square is allowed for each day of the week. If a girl is away in the morning without any reason being given, the fact is recorded by a heavy full stop in the extreme top left-hand corner of the square allocated to that day. If she is away in the afternoon a similar dot is placed in the bottom right-hand corner. Should the reason for her absence prove to be unavoidable—e. g., ill health—the dot is transformed into a cross, which represents an unavoidable absence, as distinct from unjustifiable time breaking.

Now, by looking at a chart of this sort, which extends on each page for three months, it is possible to see at a glance—

- (a) Which girls are keeping bad time.
- (b) What departments are keeping bad time.
- (c) Whether time is frequently broken on any particular day, e. g., Saturday or Monday.

In the case of girls this chart should either be prepared in the welfare supervisor's office—the necessary facts being supplied daily by the time office—or if prepared elsewhere should be sent to the welfare supervisor at least once a week. It then becomes her business to take up the matter with any employee who is keeping bad time, and to find out what the real cause is and seek to remedy it.

The cause for keeping bad time usually falls under one of the following headings:

(a) A specific illness, such as scarlet fever, which may keep a girl away for several weeks.

(b) Occasional illness, which may show that the girl's general state of health is poor.

(c) Slackness, which may be caused by either dislike of or distaste for the work.

(d) Possibly demands of parents that the girl shall do housework at certain times.

It is obvious that these causes can not be remedied in any wholesale way, nor can bad time keeping be effectively dealt with by severe disciplinary regulations. It is worth the employer's while to treat each case individually, and this can best be done by the welfare supervisor. This is much more effective than to send a clerk or a busy foreman concerned with a multitude of other matters to interview a girl who has broken time. If a tactful woman asks the girl quietly just why it is that she is breaking time she will often get an illuminating answer. If the girl is anemic or otherwise unwell she can encourage her to adopt health rules that will make her stronger. If she is merely wearied by the monotony of the work she can try and interest her in it. In any case she can get a personal approach to the girl, who knows that although the welfare supervisor is an employee of the firm she is not in the usual sense "in league" with the management. By constant care a good welfare supervisor is able materially to reduce the amount of broken time.

In addition to the chart described above, which deals with individual workers, it is worth while to prepare weekly statistics in which the average amount of broken time is shown for each department. In these statistics two sets of figures should be given. The first, a column showing the amount of time broken from all causes, whether satisfactory or otherwise, and whether with permission or otherwise; the second, a column from which are eliminated all absences which have extended over a whole week. These will almost certainly be due either to illness or to absence with leave, and may safely be deducted from the time unsatisfactorily accounted for.

I do not think it is worth while to attempt to distinguish statistically between satisfactory and unsatisfactory causes of broken time

where this only extends to a day or two, as illness is so frequently given as the cause of absence when really it is only the excuse.

These weekly statistics are valuable means of comparing the time keeping in each department. Where this is bad this will probably be found to be due to one or more of these causes:

- (a) A slack foreman;
- (b) Bad working conditions;
- (c) Too much overtime;

any of which are capable of being remedied.

A point that arises in appointing a welfare supervisor is, of course, the cost of such an officer. But this expenditure should be considered not merely as an additional outlay but as a legitimate expense for improving the efficiency of the staff. A small firm can generally secure a suitably trained person for £2 (\$9.73) per week. Larger firms should pay from £3 to £5 (\$14.60 to \$24.33) per week, if they desire a worker conversant with all the subtle difficulties that arise in handling large numbers of women.

If there are 500 girls working in a factory and the management pays £150 (\$729.98) a year for such a supervisor, she is costing the firm less than 1½d. (3 cents) per worker per week. If the average rate of wages is 12s. (\$2.92) per week, the supervisor is costing the firm 1 per cent of the annual wages bill. If they are paying their girls an average of £1 (\$4.87) per week she will only cost 0.6 per cent of the wages bill.

If, as a result of a more contented personnel, one does not get far more than 1½d. (3 cents) of extra output per week from each girl, then something is very much amiss. It is certain that such a worker is an economy in every sense of the word. She saves the manager from worrying over the thousand and one points that can be dealt with by women far better than by the best business man. Consequently she frees the executives for more important work.

It is clear that the whole success of welfare supervision will depend upon two things—firstly, the employer's recognition of its importance, and, secondly, the personality of the welfare supervisor.

After more than 20 years' experience of welfare supervision in my own factory, I am thoroughly convinced of the wisdom of appointing welfare supervisors where large numbers of girls are employed. They not only promote the well-being, the health, and efficiency of the girls, but they save the management an enormous amount of trouble. And it must be remembered that an increase of efficiency is important not only to employers but also to the workers; for there can not be progressive improvement in wages unless there is progressive improvement in methods of production.

WELFARE SUPERVISION.¹

[Memorandum No. 2.]

1. Varied and complex influences are to-day adversely affecting the efficiency of munition workers, and amongst them certain conditions, outside the ordinary undertakings of factory management, appear to be almost more important than the immediate or technical environment in which work is carried on and the length of hours during which the workers are employed. Four of the chief influences thus affecting industrial efficiency concern questions of (a) housing, (b) transit, (c) canteen provision, and (d) the individual welfare of the employee.

(a) The sudden influx of workers in certain districts has so overtaxed the housing accommodation that houses intended for one family are now occupied by several, and the same bed may be used by day and night. Before satisfactory schemes can be formulated for improving housing accommodation the extent to which present accommodation is inadequate must be ascertained and the whole problem carefully considered by suitable officers.

(b) In some districts no local accommodation whatever can be obtained and workers are, therefore, compelled to travel every morning and evening to and from the factory in overcrowded trams and trains of which the times of departure and arrival may involve waiting, delay, and serious loss of time to both employer and workman. Cases have come to the knowledge of the committee where workers have to leave home daily before 5 a. m. and do not return before 10 p. m., thus leaving barely six hours for sleep. Improved facilities for transit may contribute materially to the solution of the housing problem; but until the principal factories in a district can render accurate data of numbers, of distances, and of the practicability of cooperative arrangements the transit companies can not have reliable estimates of the problem before them or properly instructed agents with whom to cooperate.

(c) Again, the provision of facilities for obtaining a hot meal at the factory are often inadequate, especially for night workers. Frequently the arrangements made for heating carried food are also wholly insufficient. Again, workers who are poorly lodged may be unable to obtain appetizing and nourishing food to take with them; others living long distances from the factory may have little or no time to spare for meals and thus have to rely on what they carry with them to sustain them during the day. Yet the munition worker, like the soldier, requires good rations to enable him to do good work;

¹ See also "Welfare work in Great Britain." Summary of book on Welfare Work: Employers' Experiments for Improving Welfare Work in Factories, by E. Dorothea Proud (London, G. Bell & Sons (Ltd.), 1916). XVII, 363 pp. In MONTHLY REVIEW, December, 1916, pp. 81-88.

moreover, many of these workers are only boys and girls. Advice and assistance is therefore required in large factories in regard to the betterment of feeding arrangements; where canteen accommodation is provided its management calls for effective supervision.

(d) Lastly, the rapid growth of commercial undertakings, and in particular of munition works, makes it difficult or impracticable for the management to deal, unless by special arrangement, with the numerous problems of labor efficiency and the personal welfare of the employee. Yet, without some such special arrangement, there can not fail to be diminished output, discontent, and unsmooth working. In matters of discipline, output, and long or exceptional exertion, the state of mind of those who are actually at work is all important.

"One inevitable result of the growth of large industrial concerns," writes a large employer of labor, "has been the loss of the possibility of any real personal relationship between the employer (whether a single individual or a board of directors representing shareholders) and the great mass of the employees. Where the employees number several thousands it is manifestly a physical impossibility for the employers or directors to be in personal touch with them all. Those employers, therefore, who recognize that their responsibility toward their employees involves duties beyond those realized through the medium of the wage office, have to seek to fulfil these obligations by other means. This has led to the establishment in not a few large factories of an organized system of what is called social or welfare work, carried on by specially trained men and women, whose main duty is to humanize industrial conditions of life and to foster and keep alive those right relationships which are the basis of a well-ordered and harmonious community. The best welfare work that can be done is for the employer to see that the conditions of labor are satisfactory as regards wages, health conditions in workrooms, and the considerate treatment of employees by their immediate superiors. These are essentials upon which, as a basis, any system of welfare work must be founded. If the welfare workers have the confidence of the employees, and are always in touch with them, they will naturally be the medium whereby matters occasioning dissatisfaction or misunderstanding can be investigated and put right. By suggesting and advising upon improvements in conditions of work that may be helpful on the business side, by initiating and supervising recreative and other clubs, societies and classes, by visiting the sick, by endeavoring to foster the spirit of good fellowship amongst all grades of employees, and by being ready to give advice and assistance in matters affecting individual employees personally and privately—by these and other methods welfare workers may find means of giving practical effect to the desire of employers to realize their obligations toward their workers."

On these four grounds, welfare supervision is now receiving the attention of the more enlightened employers.

The success or failure of such work depends upon the spirit in which it is approached and not simply upon the means and organization devised for the purpose. "Successful welfare work in a factory," writes another large employer, "does not depend upon expensive equipment or vast organization, but the smallest factory and

humblest organization if worked in the right spirit will show good results in the character and well-being of the workers." It must not be regarded as something outside the ordinary factory management or extraneous to it, but as a vital and integral part of the whole discipline and right organization of the business to be shared in by all, directors, foremen, and employees, as well as by the duly authorized welfare supervisor. The same employer adds, "the economic results have justified the trouble and expense."

2. Further, in the course of visits to factories the committee have frequently found various difficulties in existence unknown to or unappreciated by the management. In the past these difficulties have not been so great as they are to-day and hence no one has been given the duty of inquiring into their existence and of devising means to rectify them. Yet without such inquiries, carefully pursued, these adverse conditions can not be brought to light; and without some person specially appointed or designated for the purpose by the management there is no one whose duty it is to discover and apply remedies. It is obvious that neither the employer nor the workman is sufficiently disengaged to undertake such obligations.

3. Welfare workers already exist at a number of factories, 30 of which sent representatives to a conference held at York in 1913, and the number has largely increased since. The duties fulfilled by these workers, who have generally been intrusted with the supervision of females and young persons, have varied in accordance with local requirements and the size and character of the factory. They have included: (a) Engaging workers; (b) controlling the dining room and kitchen; (c) investigating complaints; (d) supervising cloak-rooms and lavatory accommodation; (e) suggesting improvements in terms and conditions of employment; (f) assisting and advising in matters affecting the workers personally and privately; (g) visiting the sick; (h) organizing gardening, clubs, gymnasiums, and holiday excursions; and (i) supervision of first aid. Evidence gathered from places where individuals have been appointed to supervise personally the welfare of the factory worker on the lines here indicated has fully established the value of this kind of supervision. The committee are satisfied that the well-being of the workers is being affected and their output reduced by the absence of that supervision.

4. Welfare supervision is already undertaken in a number of munition factories. The proprietors of one of the largest, after describing the work of a department which has organized housing, transit, and catering for some thousands of workers, write:

As we feel it highly desirable that the workpeople should keep their minds occupied with healthy recreation while they are away from the works, which reflects directly upon their efficiency in the works, we have appointed a chaplain, who, before taking orders, served several years in a large engineering firm and has knowledge of workpeople. This chaplain's duties *inter alia* will be to

settle disputes among the families living in the hostels, to generally look after the children, to organize concerts and healthy recreation, and to generally assist in the welfare of the people. We have, therefore, decided to erect a large theater as a cinema and concert hall, and suitable entertainments will be organized. * * * A qualified doctor and surgeon is being appointed, and we have also taken over a small operating theater and infirmary where cases of illness can be removed from the hostels.

At another factory, where men only are employed, an educated man devotes all his time to matters concerning welfare; in particular, he supervises safety appliances, organizes first-aid stations and canteen accommodation, and in cases of injury or sickness visits the workers at their homes. Yet another munition firm, who carefully attend to the surroundings and physical comforts of their men in such matters as heating and lighting, washing facilities, lockers for personal belongings, and many similar details, have made a shop committee their intermediary for various questions affecting the detailed management of the workshops and the institutions for the benefit or pleasure of the men, such as dining arrangements and the works rifle club.

Many appointments of women supervisors have been made and their success has been unqualified. Employers have stated to the committee that the presence of a capable woman, of broad sympathies, has in itself provided the best and quickest aid to the solution of many of the problems affecting women's labor by which they are assailed. One munition employer writes, after having appointed a lady superintendent:

Generally speaking, we consider it very essential to have a lady superintendent where female workers are employed, and especially where there are men working in the same department. Further, on medical grounds, we think the care and advice of a matron is indispensable. The duties of the lady superintendent here are principally: 1. To maintain discipline in the works, which is exceedingly necessary where mixed classes of labor are engaged. 2. To supervise the catering for and preparation of meals. 3. To give any advice of which she is capable when appealed to by the female workers. A good lady superintendent in work such as we are engaged on is, we consider, advantageous to secure good order and protect the moral welfare of the girls under her charge.

A second, speaking of a similar officer, writes:

Having had previous experience with female labor on a large scale, I felt when I entered on this work that it would be necessary to appoint a matron to look after the girls' general welfare, especially in these strenuous times when the heads and foremen of departments are so fully occupied in endeavoring to obtain the best possible production with the smallest amount of skilled labor, that they are not able to devote very much time to details which, in any case, are better managed by a lady supervisor. In addition to this, there are many matters which arise that can only be dealt with by a lady. The duties of the matron are as follows: 1. To report any condition or irregularity in the factory, which in her opinion is detrimental to the health or welfare of the girls. 2. To take entire charge of the mess room and the lavatories,

and see that the girls wear the uniform and caps provided, and that these are kept neat and in order.

She has no connection with output in any way, as we consider this would defeat the object of her appointment. She is directly responsible to the manager, and is therefore under no restrictions whatever from any official in the works.

Although we had nothing serious to complain of before engaging the matron, we feel that her engagement has been of great assistance to us.

Other testimonies to the services rendered by welfare supervisors could be quoted.

5. The duties of welfare supervision should include the following:

(1) To be in close touch with the engagement of new labor, or, when desired, to engage the labor.

(2) To keep a register of available houses and lodgings; to inform the management when housing accommodation is inadequate; and to render assistance to workers seeking accommodation.

(3) To ascertain the means of transit used, and the length of time spent in traveling; to indicate the need of increased train, tram, or motor service; or to suggest modification of factory hours to suit existing means of transit.

(4) To advise and assist workers in regard to feeding arrangements; to investigate the need for provision of canteen facilities, or any inadequacy in the provision already made; and to supervise the management of such canteens.

(5) To investigate records of sickness and broken time arising therefrom; and in cases of sickness to visit, where desired, the homes of workers.

(6) To investigate and advise in cases of slow and inefficient work or incapacity arising from conditions of health, fatigue, or physical strain.

(7) To consider, particularly for delicate and young workers, all questions of sanitation and hygiene affecting health and physical efficiency, and to supervise the conditions of night work, Sunday work, long hours, and overtime.

(8) To advise on means of recreation and educational work.

(9) To investigate complaints and assist in the maintenance of proper discipline and good order.

(10) To keep in touch with responsible organizations having for their object the promotion of the welfare of the worker.

6. The duties here outlined are chiefly concerned with matters of health and individual welfare which are of immediate urgency to-day. They are distinct from those usually intrusted to a trained nurse or medical staff engaged to render first-aid or subsequent treatment in cases of accident and sickness, though in exceptional cases some of them might be properly undertaken by the nursing staff, increased and, if necessary, reorganized for this purpose. The ad-

vantage of bringing the work of the nurse into touch with that of welfare supervision is manifest. On the other hand, these duties can hardly be differentiated from a variety of important matters outside the reference to this committee, such as questions of wages, in conditions of contract and discharge, compensation, and notices, rules, and proceedings under the Munitions of War Act.

While, therefore, the duties we have specifically enumerated in paragraph 5 thus fall into a somewhat separate category, the committee recognize that, owing to the disadvantages of having numerous or redundant officers for purposes of oversight, it may prove in many munition works most satisfactory and effective to combine a variety of duties under one supervising staff, professional or particular assistants being appointed as may become necessary.

WELFARE SUPERVISION FOR WOMEN.

7. The committee desire to record their unanimous conviction that a suitable system of welfare supervision (to be administered by an officer specially appointed for the purpose) is essential in munition works where women or girls are employed and, they must add, urgently necessary.¹ In every case the officer should be a competent woman possessing the qualifications set out in paragraph 9. The committee consider that it is important that some scheme of welfare supervision should be adopted, however small the number employed, and they suggest that, when it is impracticable to appoint a whole-time woman supervisor, the duties of welfare supervision should be allotted to a woman on the factory staff specially designated for the purpose. If the employment of women be properly safeguarded and wisely supervised, all may be well; but if not, the ultimate results may be far from desirable or beneficial.

8. In addition to the matters to which reference is made in paragraph 5, and which concern women workers equally with their male comrades, there are certain other matters—particularly of discipline and conduct—in which helpful oversight is specially needed in the case of women and girls, if the highest and most enduring efficiency is to be attained. As examples of such matters, the committee would mention the various questions and issues raised in respect of the conduct of foremen toward women workers; of the character and behavior of fellow women workers; of the maintenance of suitable and sufficient sanitary accommodation; of the worker's own state of health; of her capacity to withstand the

¹ In this connection the committee may draw attention to the fact that it has been the custom of the Home Office, when granting orders for the sanction of night work for women and girls, to insert a condition that a matron or responsible forewoman shall be appointed to supervise the welfare of those so employed at the factory.

physical strain and stress of work; of her power to endure long hours, overtime, or night work. For these and kindred matters the committee are satisfied that the appointment of welfare supervisors is necessary and conducive to the preservation of good health and good behavior in the present novel and difficult environment of industrial employment.

9. The officer appointed should be a woman of good standing and education, of experience and sympathy, tactful and sensible in her dealings with others, and having, if not an actual experience, at least a good understanding of industrial conditions.¹ She should live near the factory, and keep in close touch with all the women and girls employed. In "national" factories she should be appointed and paid by the Ministry of Munitions; in "controlled" establishments she should be appointed and paid by the employer, but her appointment should be reported to the Ministry of Munitions. Her duties would be determined by the authority appointing her.

10. In a few areas there has been a certain amount of discontent and unsettlement owing to the fact that women workers feel that they have been summoned before the Munitions Tribunal on grounds due generally or particularly to conditions of health or physical strain. The welfare supervisor in the course of her duties must have cognizance of facts bearing on these cases; and the committee are satisfied that substantial advantage would be gained if no woman's case were brought by an employer except after consultation with the welfare supervisor; for they believe that the result of such consultation would be that cases for the tribunal would be very substantially reduced in number, and in this way many possible sources of friction and misunderstanding would be avoided. It may be desirable to safeguard the authority of the welfare supervisor in cases of this sort by requiring that her official reports on each case should be in writing, and should be furnished both to the employer and to the Ministry of Munitions.

11. The committee suggests that as cases involving matters of health may be brought before the tribunal, a woman worker should be afforded adequate facilities for the proper and full representation of her case by a responsible woman.

¹ A course of social study, which comprises university lectures and practical work, designed for students preparing themselves as members of various local government bodies, as welfare workers in factories, and for others engaged in social administration, has been established at London University (London School of Economics) and at Birmingham University. Similar courses are also given at the universities of Manchester, Leeds, Bristol, Edinburgh, and Glasgow. Experience as foremen, as teachers, and in other positions of responsibility has proved of value in providing welfare workers in several factories.

WELFARE SUPERVISION FOR MEN.

12. The committee consider that a suitable system of welfare supervision (to be administered either by the ordinary factory staff or by an officer specially appointed for the purpose) would be of advantage in munition works where 500 adult males or 100 boys are employed. Welfare supervision is of particular importance in the case of boys, since their employment presents many features of difficulty, to which special attention must be paid, if health and efficiency are to be safeguarded and discipline maintained. Where a number greatly in excess of 500 men or 100 boys are employed, additional welfare supervising staff may become necessary.

13. If a special officer be appointed, he should be a man of good character, of experience and sympathy, tactful and sensible in his dealings with others, and accustomed to the conditions obtaining in the particular industry. He must live near the factory in order to carry out his duties effectively, and he must keep in close touch with the operatives in all that concerns their industrial life. In "national" factories he should be appointed and paid by the Ministry of Munitions; in "controlled" establishments he should be appointed and paid by the employer, but his appointment should be reported to the Ministry of Munitions. His duties would be determined by the authority appointing him.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,
Chairman.

E. H. PELHAM, *Secretary.*

DECEMBER, 1915.

INDUSTRIAL CANTEENS.

[Memorandum No. 3.]

INTRODUCTION.

1. There is now an overwhelming body of experience which proves that productive output in regard to quality, amount, and speed is largely dependent upon the physical efficiency and health of the worker. In its turn such physical fitness is dependent upon nutrition. The purpose of nutrition is to secure the proper development and growth, the repair and vital energy, of the human body. Food energy is spent upon keeping up the body heat and in doing work. Nutrition is stimulated by the cooling effect of fresh air and by bodily exercise, and its needs must be met by a food supply suitable in character and sufficient in amount to meet the expenditure on body heat and work.

2. The human body calls for a constant supply of food, first for its growth, for the building up of its tissues and for repair, and secondly as fuel for the production of heat and energy. Both requirements are indispensable, and from the necessity for these there is no escape. Though no hard and fast line of division can be drawn, it may be said that certain kinds of food which are relatively rich in protein and mineral matter (meat, cheese, milk, herrings, dried peas, beans, bread, oatmeal, flour) contribute both to the formation of the body and its repair and supply it with fuel for the production of heat and energy; other kinds such as fat (lard, butter, dripping, margarine), sugar, sago and tapioca, afford an abundant supply of fuel but can not maintain growth and repair. Still other kinds of foods (fresh fruits, green vegetables) contain a small proportion of nutriment but insure the provision of the body with certain important principles conducive to good health.¹ The constituent parts of a dietary are important if the highest value is to be obtained, but, speaking generally, fresh, digestible and appetizing food is more important than chemical composition or proportion. It will be understood that digestibility is dependent partly upon the food itself being of a nature which is easily digestible and partly upon the organs of digestion being healthy and in good working order. Further, it should be noted that a variety of factors affect the relative value of food to the individual consuming it. For instance, there is the nature of the employment, whether sedentary or active, and the amount of energy called for. With increase of work there must be proportionate increase in quantity and in nutritive value of the food eaten. Ill-paid laborers and others whose food amounts only to a bare minimum can not either put forth the same energy or work at the same speed as a well-nourished man. The man who has to work hard, long, or rapidly needs a proportionately ample food supply, composed of highly nutritive ingredients, to withstand the strain. Age, sex, weight, and constitution likewise exert influence. Women require on an average about four-fifths of the food supply of a man, and an adolescent about seven-tenths. Season and climate also affect the question. Lastly, the predisposing influence upon the alcoholic habit of malnutrition, bad feeding, and long periods of work without refreshment should be borne in mind. There can be no doubt that "industrial alcoholism" is, in part, due to the lack of cheap good food.

¹ When work is nervously exhausting, e. g., nightwork, the food of the worker requires to be particularly light and digestible, well cooked and appetizing, for the organs of digestion then lack an adequate supply of nervous energy, and can not deal successfully with heavy indigestible and unappetizing meals. The warmth of the food is of great importance. Hot drinks stimulate the tired worker. The proper adjustment of the food to the expenditure of nerve energy saves a great deal of indigestion and the minor complaints which result from this and lost time.

3. What, then, in general terms, is the necessary dietary for a worker? Broadly, the answer is a dietary containing a sufficient proportion and quantity of nutritive material, suitably mixed, which is easily digestible, appetizing, and obtainable at a reasonable cost.

A STATEMENT OF THE PROBLEM.

4. Though there is little doubt that workers are getting a better type of food than formerly, it must be admitted that large numbers of workers of both sexes are not getting such a dietary day by day. Much evidence is forthcoming that this is being increasingly recognized both by employers and workers. The difficulties in the way of adequate feeding arise mainly where the worker must have his meals away from home. In past years and even now in normal times the worker lived fairly close to his work, and was frequently able to return home for his meal. At present the difficulties of securing adequate food are increased owing to the prevalence of night labor and the large number of men and women who have to travel a considerable distance to their work.

In such cases the simplest alternative is for the worker to bring or receive from his home or lodgings food ready prepared for eating. The objection to this arrangement is the limitation in the kinds of food suitable, and that it is necessarily cold, and liable to be stale. There is a special danger of its being confined to what can be most quickly prepared the night before without much regard to its nourishing character. When the weather is warm, or the food is kept for any length of time in a hot workshop, it readily undergoes degeneration.

A second alternative is for workers to bring food which can be either warmed up or cooked at the factory. This is sometimes done by the worker himself, or facilities for the purpose are provided by the employer. Arrangements on these lines are probably better than those under which the worker brings his food with him ready prepared. On the other hand, it is to be remembered that warmed-up food is generally not so nourishing as freshly cooked food, that if a large amount of food is to be warmed up it is always difficult to deal satisfactorily with widely varying kinds of food, and that valuable time is lost if the worker is compelled to cook his own meal.

Lastly, in some districts workers can obtain a substantial meal at public houses, cookshops, or other proprietary establishments in the neighborhood, but the accommodation in these places is often inadequate and unsuitable.

5. This then is the problem—to supply suitable food at a low price for large numbers of persons at specified times. The modern

progress of factory management reveals a variety of efforts to find a solution. There has been, it is true, considerable development in the provision of proprietary concerns in the form of improved coffee-houses and refreshment rooms. Philanthropic movements have also been initiated with a similar purpose. But by far the most hopeful enterprise has been the establishment by employers of industrial canteens, or workpeople's dining rooms, in or near the factory itself. There is no statutory obligation upon the employer, though action in this direction has received the whole-hearted commendation of the factory department of the Home Office. The earliest and best examples of such restaurants in factories are to be found in the food industry, but makers of soap, paper, cloth, tobacco, and tin boxes have followed suit, and now in all parts of the country accommodation of greater or less degree of suitability and attractiveness has been provided. This pioneer practice has abundantly justified itself from a business and commercial point of view, and in the opinion of the committee the time has come for a large extension of this method of solving the problem. Speaking generally, it may be said that the accommodation provided accords with one or other of the following types: (a) An available room for the workers to eat their prepared food; (b) a room furnished with a "hot-plate" or "warming cupboard"¹ or provided with hot water; (c) a refreshment barrow to perambulate the workshops at appointed hours (particularly useful for light refreshments during long spells or night shifts); (d) a fixed refreshment bar or buffet; (e) a dining room supplying cheap hot and cold dinners; and (f) such a dining room associated with an institute or club, with facilities for rest and recreation (e. g., rest-rooms, recreation or reading rooms, portable gymnasium, baths, roof garden, or educational classes, etc.). Some of these types may be suitably combined, and although arrangements indicated in (c) and (d) may prove sufficient and satisfactory in certain circumstances, the provision of proper meals seems obtainable only in the types (e) and (f). The committee recognize that the necessity for, and character of, an industrial canteen are dependent upon the nature of the need and its degree in each factory. They are, however, convinced that in the highest interest of both employer and worker, proper facilities for adequate feeding arrangements should be available in or near, and should form an integral part of, the equipment of all modern factories and workshops.

¹ "Warming cupboards" can be installed in or near the mess room and heated by steam. The cabinet may be constructed of sheet iron (finished off with asbestos and wood covering), with shelves of perforated sheet iron. Employees deposit their food in basins or dishes when they come to work, the cupboard is closed and steam applied under regulation for a specified time. At the dinner hour the employees fetch their food.

ESSENTIAL CHARACTERISTICS OF THE CANTEEN.

6. In order to insure effective results of the establishment of industrial canteens, certain conditions seem to be essential:

(a) *Accessibility and attractiveness.*—It is useless to establish a canteen which is inconvenient or unattractive. It should be situated in or near the works. The effective cleanliness, warming (55–60° F.), lighting, and ventilation should receive careful attention and be properly and continuously maintained.

(b) *Form, construction, and equipment.*¹—The premises should include an ample dining room with a buffet bar attached, with separate accommodation for men and women, and, where necessary, an additional room or partitioned section for the staff, foremen, etc. The kitchen should be properly equipped² and furnished with necessary scullery, pantry, and storerooms. It should be separated from the dining room by a servery and bar. Accommodation should be provided at the canteen or elsewhere for workers desiring to warm or cook their own food.

(c) *Food and dietaries.*—The food supplied should be varied, fresh, and good, suitable in quality and sufficient in quantity, well cooked, appetizing, and obtainable at low prices. For example:

DINNER.

Meat or fish, two vegetables.....	4d. to 8d. (8.1 to 16.2 cents)
Hot-pot, cottage pie, meat puddings....	2d. to 4d. (4.1 to 8.1 cents)
Meat pies and other prepared meat or egg dishes.....	2d. to 4d. (4.1 to 8.1 cents)
Soup, bovril, oxo, etc. (with bread)....	1d. to 2d. (2.0 to 4.1 cents)
Puddings and stewed fruits.....	1d. to 2d. (2.0 to 4.1 cents)

¹ In some works an existing part of the premises may be altered and adapted, in many cases temporary buildings may be erected, and in yet others a more permanent block may seem desirable. Some temporary canteens (100–250 places) recently built on the Mersey Dock Estate consist of timber framing fixed to steel uprights (let into concrete at intervals of 10 to 12 feet) with creosoted weather boarding on outside; lined inside with boards; roof boarded and covered with bituminous felt; floor boards carried on joists supported on concrete piers; inside colored white, with dark green dado; counter and store rooms fitted with shelving. Approximate cost per place £3 to £3 10s. [\$14.60 to \$17.03]. Minimum dining room floor space per head should be 10 square feet. Particular care should be taken to secure means for effective warming, lighting, and ventilation. The larder and kitchen should not ventilate into the mess room. Where necessary, lavatory basins should be provided. The mess room should be furnished with long, relatively narrow tables (with hard, durable smooth tops, or oil cloth, or white tiles), and benches with back rail, or chairs (preferable). Trays or boxes for waste paper.

² The kitchen of an exceptionally well-equipped industrial canteen for 250 persons at Leeds contains the following utensils: One large gas stove (three ovens); one steam-heated hot closet and carving table, for heating plates and dishes and keeping the food hot; one steamer with four compartments for steaming and boiling; one 30-gallon steam-jacketed pan for soups; one 10-gallon copper water-jacketed pan for milk, stewed fruit, porridge, etc.; a knife machine; a potato peeler; a bread cutter; a steam kettle; a whisking machine for batter and Yorkshire pudding; a mincing machine; large bins for storage; enamel bowls, jugs, and stew jars, substantial tinned steel bowls for baking, and ordinary kitchen and dining room "crockery" of white stoneware. This canteen has a staff of matron, cook, and four assistants.

Suet, bread, currant, jam, and fruit pudding.....	1d. to 2d. (2.0 to 4.1 cents)
Bread and cheese.....	1d. to 2d. (2.0 to 4.1 cents)
Vegetarian and cheese dishes.....	2d. to 3d. (4.1 to 6.1 cents)
Cakes, buns, jam tarts, bread and but- ter, sandwiches.....	1d. to 2d. (2.0 to 4.1 cents)
Tea, coffee, cocoa, milk, lemon, barley, aerated and mineral waters, etc., per cup or glass (exceptional quality im- portant)	½d. to 1½d. (1.0 to 3.0 cents)
All kinds of fresh fruit in season, oranges, lemons, bananas, prunes, plums, apples, pears, tomatoes, etc.	

In certain districts, and in special circumstances, there may be a case for the establishment of "wet" canteens, where alcoholic beverages may be obtainable. The committee recognize that such canteens will require particularly careful supervision, and it may be necessary to impose certain restrictions in regard to the sale of intoxicants.

(d) *Prompt service.*—The quick service of meals is important. Three methods are practicable (method (1) is probably best, as a rule, for large numbers):

(1) Long serving counters (with barriers as at railway booking office) from which workers fetch their food.

(2) Food placed ready on the table before workers admitted. This may be convenient for breakfasts or teas, or where the food provided is cold and the same for all, but it is not always practicable for hot dinners.

(3) Waiters or waitresses, organized in shifts or voluntary (small payment for services rendered).

(e) *Convenient hours.*—The canteen should be open at any hours which meet local needs and circumstances. Midday is clearly the principal occasion of its utility. But in many works it should also be open in the early morning hour for breakfast, and at supper time. Where there are night shifts meals and refreshments should be available as by day. Provision should also be made for the supply of water, milk, tea, or coffee at specified times.

(f) *Payment.*—Different methods of payment are in vogue, but if payment at the time by bill or check be impracticable, probably the most appropriate is for workers to buy books or series of tickets or checks previous to the meal or at the door. Money can not be deducted from wages by the employer for food or drink without a contract under the Truck Act.¹

(g) *Management.*—The success of an industrial canteen depends in considerable degree upon its management. Speaking generally,

¹ The Truck Act, 1831, sec. 23, provides that "no deduction shall be made from the wages of a workman in respect of victuals dressed and prepared under the roof of the employer unless an agreement or contract for such stoppage or deduction shall be made in writing and signed by the artificer." Such an agreement can be readily made or may prove to save time and prevent waste.

three methods, which are not mutually exclusive, are available. The employer may manage, the workers may appoint a management committee, or the entire direction may be contracted out to a professional or voluntary caterer. In not a few of the most successful canteens joint control is exercised by employer and men (an elected shop committee with a chairman representing the management), who may or may not contract out the catering. The method of control is materially affected by the proprietorship.¹ In all cases it should be disinterested and for the benefit of the workers. Exploitation in any form should be avoided, efficiency and economy being steadily kept in view.²

RESULTS.

7. The committee have been impressed with the consensus of opinion which they have received as to the substantial advantages both to employers and workers following the establishment of an effective and well-managed canteen. These benefits have been direct and indirect. Among the former has been a marked improvement in the health and physical condition of the workers, a reduction in sickness, less absence and broken time, less tendency to alcoholism, and an increased efficiency and output; among the latter has been a saving of the time of the workman, a salutary though brief change from the workshop, greater contentment, and a better midday ventilation of the workshop. The committee are satisfied that the evidence of these results is substantial, indisputable, and widespread. In the isolated cases where the canteen has failed it has been evident that its failure has been due to exceptional circumstances, misuse by the workers or mismanagement. In almost all large works the committee find that there is a body of men or women (averaging at least 25 per cent) who in the interest of physical health and vigor need canteen provision at the factory. They are convinced that this group of ill-fed workers accounts in a large degree for such inefficiency as exists, and that its energy and output is reduced in the absence of suitable feeding arrangements. The committee have received a number of statements in favor of industrial canteens from which they select that of an authority of wide experience:

¹ The committee understand that the Central Control Board (Liquor Traffic) appointed under the Defense of the Realm Act, 1915, No. 3, is empowered by the treasury to make grants in aid of capital expenditure for the erection of canteens, approved by the board, in controlled munition works. The policy of the board is first to encourage the employer or owner to make certain provision where necessary; secondly, to facilitate such provision by voluntary agency; or, thirdly, to establish a canteen themselves, either managing directly or handing over the management to a properly constituted committee.

² The tariff can be kept low only by careful management. The food materials can be made to pay, but the incidental expenditure is relatively heavy. Workers are not accustomed to paying for food in canteens, and will not always purchase the most nutritious food. Tact, discretion, and an appropriate menu of popular dishes are necessary. Constant supervision and the careful adaptations of means to ends are needed to prevent loss if good food is to be sold quickly at the low price the worker can afford to pay.

In answer to your inquiry as to the effect which our canteen arrangements have had upon the health and efficiency of our own workpeople, we were so fully alive to the importance of this as to erect a complete installation, separated from the factory proper, for the use of those who live too far away from the works to dine at home. From 1,500 to 2,000 workpeople make use of these rooms daily.

The building has a well-equipped kitchen, but the majority of those who dine at the works, although buying tea and light refreshments, bring their own dinner. This habit obtains elsewhere. We make a point, however, of having, in addition to other things, one or two cheap and very nutritious dishes, e. g., a 1d. (2 cents) basin of soup or stew, of which some hundreds are sold daily. In planning the dining block we felt it was not merely a question of supplying food, but of doing so under restful and comfortable conditions, in rooms well lighted and ventilated and properly warmed. A great deal more was done than was required for bare efficiency, and it is not necessary to build on so costly a scale. We have never had a moment's doubt as to the importance of a comfortable dinner hour for our people from the point of view of their efficiency in the afternoon.

The health of our workpeople has unquestionably improved in recent years, and we feel sure that the dining room has helped to bring about this result. At the same time, as there are many factors which have come into play, it is impossible to value with any approach to accuracy the part that each of these has played. The proper ventilation of the workrooms, medical and dental attendance freely given at the works, with facilities for those in poor health getting to a convalescent home, are among the many factors which have each exercised an influence.

This testimony with its qualifications expresses the conviction of the committee as to the benefit arising as a result of a good industrial canteen. The committee have been impressed not only with the improved nutrition manifested by the users of the canteen, but by a lessened tendency to excessive consumption of alcohol, by the prevalence of the spirit of harmony and contentment engendered, and by an increase in efficiency.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,

E. H. PELHAM, *Secretary.*

Chairman.

NOVEMBER, 1915.

CANTEEN CONSTRUCTION AND EQUIPMENT.

[Memorandum No. 6. Appendix to Memorandum No. 3 (Industrial Canteens).]

SITE.

1. The first important consideration in the erection of a new canteen is the question of a site for the building. The site should, if possible, have a pleasant open outlook and southern aspect, and should be easy of access for the workers. With high buildings adjoining and mess rooms looking out upon blank walls not many yards distant, the canteen may prove unattractive and its success be to a great extent impaired. The canteen should, if practicable, be placed

where water, gas, and electric mains are adjacent, as well as drainage capable of carrying off the discharge of soil and rain-water pipes and of sinks and lavatory wastes.

BUILDINGS.

2. Plans have been prepared showing canteens suitable for 400 and 280 diners. Instructions are given for reducing the second plan so as to provide only for 150 diners. The question which immediately arises is whether the buildings shall be of (a) temporary or (b) permanent construction. During the war there is much to be said for the erection of a temporary building, mainly on the ground of cost, rapidity of erection, and the smaller demands made upon labor.

3. Permanent buildings naturally take longer to erect, the cost varies from 25 to 40 per cent more than in the case of a temporary building, and the demands made upon labor are greater. On the other hand, a permanent building is, of course, more satisfactory and costs proportionately less than the temporary building for maintenance. In normal times the case for the permanent building is a strong one, but at the present time for canteen purposes the temporary building should be the type adopted.

4. The construction of temporary buildings is dealt with in more detail on the drawings, but it should not be overlooked that the wear and tear of the floors is considerable, whether in the mess rooms or in the kitchens, and in view of this the floors generally should be of concrete, finished with a granolithic face. This type of floor is smooth, hard, durable, and impervious and is easily washed down after meals. Advantage should, wherever possible, be taken of using local material to save railway carriage, cartage, etc.

5. In a large number of canteen proposals it may be found that the dimensions of available sites will not admit of the buildings being erected in accordance with the suggested designs accompanying this memorandum and therefore a few remarks are necessary on the general arrangements which experience proves to be desirable. The canteen or dining hall, being the principal apartment, should be arranged with the most convenient methods of egress and ingress for the workers and with direct approach to the serving counter so that traversing the whole or any great portion of the dining hall to obtain food is avoided. Barriers in front of the counters are advisable to allow of each diner obtaining his or her food in the order of arrival so that there may be no possibility of crowding or pushing, which is sometimes frequent where large numbers are concerned. Adequate gangways or passageways for each diner to proceed to the dining tables without interruption to other diners are essential. The kitchen should be situated as centrally as possible with regard to the

dining room, which it should adjoin. The wash-up or scullery should open out of the kitchen and should abut immediately upon the main dining hall. A counter or shelf with communicating hatch should be provided to admit of dirty crockery being handed direct to the hot-water sinks. In addition to the sinks in the scullery such accommodation is also required in the kitchen for the use of the cook in the preparation of food: The sinks should be supplied with hot water from an independent boiler, which should be placed as near as practicable to the sinks (or otherwise, see par. 14). The sanitary accommodation for the canteen should preferably be situated in an isolated block of buildings adjacent to the canteen, but the requirements in this respect depend upon the sanitary accommodation already existing in adjoining buildings and each case will have to be considered on its merits.

VENTILATION AND LIGHTING.

6. Ample window space (with a large proportion of the windows opening) is desirable for light and ventilation, and in no case should the total glass area of the windows be less than one-tenth of the floor area of the various rooms in which they occur. The fan-lights for casement windows should be hinged at the bottom and fall inward. Glazed cheeks or gussets should be provided to admit of continuous ventilation, and at the same time prevent down draft. All casement windows should be made to open for use in warm weather, and to flush the rooms with air after the principal meal. Louver ventilators under the roof or in turrets provide ventilation for the main mess room. A simple cord attachment to wooden flaps should be provided to admit of these ventilators being closed during cold or windy weather. The kitchen should be provided with a continuous louver ventilator, as indicated on the drawings. It is desirable, where electric or other power is available, that an exhaust fan should be placed in the kitchen to extract the heat and steam from the kitchen and scullery, and incidentally assist in the general ventilation of the dining rooms. Larders should face north and have nearly half the glass omitted in the window panes and perforated zinc panels substituted to provide suitable ventilated storage for perishable food.

EXTERNAL AND INTERNAL MATERIALS.

7. The selection of materials, owing to the high prices obtaining, presents some difficulty at the present time. Formerly one of the most favored external coverings for temporary buildings was galvanized corrugated sheet iron. The cost of this material, however, is now almost prohibitive and alternatives are ungalvanized corrugated sheets (painted) or roofing felts. These felts are usually laid on

the boarding with a lapped joint and patent cement supplied by the makers, the sheets being then secured with galvanized clout or large flat-headed nails. Only the stoutest material of the respective makers should be used to insure a water-tight roof. Light asbestos slates also provide a satisfactory, although somewhat heavier, roof covering. All roofing felts need careful laying, otherwise bulging occurs, which, in addition to being unsightly, is a frequent cause of a defective roof.

8. A large variety of materials are available for the external coverings of the walls, among which may be mentioned feather-edged weatherboarding (treated with creosote), ungalvanized painted sheet iron, plaster finished in cement, secured to the wood framing by expanded metal, asbestos slates, or other materials. Internally plaster and cement on expanded metal, asbestos sheets (the joint covered by a small fillet), match boarding or various other materials can be used above the dado. The dado should, however, be somewhat stronger; $\frac{3}{4}$ -inch match boarding is suitable. Thin sheet iron (painted) has also been used; or linoleum on flat-jointed boarding provides a suitable dado and is easily cleaned. The interior of the building should present a clean and cheerful appearance and distempers of a fairly light tint are preferable. Straw color, primrose, duck's-egg green, or French gray are suggested as suitable. An alternative color scheme would be a dark green dado about 5 feet high with 2-inch black line and the remainder of the walls, including the roof, finished white, the roof principals being stained a dark brown.

WARMING AND LIGHTING.

9. Central heating by radiators or hot-water pipes would, no doubt, provide the most satisfactory means of heating the building. The cost, however, of such a heating installation adds so considerably to the initial cost of the whole scheme that it becomes extremely doubtful if the expenditure is warranted, especially in view of the fact that for four or five months of the year no artificial heating is required. Where central heating is not provided, use may be made of an independent stove, standing on the concrete floor, the stovepipe being carried up through the roof. Such stoves may be obtained from any iron founder or ironmonger at varying prices.

10. The steps to be taken for the prevention and extinction of fires should be fully considered. The method of carrying the stovepipe through the roof should be carefully planned, as, owing to the combustible nature of the timber in roofs, defective construction at this point may prove a source of danger to the building from fire. The construction may simply consist of asbestos packing, a sheet-iron sleeve piece, with $1\frac{1}{2}$ -inch space between the sleeve piece and the stovepipe, and a hood to keep the rain out.

11. Where electricity is available it is no doubt the most satisfactory means of artificial illumination, otherwise gas should be used.

COOKING APPARATUS AND KITCHEN EQUIPMENT.

12. The cooking arrangements in an industrial canteen naturally form an important part in the equipment of the building. There are various means of cooking food, but for canteen purposes attention may be confined to: (a) Electricity, (b) gas, (c) coal, (d) steam.

(a) Electricity as a cooking factor has not hitherto been very largely used, but in any case where the power can easily be provided it is worthy of consideration.

(b) Where gas in sufficient quantity is available, gas cooking is usually preferred on account of cleanliness, efficiency, and saving of labor.

(c) Coal is suitable in districts where it is obtainable at cheap prices, or where gas is unobtainable.

(d) As the adoption of steam cooking necessitates the installation of an expensive plant, this method need not be considered unless a special supply of steam is available.

13. The relative position of cooking apparatus naturally varies with the type of apparatus used, but, generally speaking, it has been found better to have the stoves and roasters in the center of the kitchen, with the steamers or boilers behind and the carving table and hot closets adjacent to the serving counter. The serving of tea, etc., should be kept quite separate from the general service table.

14. It is most essential that there should always be a plentiful supply of hot water through the sink taps for washing-up purposes. There are several alternative methods of producing this, among which are the following:

- (1) Circulator boiler connected to a storage system.
- (2) Large hot-water geyser.
- (3) Separate boiler over each sink.

15. The maintenance of cleanliness is one of the most important points in the whole scheme of a canteen, and it is one that the workers are quick to appreciate. In the mess room all floors, tables, seats, and windows should be thoroughly cleansed every day, and in the kitchen all cooking apparatus should be well scoured and kept scrupulously clean. The table equipment should always be well washed and polished. The immediate surroundings of the canteen should be kept free from accumulated rubbish and refuse, as by this means trouble from flies is greatly reduced.

CATERING EQUIPMENT.

16. The following is a list of articles required. The number to be ordered will depend on the size of the canteen and the accommodation for which it is to provide. It is never advisable to purchase inferior table and cooking equipment. As prices vary considerably no estimates are given. Speaking generally, however, it may be said that inclusive equipment will be approximately 32s. (\$7.79) per head for 100 persons, 21s. 6d. (\$5.23) for 500, and 20s. 9d. (\$5.05) for 1,000:

I.—CATERING OFFICE EQUIPMENT.

Account books, etc.
Chairs.
Desk.
Safe for money.

II.—MESS ROOM.

American cloth or linoleum for tables and counter.¹
Chairs or benches.²
Cash till.
Curtains for window (dark).
Scraper mat at door.
Tables (2 feet 3 inches or 2 feet 6 inches wide).³
Waste-paper baskets.⁴

III.—TABLE EQUIPMENT CUTLERY.

Carving knives and forks.
Dessert spoons (7 inches in length).
Forks (7½ inches in length).⁵
Knives (9½ inches in length).⁶
Mustard spoons.
Steels.
Salt spoons.
Tablespoons (8½ inches in length).
Teaspoons (5½ inches in length).

IV.—GLASS AND CROCKERY.

Cups (liquid capacity 10 ounces) and saucers.
Egg cups.
Jugs for water (liquid capacity 2 pints).
Mustards.
Milk jugs (liquid capacity 1½ pints).
Meat dishes (assorted sizes).
Peppers.
Plates for meats and puddings (10½ inches—one size only).⁷
Salts.⁸
Small plates (7½ inches).
Sugar basins.
Soup bowls (preferable to plates).
Teapots.⁹
Tumblers (liquid capacity 13 ounces).
Vinegars.

V.—COOKING AND SERVING APPARATUS.¹⁰

Boilers or steamers for vegetables and puddings.
Boilers for heating water for making tea, etc.
Carving table.

¹ In some of the best managed canteens the use of tablecloths has been found quite satisfactory.

² Chairs are generally found to be more comfortable and satisfactory than forms, particularly where the workers wait upon themselves.

³ If space permits, frequent passages between the tables should be allowed for.

⁴ Waste paper baskets, preferably wire ones, should be provided about the mess room; the effect these have on the general tidiness of the room is considerable. Trucks can be used for the collection of dirty crockery, etc.

⁵ Large knives and forks only are necessary; the most suitable knives are those with solid metal handles.

⁶ The provision of flat-topped covers for the plates of food is suggested, as these keep the food hot, and render them more easily stored in the hot closets.

⁷ Pourer salts can be used, but it is generally found that an ordinary salt and spoon is best.

⁸ It is not generally advisable to supply a teapot for each individual, and only cups of tea should be served. The tea can be made in one gallon teapots, but can be most economically served from an urn.

⁹ In some districts the local gas companies will hire out stoves, etc., for cooking.

Hot-water apparatus for washing up,
etc.
Oven range.
Roasting oven.
Hot closet for storing cut-up plates of
meat, etc.
Stock pot.
Grilling table.

VI.—LINEN.

Dusters.
Glass cloths.
Kitchen rubbers.
Muslin strainers.
Roller towels and roller.
Swabs.
Small hand towels.

VII.—KITCHEN, SCULLERY, AND LARDER
REQUISITES, ETC.

Baking tins.
Bass broom.
Box of mixed tools and accessories.
Bread knife.
Bread-cutting machine.
Cooks' knives.
Colanders.
Chopping board.
Covered sanitary bins.
Corkscrews.
Dustpan and brushes.
Enameled washing-up bowls.
Enameled cans.
Enameled pie dishes.
Frying pans.
Flour dredger.

Flour bin.
Fish kettle.
Gravy strainer and ladle.
Graters.
Japanned trays.
Knife machine.
Knife boxes.
Kitchen chairs.
Kettles.
Large black oval pots with tin covers.
Large iron spoons.
Lemon squeezers.
Meat safe.
Meat chopper.
Mincing machine.
Potato peeling machine.
Plate rack.
Pudding basins.
Pastry board and rolling pin.
Rigid table.
Scales and weights.¹
Scoop.
Sweeping brushes.
Scrubbing brushes.
Saucepans.
Stepladder.
Sinks (a good size is 3 by 2 by 1 foot).²
Sink brushes.
Sink baskets.
Tin opener.
Towel rack.
Tea canister.
Urns (holding capacity 4-6 gallons).³
Wire dish covers.
Wire sieves.
Wooden spoons.

17. In the preparation of the above memorandum the committee have had the advantage of the expert advice of a number of authorities, including Mr. D. N. Dyke, of His Majesty's Office of Works, Mr. A. F. Agar, the adviser of the catering department of the Young Men's Christian Association, and other persons of practical experience.

¹ When large quantities of food have to be purchased, a platform scales is suggested as well as a small cook's scales. It is most important that everything should be weighed and checked.

² There should always be at least two sinks provided, one for the cook's own use, and the other, or others, for the general washing up.

³ Urns with earthenware linings are recommended, as the ordinary unlined urns show a tendency after a time to impart an unpleasant taste to the tea.

18. Communications respecting canteens and their equipment should be addressed to the Secretary, Canteens Committee, Central Control Board, Canada House, Kingsway, London, W. C.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D.,

Chairman.

E. H. PELHAM, *Secretary.*

JANUARY, 1916.

INVESTIGATIONS OF WORKERS' FOOD AND SUGGESTIONS AS TO DIETARY.

[Memorandum No. 11. A second appendix to Memorandum No. 3 (Industrial Canteens).]

1. Although shortage of food supplies may not possess for ourselves or our allies the same urgent importance as it does at the present moment for the Teutonic nations, still, the high prices of food have rendered of primary importance the provision of a nourishing and economical diet for the civilian population of the country. Some examination, therefore, of the value and character of the food consumed by munition workers seems desirable in the interests of efficiency. Food is necessary to life; for the living body is always losing energy in the form of heat and mechanical work, and this loss is made good by food. The food taken, however, should be regulated by the loss of energy it is required to replace, and not, as it often is, by overindulgence of the appetite. The loss of energy due to cooling of the surface of the body is greater than that due to mechanical work; the latter is variable and may be small. The amount of food required bears a closer relation to the extent of the surface of the body than to its weight; owing to the greater cooling surface of their bodies, tall lean men require more food than short fat men of equal weight, and the latter, in spite of eating less, may continue to grow fat. Growing boys and girls require comparatively more food than adults for two reasons: (a) Their bodies present a greater cooling surface compared with their weight, and (b) they have not only to make good the daily loss of energy, but also to have energy necessary for growth.

2. The amount of physical force expended in daily work and the environment of the work have a great effect on the requirements of the body for food. Hard labor and exposure to open air together call for increased food supply; sedentary work in an artificially heated and confined atmosphere, on the other hand, reduces the output of energy and less food is required. An ordinary laborer may lose one-sixth or more of his total energy output as work, and the remainder as body heat. A sedentary worker may lose little energy as work, and almost all as body heat. The loss due to this latter

cause, as activity increases, grows out of proportion to the actual energy expended as work.

3. Natural foods yield the essentials required to replace the energy expended and for the repair and growth of the body. They contain these essentials in the form of protein, fat, and carbohydrates, and also supply salts and certain substances of unknown nature, called vitamins, which exist in minute quantities in fresh foods and are necessary for the growth and health of the body. Protein is the chief solid constituent of lean meat; it is also present in milk, cheese, and eggs; and occurs in all vegetables, particularly in flour (bread), peas, and beans; it is not only a source of energy, but it is also a body builder, and no dietary can be complete without it. Fat is chiefly derived from animals; nuts also are rich in fat (from which margarine is made), but other vegetables only contain fat in a much smaller degree. Carbohydrates are mainly derived from vegetables in the form of flour, potatoes, or sugar.

Fat and carbohydrate can replace one another in a diet, but the body digests and deals best with a certain proportion of each. Fat, however, yields weight for weight more than twice as much energy as carbohydrate, and so in cold climates and cold weather more fat is naturally eaten. Experience shows that the diet should include raw food, fruit, or salads. The consumption of fresh fruit, such as apples, oranges, or bananas, is highly to be commended, and should be actively encouraged by the provision of good fruit at the lowest possible prices.

Fortunately, the cheaper foods (bread, margarine, porridge, milk, herrings, cheese, beans, onions, cabbages, oranges, and the cheapest cuts of meat) provide all the requisite nourishment, and probably better health, than is derived from more highly flavored and expensive foods which only artificially stimulate the appetite. The drinking of strong tea many times in the day is physiologically unsound, as also is the consumption of sweetmeats between meals, especially by boys and girls.

4. Fatigue prevents the proper digestion of food, and one of the earliest symptoms of overwork is some form of digestive derangement; further, since nervous energy is required to control the work of the digestive organs, nervous fatigue, as well as physical fatigue, is followed by digestive disturbances. A tired man accordingly benefits by a brief rest before a meal. Food should be taken regularly and not hurriedly, and the energy so taken should be distributed fairly evenly over the day; thus strength is maintained and the digestion at no time overloaded. Food should not be taken between meals or at

frequent intervals, because a good digestion depends upon a keen appetite.

5. *Calculation of energy value of foodstuffs.*—The energy value of a foodstuff can be determined by burning a weighed quantity of it in a suitable apparatus called a calorimeter, and ascertaining how much heat it gives off. The large calorie, which is used as the unit of energy value, is the amount of heat required to raise 1 kilogram (1½ pints) of water through 1° Centigrade (1.8° Fahrenheit). Calculation has shown that, when dried, foodstuffs contain the following energy value:

One gram¹ of—

Protein.....	Contains 4.1 calories.
Carbohydrate.....	Contains 4.1 calories.
Fat.....	Contains 9.3 calories.

6. The energy expended in mechanical work can also be expressed in calories, for 1 calorie has been found to be equivalent to the energy expended in lifting 1 kilogram through 425.5 meters, which is about the energy expended by a man 70 kilograms (11 stone) in weight in walking up a staircase 6 meters (about 20 feet) in height. Such a man would require 1 extra calorie in the energy value of his food to make good this expenditure of energy. Even in walking on the level the body is raised at each step, and the calculation has been made that to walk 2.7 miles in an hour on a level road calls for the expenditure of 160 calories in a man of 11 stone.

7. Investigations made by a number of authorities indicate that about 15 per cent of the energy expended is derived from protein, and about 80 per cent from fats and carbohydrates combined; that is to say, that normally protein supplies only one-fifth of the total energy expended. Numerous investigations have shown that the energy required by a man engaged in fairly light munition work is about 3,500 calories of food as purchased. Where calculations are based (as they are in this report) on food as eaten the minimum canteen diet may be taken to be about 3,000 calories when balanced among the three classes of foodstuffs in the following proportions of dried weights:

Protein.....	100 grams.
Fat.....	100 grams.
Carbohydrate.....	400 grams.

¹ To express in terms of calories per pound it should be remembered that 1 pound is equal to 453.6 grams; 1 ounce is equal to 28.35 grams.

Example.—Suppose 1 pound of roast beef contained—

Protein.....	26.75 per cent.
Fat.....	12.90 per cent.

In this case there would be $(26.75 \times 4.1) + (12.90 \times 9.3) = 229$ calories per 100 grams. In the pound of meat there would, therefore, be $229 \times 4.536 = 1,040$ calories.

This diet will often be supplemented with fruit or other small addition, according to individual taste. Men engaged in hard physical work, especially in the open air, require a good deal more energy-producing food, and may consume as much as 4,500 calories with advantage. On the other hand, the energy required from food by a man clothed, lying at complete rest, at ordinary room temperature in a still atmosphere, is about 1,600 calories of eaten food, while for a man engaged in a sedentary occupation as little as 2,200 calories may suffice.

An average adult woman worker requires rather less (about 0.8 or 0.9) than a man.

RESULTS OF RECENT INQUIRY.

8. *Canteen meals.*—In order to determine the kinds of dietaries provided for munition workers specimen meals were obtained, by personal visit or otherwise, from a number of canteens attached to munition works, and, to serve as a contrast, from other sources as well. The amount of protein, fat, and carbohydrate in each meal were estimated, the calorie value was calculated, and the costs of the meals and number of calories per penny determined. See Table I.¹

¹The method of making the estimations was the same in each case. The ingredients were all thoroughly mixed after weighing each separately so that dietaries could afterwards be constructed from the weights. An aliquot part of the intimate mixture was thoroughly dried and weighed. In the dry material protein was determined from a nitrogen estimation, the fat by other extractions in a Soxhlets apparatus, the ash by burning and weighing, and the carbohydrate by difference. In this way the amounts of dry protein, fat, and carbohydrate, respectively, in the meal were obtained, and from these the calorie value was calculated.

TABLE I.

Factory or restaurant.	Style of catering.	Ingredients.	Dry weight, in grams.					Total calories.	Calories per id.	Total cost.
			Protein.	Fat.	Carbohy- drate.	Ash.	Total.			
No. 4.....	Professional.	Potatoes, cabbage, steak, pudding, jam roll.	35.0	42.0	127.0	5.0	209.0	1,053.0	175	s. d. Cts. 0 6 (12.2)
No. 5.....	Amateur....	Roast mutton, boiled potatoes, cabbage, and rice pudding.	48.0	51.0	87.0	7.0	193.0	1,025.0	146	0 7 (14.2)
No. 6.....	.....do.....	Potatoes, cabbage, steak pudding, rice pudding.	36.0	30.0	93.0	4.0	163.0	806.0	101	0 8 (16.2)
A students' club.	Professional.	Roast beef, boiled potatoes, cabbage, sirup roll.	34.0	28.0	101.0	3.0	166.0	814.0	58	1 2 (28.3)
Popular restaurant.	.....do.....	Steak pudding, potatoes and cabbage, sirup pudding.	44.0	42.0	193.0	3.0	282.0	1,344.0	79	1 5 (34.5)
No. 7.....	Amateur....	Steak pudding, peas and potatoes, jam roll, rice pudding.	51.0	42.0	204.0	8.0	305.0	1,433.0	288	0 5 (10.1)
Working class restaurant.	Professional.	Meat pudding, potatoes, cabbage, suet pudding.	29.0	39.0	128.0	4.0	200.0	1,004.0	125	0 8 (16.2)
No. 3 (A).....	Works.....	Roast beef, potatoes and peas, sago pudding.	31.0	31.0	131.0	5.0	198.0	948.0	135	0 7 (14.2)
No. 3 (B).....	.....do.....	Liver and bacon, potatoes and peas, currant pudding.	55.0	30.0	160.0	6.0	251.0	1,155.0	165	0 7 (14.2)
No. 1.....	Professional.	Meat pudding, cabbage, potatoes, and jam roll.	32.0	52.1	178.4	7.5	270.0	1,346.0	192	0 7 (14.2)
No. 2 (A).....	Works.....	Roast mutton, potatoes, peas, currant pudding, bread.	55.5	22.8	180.1	7.1	258.4	1,177.9	131	0 9 (18.3)
No. 2 (B).....	.....do.....	Liver and bacon, potatoes and peas, currant pudding, bread.	58.7	30.1	180.2	7.3	268.9	1,259.0	140	0 9 (18.3)

The results obtained show that the average canteen dinner is a good one, containing, as it should, an energy value of about 1,000 calories, well distributed among the amounts of protein, fat, and carbohydrate. Apart from calorie value, inspection of the dinners showed that meat, vegetables, and puddings were made of good materials and were well cooked. The cost compares favorably with café or restaurant charges, and so the worker gains in pocket and obtains a dinner of good food, well prepared. For the relief of monotony, an important factor in connection with industrial canteens, a change of surroundings during the meal and a short walk before partaking of it are desirable. On this account, and also on account of the importance of ventilating the workshop so that the air may be fresh when the workers return, the custom of eating meals within the workshop should be discontinued, and all food should be taken, whether in a canteen, restaurant, in the open air, or at least away from the ordinary place of work.

9. *Food brought by workers.*—The next subject investigated was the nature and energy value of meals brought by workers from their own homes. Many workers who bring their own food often supplement it by purchasing sweets, cake, or fruit and by taking tea or drinking mineral waters. Even where there is no canteen established, facilities are often provided for heating carried food and for supplying hot water to make tea; and there may be places where sweets, cakes, chocolates, mineral waters, and sometimes fresh fruit can be purchased. The workers from whom meals for analysis were obtained were not asked beforehand to bring a sample meal, but were interrogated at the entrance gate and asked if they would exchange the contents of their dinner basket for a sum ample to buy a meal at the canteen.

The following results were obtained:

(1) Meal brought from home by man on night shift—

Rabbit and vegetables in basin.

Protein.....	28.9 grams	} 683.4 calories.
Fat	7.6 grams	
Carbohydrate.....	120.8 grams	

This meal contained no pudding or other sweet, so probably the owner meant to supplement it by minor purchases at the canteen.

(2) Meal brought from home by man on night shift—

Sausage roll; bread and butter and ham; and cheese.

Protein.....	36.2 grams	} 1,448 calories.
Fat	58.2 grams	
Carbohydrate.....	160.5 grams	

(3) Meal brought from home by boy, aged about 15, on night shift—

Dish of potatoes, tomatoes, and bacon; jam puff; a cake; bread and butter and jam.

Protein.....	31.7 grams	} 1,719 calories.
Fat	61.4 grams	
Carbohydrate.....	248.3 grams	

These meals may be compared with the meal supplied by canteen of the factory (No. 1 in Table I). The boy's meal with its 1,719 calories as contrasted with the 1,346 of the canteen, or with the 1,448 of the man, illustrates the effect of growth and work in producing appetite, but, even after allowance is made for growth, it is probably excessive.

10. *Food of women workers.*—The dietaries of women workers were next examined; and in Table II the energy value of food obtained from women's restaurants, from a works canteen, and from workers is contrasted. The meal from restaurant No. 1 is a sensible meal supplied at small cost, but that from restaurant No. 2 is an example of the unsatisfying meals which pale-faced young women may often be seen consuming in popular cafés. In considering the canteen meals a portion of sweet should be added to each meat dish; the meal then totals up to between 500 and 700 calories of energy value for the sum of 7 to 8 pence. Unless somewhat larger meals are eaten at home, this is too near the minimum required for girls working long hours and traveling considerable distances to and from work. Each of the three normal meals of an average workingman should contain 1,000 calories, as eaten, and of a working woman 0.8 to 0.9 of this amount; that is, from 800 to 900 calories.

11. Girls who bring their own dinner often buy in addition a portion of pudding or cake from the canteen, and the analyses show that this portion adds from 150 to 300 calories to the meal. The food brought from home varies greatly in nutritive value from 295 to 1,143 calories; while the latter is sufficient without anything from the canteen, the former could scarcely be made enough even if a double helping of pudding were added. Whether deficiencies in the meal taken during the working period are made up by more liberal meals at home, or whether these meals also are deficient could not be ascertained; but even if the home meals are more liberal the distribution of the day's eating is on wrong lines; for in a long day's work, say of 12 hours, there should be a good meal in the longest break, if the efficiency of the worker is to be maintained for months and years. Experience, however, indicates that for a large class of workers home meals are hurried, and, especially for women workers, too often consist of white bread and boiled tea. A worker starting the day with a bread-and-tea breakfast and walking or traveling for an hour or more to work can not remain for long an efficient worker, and probably much broken time and illness arise from this cause.

TABLE II.

Source of meal.	Ingredients.	Weight in grams.			Calo-ries.	Total cost.
		Gross.	Dry.			
			Pro-tein.	Fat.			Carbo-hydrate.
Women's restaurant....	Roast mutton.....	50	29.0	13.0	109.0	687
	Boiled potatoes.....	123				
	Cabbage.....	73				
	Sirup roll.....	157				
Women's tea shop.....	Roll.....	50	8.4	8.0	70.0	397
	Butter.....	8				
	Milk.....	15				
	Sugar.....	10				
	Stewed prunes.....	67				
Girls' canteen:	Sirup.....	20				
	Meat dishes.....	92	39.0	4.0	56.0	426
Stewed steak.....	200					
Extra and sweet dishes.	Potatoes.....	70	26.5	3.1	34.9	281
	Peas.....	69				
	Roast beef.....	127				
	Potatoes.....	47				
	Cabbage.....	66				
	Roast mutton.....	117				
	Potatoes.....	98				
	Cabbage.....	276				
	Stewed fruit and custard.....	133				
	Rice pudding.....	72				
	Seed cake and bun loaf.....	61				
	Roll.....	9				
Meals brought from home.	Butter.....	87	29.5	34.9	93.7	871
	Meat.....	100				
	Potato.....	36				
	Pastry.....	112				
	Rabbit.....	215				
	Pastry.....	70				
	Roast pork.....	72				
	Yorkshire pudding.....	128				
	Potatoes.....	94				
	Cabbage.....	78				
	Roast beef.....	64				
	Potatoes.....	71				
	Cabbage.....	50				
Haricot beans.....	50					

12. *Hostel dietaries.*—The erection of hostels, required on account of the inadequacy of preexisting accommodation for housing the suddenly increased personnel of certain large munition factories, has afforded an opportunity of investigating the whole daily dietary of operatives. The investigation was made at a well-managed hostel where each worker may eat as much as he or she desires. In the dining hall there are separate tables for men and women; and by weighing the food supplied to a definite number at given tables, and by weighing the uneaten residue, the cost of each ingredient being known, the management obtained the cost price of food per week, and found it amounted, in March, 1916, to 15s. 2d. (\$3.69) per man, and 11s. 9½d. (\$2.87) per woman. This gives a consumption for a woman of 0.8 that for a man, a ratio in agreement with that stated

above. The amounts of protein, fat, and carbohydrate present in the food consumed were estimated by two schemes:

(a) The management weighed the amount of each type of food supplied throughout the day to (a) six men and (b) six women, and deducted the amounts unconsumed. The amounts of protein, fat, and carbohydrate present were determined at the laboratory from known data.

(b) The hostel was visited personally and the amounts of all the most important constituents of the menu actually eaten by a large number of persons were weighed; the average daily ration consumed per person was calculated from these data, and then samples of the foodstuffs were analyzed as above.

The results obtained by these two schemes, which closely agree, are set out in the following Tables III and IV:

TABLE III.—HOSTEL DAILY DIETARY PER MAN.

[Calculated from data supplied by management.]

Meal.	Ingredients.		Weight in grams.			
			Gross.	When dried.		
				Protein.	Fat.	Carbo- hydrate.
Breakfast.....	3½ ounces.....	Bacon.....	110	25.3	47.0	.....
	½ ounce.....	Butter.....	14	3.0	11.3	.....
	6 ounces.....	Bread.....	170	12.0	2.0	89.4
	1 ounce.....	Sugar.....	28	.....	.....	28.0
	½ pint.....	Milk.....	180	2.5	3.0	4.0
	½ ounce.....	Jam.....	28	.....	.....	14.0
Dinner.....	7 ounces.....	Fish.....	200	36.2	1.0	.....
	8 ounces.....	Potatoes.....	228	4.0	.....	55.0
	3 ounces.....	Bread.....	85	6.0	1.0	44.7
	8 ounces.....	Pudding.....	228	7.3	9.3	70.0
Tea.....	1 ounce.....	Sugar.....	28	.....	.....	28.0
	1 ounce.....	Butter.....	28	.6	22.6	.....
	4 ounces.....	Bread.....	114	8.0	1.4	60.0
	½ pint.....	Milk.....	180	2.5	3.0	4.0
Supper.....	4 ounces.....	Meat.....	114	37.8	3.5	.....
	1 ounce.....	Butter.....	28	.6	22.6	.....
	1½ ounces.....	Pickles.....	43	.....	.....	5.0
	6 ounces.....	Bread.....	170	12.0	2.0	89.4
All meals.....				152.9	129.7	491.3
Caloric value: Total.....			3,847	626.9	1,206.2	2,014.3

¹ Cubic centimeters.

The food consumed by women similarly worked out gives a total of 3,070 calories.

TABLE IV.—HOSTEL AVERAGE DIETARY PER MAN.

[Data obtained by personal visit.]

Meal.	Ingredients.	Dry weight in grams.			Calories.
		Protein.	Fat.	Carbohydrate.	
Breakfast.....	Sausage.....	6.3	8.2	12.2	1,020.9
	Bacon.....	15.1	30.5	96.7	
Dinner.....	Bread.....	12.1	8.4	96.7	973.8
	Meat.....	42.7	4.0	50.6	
	Potatoes.....	3.7		9.5	
	Cabbage.....	2.5		66.3	
Tea.....	Apple pie.....	5.3	21.2	111.6	603.4
	Bread, butter, and jam.....	13.8	9.6	96.0	1,097.4
Supper.....	Bread, butter, ham, and cheese.....	44.6	55.8	442.9	
		146.1	137.7		
All four meals.....	All kinds	Calories.			Total.
		Protein.	Fat.	Carbohydrate.	
		599.0	1,280.6	1,815.9		3,695.5
Sugar and milk used in tea not included in above.....					218.0

13. The calorie values obtained by these two analyses, 3,847 (Table III) and 3,913 (Table IV) approximate closely; they should satisfy the requirements of factory workers, unless very heavy work is being done, and could perhaps be reduced somewhat if facilities for getting extra food are afforded to anyone who wants more. Excess food either passes into useless adipose tissue (fat) or is imperfectly utilized and impairs the digestion and efficiency.

SIMPLE DAILY MEALS DESIGNED TO SECURE A WELL-BALANCED MINIMUM DIETARY.

14. In order to afford assistance to caterers for munition workers, a series of simple but adequate meals is given below. The daily dietaries are arranged to show different types, such as a light breakfast and a heavy dinner, or moderate meals all round. The prices quoted are approximate only, and are based on prices ruling in April, 1916. The dinners are selected from specimens analyzed in the laboratory, and the other meals are computed from data obtained from well-managed canteens. The weights given of bacon, meat, etc., are of cooked food. If food as purchased is taken as a basis, the weights stated will need to be somewhat increased; 28 grams are equal approximately to one ounce. Certain articles of diet, not included in these meals, have their values; thus, an apple or orange gives 60 to 70 calories, and two ounces of sweet or chocolates give 200 calories.

INVESTIGATION OF WORKERS' FOOD.

TABLE V.—SUGGESTED DAILY DIETARY FOR MUNITION WORKERS.

No. 1.

Meal.	Ingredients.	Cost.	Weight in grams.			Calo-ries.	
			Gross.	Dry.			
				Pro-tein.	Fat.		Car-bohy-urate.
Breakfast.....	2 boiled eggs.....	4.0 (8.1)	100	26.2	19.6	107.8	731.7
	3 slices bread, butter and jam	2.0 (4.1)	175				
Dinner.....	Sugar.....	.1 (.2)	10	32.0	52.1	178.4	1,346.0
	Milk.....	.5 (1.0)	30				
	Meat pudding.....	5.0 (10.1)	120				
	Pudding (jam roll).....	2.0 (4.1)	160				
	Potatoes.....	.75 (1.5)	200				
Tea.....	Cabbage.....	1.0 (2.0)	120	11.9	8.6	93.9	527.0
	2 slices bread, butter and jam	2.5 (5.1)	116				
	Piece of cake.....	.5 (1.0)	35				
	Sugar.....	.1 (.2)	10				
Supper.....	Milk.....	.5 (1.0)	30	41.5	23.1	64.2	648.0
	Cold meat.....	3.5 (7.1)	70				
	Cheese.....	1.0 (2.0)	35				
	2 slices bread and butter.....	2.0 (4.1)	116				
All meals.....		25.5 (51.8)		111.6	103.4	444.3	3,252.0

No. 2.

Breakfast.....	Bacon, 3 rashers.....	4.0 (8.1)	75	30.0	44.9	109.7	989.5
	Bread, 3 slices, butter and jam.	2.0 (4.1)	172				
Dinner.....	Tomato.....	.5 (1.0)	50	44.3	32.3	122.2	983.0
	Sugar.....	.1 (.2)	10				
	Milk.....	.5 (1.0)	30				
	Roast beef.....	4.0 (8.1)	78				
	Yorkshire pudding.....	1.5 (3.0)	110				
Tea.....	Potatoes.....	.75 (1.5)	200	11.9	8.6	93.9	527.0
	Cabbage.....	1.0 (2.0)	140				
	A pple pie and custard.....	1.5 (3.0)	171				
	2 slices bread, butter and jam	2.5 (5.1)	116				
Supper.....	Cake.....	.5 (1.0)	35	34.9	21.7	67.2	621.1
	Sugar.....	.1 (.2)	10				
	Milk.....	.5 (1.0)	30				
	2 slices bread.....	2.0 (4.1)	116				
	Cheese.....	1.0 (2.0)	35				
All meals.....	Meat.....	2.0 (4.1)	50	121.1	107.5	393.0	3,120.0
	Pickles.....	.5 (1.0)	25				

No. 3.

Breakfast.....	Fried fish.....	4.0 (8.1)	110	31.2	16.6	114.8	752.9
	3 slices bread, butter and jam	2.0 (4.1)	172				
Dinner.....	Sugar.....	.1 (.2)	10	53.6	25.3	158.4	1,101.7
	Milk.....	.5 (1.0)	30				
	Liver.....	3.0 (6.1)	80				
	Bacon.....	1.0 (2.0)	20				
	Potatoes.....	.75 (1.5)	200				
Tea.....	Peas (preserved).....	1.0 (2.0)	134	11.9	8.6	93.9	527.0
	Sago pudding.....	2.0 (4.1)	250				
	2 slices bread, butter and jam	2.5 (5.1)	116				
	Piece of cake.....	.5 (1.0)	35				
Supper.....	Sugar.....	.1 (.2)	10	30.0	8.0	120.0	895.6
	Milk.....	.5 (1.0)	30				
	Irish stew.....	4.0 (8.1)	600				
All meals.....	2 slices of bread.....	1.5 (3.0)	116	126.7	58.5	497.1	3,077.2
		24.0 (48.7)					

TABLE V.—SUGGESTED DAILY DIETARY FOR MUNITION WORKERS—Concluded.

No. 4.

Meal.	Ingredients.	Cost.	Weight in grams.			Calo-ries.	
			Gross.	Dry.			
				Pro-tein.	Fat.		Car-bohy-urate.
Breakfast.....	2 eggs.....	d. Cts. 3.0 (6.1)	110	33.8	50.3	65.3	876.1
	2 rashers bacon.....	3.0 (6.1)	50				
	2 slices bread, butter and jam.....	1.25 (2.5)	112				
Dinner.....	Sugar.....	.1 (.2)	10	40.0	30.0	101.0	857.0
	Milk.....	.5 (1.0)	30				
	Roast beef.....	5.0 (10.1)	110				
	Potatoes.....	.75 (1.5)	182				
	Cabbage.....	.75 (1.5)	77				
Tea.....	Sirup roll.....	1.5 (3.0)	120	16.8	9.6	132.4	700.1
	3 slices bread, butter and jam.....	2.5 (5.0)	175				
Supper.....	Lettuce or radishes.....	.5 (1.0)	210	28.0	36.2	64.2	718.3
	Sugar.....	.2 (.4)	20				
	Milk.....	.5 (1.0)	30				
	2 slices bread and butter.....	2.0 (4.1)	112				
All meals.....	Ham.....	3.5 (7.1)	60	119.5	126.1	362.8	3,151.0
	Cheese.....	1.0 (2.0)	35				
		26.25 (53.2)					

No. 5.

Breakfast.....	1 sausage.....	1.75 (3.5)	60	21.8	27.4	89.0	708.3
	1 rasher bacon.....	1.5 (3.0)	25				
	2 slices bread.....	1.25 (2.5)	116				
Dinner.....	Sugar.....	.1 (.2)	10	33.4	25.0	132.8	1,002.6
	Milk.....	.5 (1.0)	30				
	Roast beef.....	4.0 (8.1)	80				
	Potatoes.....	.75 (1.5)	200				
	Peas.....	1.0 (2.0)	150				
Tea.....	Currant pudding.....	2.0 (4.1)	136	11.9	8.6	93.9	537.0
	2 slices bread, butter and jam.....	2.5 (5.1)	116				
Supper.....	Sugar.....	.1 (.2)	10	28.9	36.2	64.2	718.3
	Milk.....	.5 (1.0)	30				
	1 piece cake.....	.5 (1.0)	35				
	2 slices bread and butter.....	2.0 (4.1)	116				
All meals.....	Ham.....	3.5 (7.1)	60	96.0	97.2	379.9	2,956.2
	Cheese.....	1.0 (2.0)	35				
		24.0 (48.7)					

15. In conclusion, I desire to acknowledge the assistance received by me from Dr. Benjamin Moore, F. R. S., and from Mr. A. Webster (who has carried out many of the analyses).

LEONARD E. HILL.

JULY, 1916.

WASHING FACILITIES AND BATHS.

[Memorandum No. 14.]

1. In a previous memorandum on "Special industrial diseases (No. 8)" the committee have advocated the provision in factories of suitable washing accommodation and lavatories, more especially for

workers engaged on processes in which poisonous materials are manipulated. Though such provision is most needed where poisonous substances are manipulated or where heat, dust, or dirt are present to an unusual degree there is a general agreement that washing is beneficial to the health and efficiency of all workers and that facilities should be provided wherever possible. In France and Belgium provision of this nature has been frequently instituted. Account must also be taken of the beneficial effect upon the self-respect of the worker who is able to leave his employment clean and tidy. There is the further question of the association with his fellow travelers of a man who returns home straight from work from some dusty or dirty employment. A representative trades-unionist stated in evidence before the committee that—

Material improvements in the arrangements for washing are desirable. It would be a great help if a worker could have the opportunity for really washing up and putting himself in a condition to go out with his family without having to return home first. Anything in the nature of evening recreation is rendered almost impossible if a worker has to travel all the way home, perhaps right through the city, and get cleaned up before returning to the city with his family.

Lastly, there is the relation of cleanliness to good health and personal efficiency, a relation which is sufficiently obvious to make any emphasis unnecessary.

2. Experience has shown that when opportunities for washing are provided they are freely used; there may be a short period of inertia at first, but workers have not only no innate desire to be otherwise than clean, but soon bring influence to bear upon any of their fellows who do not avail themselves of the facilities offered. Evidence laid before the committee and reports received from investigators have clearly established the desire of many operatives, especially those engaged in heavy engineering processes, for improved lavatory and washing accommodation.

Thus a medical investigator appointed by the committee who has carried out a prolonged inquiry at eight large engineering factories, reports that in seven facilities for washing were lacking, but that in the one where provision was made full advantage of it was taken by the workers. As regard the others he reports: "Many complaints were made by the workmen and many expressions of hope were heard that a remedy for the present condition will be found," and almost without exception it was stated by these men how much advantage was to be gained from the freshness resulting after a "good swill." The same investigator adds that on the Continent at a factory belonging to one firm visited every provision for washing is made for operatives engaged at hot and dusty processes. "Individuals who have returned told me that hot and cold shower baths are provided and very freely made use of, and that the workmen leave the premises spick and span, frequently clad in flannels in summer, so giving the impression they are going to a tennis party. They are much envied by the worker at home, and the suggestion was made that the same facilities should be provided

at home as for the continental worker. Questions of washing accommodation in the home may come under discussion, but nevertheless the craftsman expresses himself forcibly and sometimes bitterly upon the indignity of having to leave his work in such a grimy condition. The pleasure of changing into clean and dry clothing after a heavy day's work is considerable."

An employer at another munitions center informed the committee that—

Spray baths are provided for the foundrymen, who number about 100. Tickets can be bought at the rate of 10 for 3d. (6 cents) ; this charge includes the use of towel and soap. Seven minutes out of working hours are allowed each man in the foundry to wash thoroughly before stopping time. Though the foundrymen are not in any way specially selected they use the spray baths greatly, especially in summer.

A representative of the National Federation of Blast Furnacemen has informed the committee that not more than 5 per cent of the members of his union have a house with five or six rooms and a bath. "In Lancashire and South Yorkshire many are living in houses of three small rooms with no scullery. Considering the dirty state into which the men's bodies and clothing get when working, baths should be general."

WASHING FACILITIES.

3. *Lavatories.*—Where washing accommodation has been provided, inspection has shown that sufficient attention is seldom paid to details of construction. Frequently the details seem to have been left to a building contractor with no special knowledge of the hard usage to which fittings are subjected under the conditions of industrial life; as a result lavatories, though adequate when new, may quickly fall into disrepair. Separate basins, originally provided with plugs attached by chains, are found with the chains broken, the plugs lost, and the waste pipes stuffed up with rags. Walls against which basins are fixed, unless protected by an enameled surface, soon become splashed with soap suds, and present an uninviting aspect which can not be easily or quickly improved. Waste pipes are often too narrow for convenient cleansing or contain sharp bends and angles, and consequently become blocked or broken.

Insufficient provision is often made for draining the lavatory floor, which possibly through bad construction becomes uneven and the site of pools of dirty water. The floor should be smooth, hard, impervious, and properly sloped and graded. Nailbrushes and soap, even though frequently renewed, disappear, and thus involve a constant source of annoyance and expense. These troubles may be largely overcome by adhering to certain principles in construction. The installation should be—

- (a) As simple as possible in construction and arrangement;
- (b) Strong and durable, able to withstand considerable wear and tear;
- (c) Sufficient and suitable in accommodation so that a large number can wash together or in a short time;¹
- (d) Economical in space;
- (e) So constructed that it can be easily cleaned and contain a minimum of removable or detachable articles;
- (f) Provided with an ample supply of water (hot and cold); and
- (g) So situated in the factory as to be fairly available to all for whom it is provided.

4. Where difficulties arise in regard to the use of ordinary lavatory basins they may in certain cases be overcome by using a washing trough. There the necessary plumbing is reduced to a minimum; there is no plug; washing is done under a spray of water; the waste pipe opens directly over the drain; and the drain itself is flush with the floor, which is sloped toward it. The trough stands in the center of the room, free from the walls, and the wall space can be used for cloak-room accommodation, whether hooks or lockers. A useful modification of the water supply is to have only two spray taps for occasional use, and a series of flush holes in both sides of the water pipe, the supply to which is controlled by a cock on the far side of the taps. This cock is turned on just before the operatives come to wash at the close of each spell of work. Arrangements can be made for controlling the temperature of the water. Where space is limited, say near the exit of a bit engineering shop, a more compact installation may be used. This may take the form of a large circular basin with spray taps radiating from a central supply pipe coming down from above, and with an open pipe in the center for carrying off the waste water to a drain in the floor. Wherever spray taps are used, advantage is gained by so arranging the height and position of the taps that a douche bath for the head, neck, and arms can be taken if desired.

5. *Nailbrushes*.—The difficulty occasioned by the disappearance of nailbrushes may be overcome by having large brushes made and

¹ The standard adopted under factory regulations is as follows. The washing conveniences should be under cover, and maintained in a cleanly state and in good repair. There should be either—

- (a) A trough with a smooth impervious surface (fitted with a waste pipe without plug), and of such length as to allow at least 2 feet for every five persons, and having a constant supply of water from taps or jets above the trough at intervals of not more than 2 feet; or
- (b) At least one lavatory basin for every five persons, fitted with a waste pipe and plug, or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on, and a supply of hot water always at hand when required for use by persons employed.

fixed in position so that they can drain into the trough. In use the hand is rubbed against such brushes instead of the usual reverse process. In a number of factories stout nailbrushes are provided attached to the washing troughs by chains, and on the whole this plan appears to work satisfactorily.

6. *Soap*.—Soap may be supplied economically in small boxes, about 4 inches square, kept locked and fixed in convenient positions above the trough, say on or near the water pipe; the soap of the consistency of butter or jelly is obtained by inserting a finger into a round hole in the bottom of the box. Each day the attendant fills up the box. Soap for use in this way can be obtained in powder form which sets to a jelly on the addition of water; by buying soap thus in powder form the cost of carriage is diminished. Alternatively, the soap may be served out as a powder placed in a flour dredger chained to the trough. One point, however, should be borne in mind, the natural oil of the skin and hair may be removed by the use of strong alkaline soaps; if such soaps are used, as may be necessary to cleanse hands soiled with oil and grime in engineering works, then some ointment, glycerine, or lanoline should be employed after washing to restore the suppleness of the skin. Without this precaution the skin may become dry and cracked, and so be unable to resist bacterial infection, when dermatitis results.

7. *Towels*.—The supply of clean, dry towels should be adequate; for this purpose it is desirable that—

(a) A towel at least five square feet in area should be provided for each worker, and should be renewed or washed daily; or

(b) One roller towel fastened in position, at least 15 square feet in area, should be provided for every three workers, and should be renewed or washed daily; or should be provided for every nine workers and should be washed or renewed after every mealtime and at the close of the day's work.¹

The provision of separate towels is preferable, partly because the danger of infection is minimized, and partly because each worker thus obtains a dry towel.

BATHING FACILITIES.²

8. *Baths*.—In addition to ordinary washing accommodation, the provision of bathing facilities is desirable for workers in many industries, especially those exposed to great heat and excessive dust, and those brought into contact with poisonous material. Where men are employed under conditions of great heat baths may prove an effective antidote to muscular rheumatism. For men, the simplest

¹ These suggestions are identical with the requirements of the Home Office order for the manufacture and decoration of pottery.

² Reference may be usefully made to the report of the Departmental Committee on Washing and Drying Accommodations at Mines. (Cd. 6724, 1913.)

and at the same time the cheapest and most efficacious installation is that of shower or douche baths. The stimulating effect on the skin of the falling water is greater than is obtained by total immersion. Douche baths have been strongly recommended for use by coal miners, and have been installed with success in many factories. For women, ordinary shower baths are less applicable, because of the difficulty of keeping the hair dry or of drying it after bathing; a horizontal spray fixed at the level of the shoulders, or obtained from a movable nozzle or ring on a flexible tube, overcomes this objection. Such arrangement may also be found preferable for men.

The number of baths should be sufficient to enable a worker to have a bath at any time without appreciable delay.

9. *Cubicles.*—The cubicles in which the baths are placed should be arranged to secure privacy. In order to reduce the time which each worker spends in the cubicle it may be possible to arrange for the workers to dress and undress partly outside the cubicle, but at any rate, in the case of women, some provision for dressing, including a seat and pegs, must be provided inside the cubicle. Where this is done the size of the cubicle should not be less than 3 feet wide by 4 feet deep. The walls should ordinarily not be less than 6 feet high. A space should be left between the floor and the walls of the cubicles sufficient to permit of drainage and cleaning.

10. *Cleaning.*—The building and fittings should be so constructed as to facilitate the maintenance of absolute cleanliness. Square corners, ledges, or rough inner surfaces should be avoided. Wood should be used only for seats, and for this purpose hardwood should be employed with spaces between the wood for ventilation. The walls and partitions (and this applies also to lavatories and sanitary conveniences) should always have smooth and curved surfaces which can be readily washed down and can not be used for writing on. Enamel tiles and bricks or enamel metal sheets may be used for this purpose; any initial cost thus incurred is soon recouped by saving in cleaning and lime washing.

11. *Water.*—The water used should be of adequate purity and should not be liable to cause injury to the health of the workers or to yield effluvia. It will generally be found preferable for the temperature of the water to be regulated by an attendant rather than for the temperature of each bath to be regulated separately by the worker. A temperature of about 100° F. is usual. A thermometer should be placed in a convenient position so that the attendant can readily correct variations of temperature.

12. *Soap and towels.*—A simple and economical method of supplying soap is to provide small tablets sufficient for one bath. A convenient size for towels is 25 inches by 60 inches. When the baths

are used by a large number of workers it may be found convenient and economical to provide a small laundry for washing them.

13. *Drying of clothes.*—The conditions of employment which render the provision of baths specially important often also make it desirable that facilities should be available for the drying of clothes. If only cloakroom pegs or lockers are provided for the damp clothes, hot water pipes should be placed immediately beneath them. A preferable plan where a large amount of clothing has to be dried is to suspend the clothes from the roof of the building by a chain or string securely fastened at the lower end. The heat of the building produced by the hot water pipes for the baths causes a good ventilation in the roof which satisfactorily dries the clothes and prevents any disagreeable odor. The interior of the building may with advantage be maintained at a level temperature of about 70° F. This adds to the comfort of the workers and effectively dries the clothes. Ventilation can be obtained by the provision of ventilators in the roof or by the use of fans.

14. The maintenance of any installation provided is almost as important as its construction. This should be made the definite duty of an appointed officer acting under the welfare supervisor, who should keep the lavatory clean, control the supply of nailbrushes and soap, and arrange that dry clean towels are available. Such an officer may also usefully be employed in attending to the sanitary conveniences, and in supervising the cloakroom. While the ultimate responsibility for upkeep must rest with the employer, it may be found, at any rate in the case of baths, that the workers may, with advantage, be encouraged to participate in the management by a special committee or otherwise. The question of the payment to be made for baths will also need careful consideration; in some cases at any rate the workers may prefer to make some small payment. Where periodic baths are of special benefit to health and efficiency, it is found desirable to allow workers time for bathing within working hours.

Signed on behalf of the committee,

GEORGE NEWMAN, M. D., *Chairman.*

E. H. PELHAM, *Secretary.*

AUGUST, 1916.

APPENDIX.

CONTENTS OF OTHER BULLETINS RELATING TO LABOR IN GREAT BRITAIN AS AFFECTED BY THE WAR.

- Bulletin No. 221.** Hours, fatigue, and health in British munition factories.
- Introduction.
 - Summary of the committee's conclusions.
 - Sunday labor (Memorandum No. 1).
 - Hours of work (Memorandum No. 5).
 - Output in relation to hours of work (Memorandum No. 12), report by H. M. Vernon, M. D.
 - Industrial fatigue and its causes (Memorandum No. 7).
 - Sickness and injury (Memorandum No. 10).
 - Special industrial diseases (Memorandum No. 8).
 - Tetrachlorethane poisoning (report of the British medical inspector of factories).
 - Dope poisoning (leaflet issued by the British factory inspector's office).
 - Ventilation and lighting of munition factories and workshops (Memorandum No. 9).
 - Effect of industrial conditions upon eyesight (Memorandum No. 15).
 - British treasury agreement as to trade-union rules affecting restriction of output.
 - Munitions of War Act, 1915, relating to labor disputes and restoration of trade-union conditions after the war.
 - Munitions of War (Amendment) Act, 1916.
 - Munitions tribunals (provisional) rules for constituting and regulating munitions tribunals in England and Wales.
 - Compulsory arbitration in munitions industry in France.
- Bulletin No. 223.** Employment of women and juveniles in Great Britain during the war.
- Introduction.
 - Summary of the committee's conclusions.
 - Replacement of men by women in industry in Great Britain.
 - Extension of employment of women in Great Britain in 1916.
 - Employment of women (Memorandum No. 4) in Great Britain.
 - Migration of women's labor through the employment exchanges in Great Britain.
 - Employment and remuneration of women in Great Britain—munitions orders.
 - Output of munitions in France.
 - Regulations as to wages of workers in munitions factories in France.
 - Juvenile employment (Memorandum No. 13) in Great Britain.
 - Juvenile employment committees in Great Britain.
 - Employment of women and boys in munition work in Italy.

ADDITIONAL MATERIAL RELATING TO LABOR IN FOREIGN COUNTRIES AS AFFECTED BY THE WAR.

WOMEN IN INDUSTRY.

- Woman's war work in Great Britain. Summary of British War Office report on woman's war work. (London, Sept., 1916. 92 pp. 72 illustrations.)
(In MONTHLY REVIEW, Dec., 1916. pp. 88-92.)
- Employment of women on munitions of war. Summary of Ministry of Munitions pamphlet, entitled "Notes on the Employment of Women on Munitions of War, with an Appendix on Training of Munition Workers." (London, 1916. 94 pp., ill.)
(In MONTHLY REVIEW, Sept., 1916. p. 105.)
- Employment of women in retail stores. Summary of reports of the shops committee appointed by the secretary of state for the home department to consider the conditions of retail trade which can best secure that the further enlistment of men or their employment in other national service may not interfere with the operations of that trade. (London, 1915. 10 pp.)
(In MONTHLY REVIEW, July, 1916. pp. 162, 163.)

LABOR CONDITIONS AND LEGISLATION.

- Effect of the war upon railway labor in Great Britain. Article based on report of the general secretary of the National Union of Railwaymen in Great Britain, 1916.
(In MONTHLY REVIEW, Aug., 1916. pp. 81, 82.)
- Proposed Ministry of Labor in Great Britain. Article based on proceedings of British Trades-Union Congress, September 6 to 11, 1915.
(In MONTHLY REVIEW, Aug., 1916. pp. 82, 83.)
- Report of the chief inspector of factories and workshops. Summary of annual report of British factory inspector's office for 1915 (London, 1916. 15 pp.)
(In MONTHLY REVIEW, Dec., 1916. pp. 121-123.)
- Extension of unemployment insurance in Great Britain.
(In MONTHLY REVIEW, Nov., 1916. pp. 65-68.)
- Labor in Great Britain after the war. Resolutions of conference of representatives of capital and labor held in London, January, 1917.
(In MONTHLY REVIEW, Mar., 1917. pp. 479, 480.)
- Industrial unrest in Great Britain. Summary of Chapter II of Labor, Finance, and the War, edited by A. W. Kirkaldy. Published by authority of the Council of the British Association for the Advancement of Science. (London, 1916.)
(In MONTHLY REVIEW, Apr., 1917. pp. 520-525.)
- New Ministries in the British cabinet.
(In MONTHLY REVIEW, May, 1917. pp. 769, 770.)
- Minimum wage law in France.
(In MONTHLY REVIEW, Dec., 1915. pp. 36-41.)
- Chinese labor in France. Summary of article by "S. G. C., a Chinese correspondent," in the New Statesman, January 13, 1917. p. 343.
(In MONTHLY REVIEW, Mar., 1917. pp. 480, 481.)
- Compulsory arbitration in Norway.
(In MONTHLY REVIEW, Sept., 1916. pp. 78, 79.)

- Great Britain: **The Public General Acts, 1914-16, London.** Printed for F. Atterbury, King's Printer of Acts of Parliament, by Eyre & Spottiswoode, Ltd., 1916. XII, 459 pp. Price, 3s.
- Great Britain: **Manual of Emergency Legislation, comprising all of the acts of Parliament, proclamations, orders, etc., passed and made in consequence of the war to September 30, 1914.** Edited by Alexander Pulling, London. Printed for F. Atterbury by Darling & Son, Ltd., September, 1914. XI, 572 pp. Price, 3s. 6d.
- Great Britain: **Supplement No. 1, to November 2, 1914, to the Manual of Emergency Legislation.** November, 1914. VII, 54 pp.
- Great Britain: **Supplement No. 2, to December 15, 1914, incorporating and**
- Great Britain: **Supplement No. 4, to August 31, 1915, in continuation of supplement December, 1914.** XIII, 217 pp. Price, 1s. 6d.
- Great Britain: **Supplement No. 3, to April 30, 1915, in continuation of Supplement No. 2 to the Manual of Emergency Legislation.** May, 1915. XVIII, 219 to 697 pp. Price, 2s. 6d.
- Great Britain: **Supplement No. 4 to August 31, 1915, in continuation of supplement No. 3 to the Manual of Emergency Legislation.** September, 1915. XXVII, 462 pp. Price, 2s. 6d.
- Great Britain: **Manual of Emergency Legislation, Defense of the Realm Regulations made to May 23, 1916.** Second edition. London. Printed for F. Atterbury by Darling & Son, Ltd., 1916. X, 102 pp., ill.
- Canada: **Copies of proclamations, orders in council, and documents relating to the European war; compiled by the department of the secretary of state of Canada.** Ottawa, Government Printing Bureau, 1915. XX, 209 pp.; appendixes, 142 pp.
- Canada: **First supplement to copies of proclamations, orders in council and documents relating to the European war.** Ottawa, 1915. XXXII, 526 pp.; appendixes, 350 pp.
- Canada: **Second supplement to copies of proclamations, orders in council, and documents relating to the European war.** Ottawa, 1916. LXVI, 527 to 1050 pp.; appendixes, 351 to 537 pp.
- Canada: **Order in council of March 23, 1916, for the extension of the provisions of the industrial disputes investigation act, 1907, other than section 63, to include employers and employees engaged in the construction, production, repairing, manufacture, transportation and delivery of ships, vessels, works, buildings, munitions, ordnance, guns, explosives, and materials and supplies for the use of the military or naval forces.**
- Canada: **Order in council of November 10, 1916, respecting the high cost of living, as amended by order in council of November 29, 1916.**
- Canada: **Sessional Paper No. 35a. The provision of employment for members of the Canadian expeditionary force on their return to Canada, and the re-education of those who are unable to follow their previous occupations because of disability. A plan submitted by the secretary of Military Hospitals and Convalescent Homes Commission, together with appendixes dealing with similar work in England and on the Continent of Europe.** Ottawa, 1915. 58 pp.
- Canada: **Sessional Paper No. 185. Pensions granted and money allowances made to members of the Canadian expeditionary force since beginning of war, to February 16, 1916.** Ottawa, 1916. 83 pp.
- Canada: **Ministry of Agriculture. Patriotism and production more than usual. Agricultural war book.** Ottawa, January, 1915. 157 pp.

GOVERNMENT REGULATION OF INDUSTRIES AND COMMODITIES.

Restrictions on output of textile establishments in Germany. Article based on material in Reichs-Arbeitsblatt, November, 1915; Soziale Praxis, November 11, 1915.

(In MONTHLY REVIEW, April, 1916. pp. 81, 82.)

Government control of food supplies in Great Britain.

(In MONTHLY REVIEW, March, 1917. pp. 390-407.)

Government control of food supplies in France.

(In MONTHLY REVIEW, April, 1917. pp. 525-533.)

Government control of coal mines in Great Britain.

(In MONTHLY REVIEW, April, 1917. pp. 533, 534.)

Government control of food supplies in Germany.

(In MONTHLY REVIEW, May, 1917. pp. 702-726.)

Government control of food supplies in Italy.

(In MONTHLY REVIEW, May, 1917. pp. 726-743.)

WAGES.

Wages of miners in Germany during the first year of the war. Article based on material in Soziale Praxis, Berlin, 1915, Vol. XXV, No. 4, October 28, 1915, p. 89.

(In MONTHLY REVIEW, April, 1916. pp. 80, 81.)

Minimum wage law in France.

(In MONTHLY REVIEW, December, 1915. pp. 36-41.)

New regulations as to wages of workers in munitions factories in France.

Text of decree issued by minister of munitions on January 17, 1917.

(In MONTHLY REVIEW, March, 1917. pp. 362-365.)

PRICES.

Foreign food prices as affected by the war.

In Bulletin No. 170 of the U. S. Bureau of Labor Statistics.

(May, 1915.) Also, summarized in MONTHLY REVIEW, July, 1915. pp. 42-44.)

Increase in retail prices of coal in Great Britain. Summary of British Board of Trade report of departmental committee to inquire into the causes of the present rise in the retail prices of coal sold for domestic use. (London, 1915.)

(In MONTHLY REVIEW, July, 1915. pp. 45-56.)

Retail prices in foreign countries.

(In MONTHLY REVIEW, September, 1915, pp. 46-57; October, 1915, pp. 44-49; December, 1915, pp. 44-53; March, 1916, pp. 80-85; July, 1916, pp. 80-91; November, 1916, pp. 49-60; February, 1917, pp. 244-251.)

Increase in prices of commodities in Great Britain, 1916. Summary of interim report on meat, milk, and bacon of British Board of Trade Departmental Committee on Prices. (London, 1916. 20 pp.)

(In MONTHLY REVIEW, January, 1917. pp. 51-56.)

Wholesale prices in Great Britain.

(In MONTHLY REVIEW, April, 1917. pp. 586-588.)

EMPLOYMENT.

Employment conditions in foreign countries.

(In MONTHLY REVIEW, July, 1915, pp. 60-80; August, 1915, pp. 16-20; October, 1915, pp. 49-52; December, 1915, pp. 56-71; March, 1916, pp. 86-89; July, 1916, pp. 92-98; January, 1917, pp. 136-149.)

Land settlement and unemployment in England. Summary of introduction and Part I of the final report of the British departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the settlement or employment on the land in England and Wales of discharged sailors and soldiers. (London, 1916, 30 pp. fold. chart.)
(In MONTHLY REVIEW, April, 1916, pp. 11-13.)

Employment of discharged soldiers and sailors on the land in Great Britain. Summary of Part II of the final report of the British departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the settlement and employment on the land in England and Wales of discharged sailors and soldiers. (London, 1916, 39 pp.)
(In MONTHLY REVIEW, September, 1916, pp. 87-90.)

INDUSTRIAL DISEASES.

A nonpoisonous dope for airplanes. Parliamentary statement by British War Office and Admiralty.
(In MONTHLY REVIEW, January, 1917. pp. 97-98.)

INDUSTRIAL FATIGUE.

Some new studies of industrial fatigue. Summary of the following reports:

Interim Report on an Investigation of Industrial Fatigue by Physiological Methods, by A. F. Stanley Kent, Professor of Physiology in the University of Bristol. Great Britain, Home Department, London, August 1915, 34 pp. [Cd. 8056.]

Second Interim Report on an Investigation of Industrial Fatigue by Physiological Methods, by A. F. Stanley Kent, Professor of Physiology, University of Bristol. Great Britain, Home Department. London, August, 1916. 76 pp., 18 charts. [Cd. 8335].

The question of Fatigue from the Economic Standpoint. Interim report of the committee, consisting of Prof. J. H. Muirhead (chairman), Miss B. L. Hutchins (secretary), Mr. P. Sargant Florence (organizing Secretary), Miss A. M. Anderson, Prof. Bainbridge, Mr. E. Cadbury, Prof. Chapman, Prof. Stanley Kent, Dr. Maitland, Miss M. C. Matheson, Mrs. Meredith, Dr. C. S. Myers, Mr. C. K. Ogden, Mr. J. W. Ramsbottom, and Dr. J. Jenkins Robb. Report submitted at the Manchester meeting of the British Association for the Advancement of Science in 1915. Manchester, 1915. 67 pp.

The Question of Fatigue from the Economic Standpoint. Second interim report of the committee. Report submitted at the Newcastle meeting of the British Association for the Advancement of Science. Newcastle, 1916. 24 pp.

(In MONTHLY REVIEW, December, 1916. pp. 97-105.)

WELFARE WORK.

Welfare work in Great Britain. Summary of book on Welfare work: Employers' experiments for improving welfare work in factories, by E. Dorothea Proud. (London, G. Bell & Sons (Ltd.), 1916. xvii, 363 pp. 7s. 6d. net.)
(In MONTHLY REVIEW, December, 1916. pp. 81-88.)

COAL MINING INDUSTRY.

Organization in coal mines to increase output in Great Britain. Summary of report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry. (London, 1915. Cd. 7939.)
(In MONTHLY REVIEW, July, 1915. pp. 56-58.)

66 WELFARE WORK IN BRITISH MUNITIONS FACTORIES.

Compulsory cartel or monopoly in the German coal-mining industry.

(In MONTHLY REVIEW, November, 1915. pp. 83-85.)

Conditions prevailing in the coal-mining industry in Great Britain. Summary of second report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry.

(In MONTHLY REVIEW, July, 1916. pp. 151-153.)

Effect of the war on the coal-mining industry in Great Britain. Summary of third report of British Home Office committee to inquire into the conditions prevailing in the coal-mining industry. (London, 1916. 17 pp.)

(In MONTHLY REVIEW, April, 1917. pp. 534-535.)

Increase in retail prices of coal in Great Britain. (See Prices.)



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