

1) United Provinces and Bihar. Joint Power Alcohol and Molasses
Inquiry Committee : Report.

X9(F55-54).252.N380 G8

2) United Provinces. Cawnpore. Labour Enquiry Committee
Report. X:9.252CC.N386 G8

REPORT
OF THE
JOINT POWER ALCOHOL AND MOLASSES
INQUIRY COMMITTEE
WITH ANNEXURES
BIHAR AND THE UNITED PROVINCES
1938



ALLAHABAD:
SUPERINTENDENT, PRINTING AND STATIONERY, UNITED PROVINCES, INDIA
1938

No. 3473/XVIII—923
GOVERNMENT OF THE UNITED PROVINCES
INDUSTRIES DEPARTMENT

RESOLUTION

Dated June 21, 1939

READ—

The report of the Joint Power Alcohol and Molasses Enquiry Committee, Bihar and the United Provinces, 1938.

THE problem of the utilization of molasses, especially for the manufacture of power alcohol, has been engaging the attention of both Government and the public for some years. The Governments of the United Provinces and Bihar accordingly appointed a committee in January, 1938, to go into the whole question and report as to the best way of dealing with the problem. The committee consisted of—

- (1) Dr. N. R. Dhar, D.Sc., F.I.C., I.E.S., Professor, Allahabad University,
- (2) Mr. G. H. Dickson, Messrs. Begg, Sutherland & Co., Cawnpore,
- (3) Mr. Ananthasubramanayam, Mysore Sugar Co., Ltd., Bangalore,
- (4) Mr. P. S. Maker, Chief Chemist, Majhulia Sugar Factory, district Champaran,
- (5) Lala Padampat Singhania, Cawnpore,
- (6) Mr. M. P. Gandhi, Chief Commercial Manager, The Rohtas Industries, Ltd.,
- (7) Dr. S. S. Bhatnagar, O.B.E., D.Sc., F.INST.P., Professor of Punjab University, and
- (8) Dr. N. G. Chatterji, D.Sc., Harcourt Butler Technological Institute, Cawnpore.

The report of the Committee was received in the middle of June and has been further examined by both Governments. The most important points that have to be considered in this connexion are whether the manufacture of power alcohol is a sound economic proposition and what arrangements are to be made for the disposal of the power alcohol when manufactured.

2. The total quantity of molasses produced in vacuum-pan sugar factories in the United Provinces and Bihar has been estimated at 300,000 tons a year of which, it appears, nearly 200,000 tons are mixed with factory effluent and discharged into neighbouring fields and watercourses as waste, thereby polluting the local sources of water supply, giving rise to offensive odours and causing numerous complaints from the local inhabitants. Some 3 years ago an exporting company undertook to purchase molasses at four annas a maund, but it appears that in 1936-37 they purchased some 80,000 tons at an average price of just over one anna a maund, while the quantity purchased since is much less. The value of the molasses lost at four annas a maund comes to 13½ lakhs of rupees annually.

3. If power alcohol were to be manufactured from molasses, it is estimated that the output would be 2·2 gallons of alcohol from

one maund of molasses or 60 gallons from one ton. Hence the United Provinces and Bihar could between them produce 120 lakhs of gallons of power alcohol a year. The Committee have however recommended that for the present only as much power alcohol should be manufactured as can be absorbed in the United Provinces and Bihar, and the Governments of both provinces are disposed to accept this. They also agree that the minimum economic unit for manufacture should be taken to be a plant of a capacity of 2,200 gallons a day, which it is estimated will cost $2\frac{1}{2}$ lakhs of rupees. A number of such plants may be put up at convenient places, the plant being duplicated where a central distillery is found to be more convenient for the purpose of distribution of power alcohol as in the case of Bihar.

4. The cost of manufacture, if a plant of this size is installed, has been estimated by the Committee at from 3 to $3\frac{1}{2}$ annas per gallon of alcohol produced, excluding the cost of molasses. Since the report of the Committee was written, it has come to light that no recurring royalty will have to be paid for the use of the patent process to be adopted. Hence the cost of manufacture may be taken to be 3 annas. It has been suggested that this cost can be reduced by having one large-scale plant instead of a number of smaller ones, but this need not be considered for the present. Even allowing for the price of molasses at annas 4 a maund, and another anna 1 pies 6 as the cost of transfer thereof, the cost of the molasses in one gallon of power alcohol comes to annas 2 pies 6 and the cost of production of one gallon of alcohol to annas 5 pies 6.

5. In order to arrive at the actual selling price, it is necessary to add to this figure the amount of the excise duty, if any, and the actual distribution and selling costs. The latter should not exceed $3\frac{1}{2}$ annas a gallon and even if the excise duty is calculated at the same rate as the customs duty on petrol, the total cost comes to Re.1-3 a gallon which is appreciably lower than the price of petrol in the United Provinces and Bihar. It thus appears that it is an economic proposition to manufacture power alcohol, provided it can be used in these provinces.

6. Practically the only use for power alcohol is as a motor fuel, mixed with petrol. The Governments of the United Provinces and Bihar are satisfied that the admixture of 20 per cent. of power alcohol with petrol is unobjectionable from the point of view of the motor industry and are prepared to undertake legislation to make such admixture compulsory in the United Provinces and Bihar, unless other suitable arrangements can be made for the same. As the total quantity of petrol consumed in these provinces is in the neighbourhood of 90 lakhs of gallons a year, it is possible to replace some 18 lakhs of gallons of petrol by power alcohol. In other words some 30,000 tons of molasses can be utilized in this way.

7. The Provincial Governments realize that this will not solve the problem of surplus molasses. But a useful beginning can be made and it may be possible later to arrange to supply power alcohol to other provinces also at a price which is not appreciably higher than that of petrol, especially if the excise duty is reduced to the level of the customs duty on petrol, excluding the surcharge. For the present, however, the two Governments intend to proceed with the making of suitable arrangements for the manufacture and sale of power alcohol in these provinces.

8. In conclusion, the Governments of the United Provinces and Bihar desire to thank the members of the Committee for their arduous work and their valuable report; which will serve as a useful guide for the development of the power alcohol industry.

ORDER—Ordered that a copy of this resolution be forwarded to the members of the Committee for their information.

Ordered also that a copy of this resolution be sent to the Director of Industries, the Director of Agriculture, the Excise Commissioner, the Director of Public Health, the Inspector General of Civil Hospitals, the Inspector General of Police, the Registrar, Co-operative Societies, the Chief Engineers, Public Works Department, Buildings and Roads and Irrigation Branches, the Chief Conservator of Forests, the Director of Public Instruction and the Director of Public Information.

Ordered also that a copy be sent to all Commissioners of Divisions, all district officers, and all vacuum-pan sugar factories in the United Provinces for information.

Ordered also that a copy be sent to the Central Government and the Government of the Bihar for information.

Ordered also that a copy of this resolution be published in the *United Provinces Gazette*.

By order,
N. C. MEHTA,
Secretary to Government,
United Provinces.

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Report of the Joint Power Alcohol and Molasses Inquiry Committee (Bihar and the United Provinces), 1938

1. *Preliminary*—The Committee was appointed by two identically worded resolutions, one issued by the Government of Bihar, Development Department (No. 2199-D, dated the 22nd December, 1937), and the other by the Government of the United Provinces, Industries Department (No. R/247/XVIII, dated 18th January, 1938). These resolutions were as follows :

“The problems of the sugar industry were discussed at a Joint Conference of the representatives of the United Provinces and Bihar, which was held at Lucknow on the 29th and 30th September, 1937, and by a sub-committee of this Conference which met at Patna on the 19th and 20th October, 1937. One of the recommendations of this sub-committee was that the Governments of the United Provinces and Bihar should set up a joint committee to consider the question of the utilization of molasses for the manufacture of power alcohol and for other profitable purposes. In pursuance of this recommendation, the Government of Bihar, in consultation with the Government of the United Provinces, have decided to appoint a committee to devise ways and means of starting the manufacture of power alcohol out of molasses, to report on the best method of manufacture and of mixing power alcohol with petrol and to explore the possible uses for molasses and their practical application.

“2. The Committee will consist of the following members :

(1) Dr. N. R. Dhar, D.Sc., F.I.C., I.E.S., Professor, Allahabad University.

(2) Mr. G. H. Dickson, Messrs. Begg, Sutherland & Co., Cawnpore.

(3) Mr. Ananthasubramanyam, Mysore Sugar Company, Ltd., Bangalore.

(4) Mr. P. S. Maker, Chief Chemist, Majhulia Sugar Factory, District Champaran.

(5) Lala Padampat Singhania, Cawnpore.

(6) Mr. M. P. Gandhi, Chief Commercial Manager, The Rohtas Industries, Ltd.

(7) Dr. S. S. Bhatnagar, O.B.E., D.Sc., F. INST. P., Professor, Punjab University, and

(8) Dr. N. G. Chatterji, D.Sc., Harcourt Butler Technological Institute, Cawnpore,

who will also be the Secretary of the Committee.

“The Committee will elect its own Chairman, settle its own procedure and decide whom it will examine.”

Further instructions were conveyed to the Committee through the Director of Industries, United Provinces, under the United Provinces Government Order No. 155/XVIII—1180, dated 15th February, 1938, which was as follows :

“I am directed to refer to G. O. No. 155 of 2nd January, 1938, and to say that the Provincial Government would be glad if the Committee appointed to consider the question of the utilization of molasses for the manufacture of power alcohol and for other profitable purposes, would take up the question of power alcohol first and submit its report

on that subject to the Provincial Government by 31st March, 1938, at the latest. The Committee may please be informed accordingly and requested to divide its work into two portions and take up later the question of the utilization of molasses for other profitable purposes."

2. The Committee unanimously elected Lala Padampat Singhania as its Chairman.

3. There were three sittings of the Committee, all held at Cawnpore, on the following dates, viz., on 24th and 25th January, 1938, 7th, 8th and 9th March, 1938, and 16th and 17th April, 1938.

4. In view of the fact that the question of the utilization of molasses, especially through the manufacture of power alcohol, has been widely discussed in India for some years, and has given rise to certain points of a controversial nature, the Committee found it necessary to interpret the terms of reference in a liberal manner. Further, as the public has been taking interest in the subject and as the success of the power alcohol industry would depend upon a favourable reception of the alcohol-petrol mixed fuel by the motorist within the country, the Committee considered that it would be desirable to include a general survey of the various aspects of the industry in this report. ●

5. Information, both written and verbal, has been obtained from a large number of sources; in some cases on condition that the details or the names of the authority would be withheld from publication. The Committee desires to take this opportunity of expressing its appreciation of the valuable assistance rendered by all those who have so willingly placed authoritative information at its disposal.

6. The report is presented in two sections. Section I deals with Power Alcohol, and Section II with Industrial Alcohol and agricultural and other uses of molasses: viz:

SECTION I—POWER ALCOHOL

- (1) Introductory.
- (2) Molasses Situation.
- (3) Manufacture and Cost.
- (4) Economic and Legal Aspects.
- (5) Conclusions.

SECTION II—OTHER USES

- (1) Introductory.
- (2) Industrial Alcohol.
- (3) Agricultural Uses.
- (4) Other Uses.
- (5) Conclusion.

SECTION I—POWER ALCOHOL

INTRODUCTORY

7. The problem of using alcohol as a source of power has been engaging the attention of the scientific world for a long time. Whatever may have been the reasons for promoting the undertaking of this problem in the pre-War days, there is no doubt that at the time of the Great War and thereafter, certain aspects of the problem were brought out in strong relief and led every country to push on energetically with the task of solving it to its

own best advantage. Though each country has some special reasons for its interests in power alcohol, a careful examination of the history and growth of this industry in the more important countries of Europe reveals the following reasons common to all of them :

(i) To minimize the heavy drainage of national wealth out of the country on account of imported petrol.

(ii) The advisability of having a national product as a substitute for petrol in view of the sad experience due to shortage of the latter in the country during the war.

(iii) The necessity of having a large supply of alcohol which is now regarded as an important munition.

(iv) To have an alternative motor fuel available within the country.

(v) The alcohol industry can be made to play a very important part (i) in the prosperity of the agricultural classes, and (ii) in the development of other industries.

The development of the automobile industry brought the question of power alcohol into prominence. During the early stages of experimentation on the running of automobiles with alcohol, it was realized that motor car engines designed and constructed for working with petrol could not be run satisfactorily on alcohol alone. Trials with mixtures of hydrocarbons (petrol or benzol) and alcohol, however, gave encouraging results and extensive experiments under technical control were undertaken by the State in France, Germany, Sweden, Czechoslovakia and Poland.

The result of these experiments was the knowledge that a mixture of petrol or benzol and alcohol in certain proportions can replace, without any disadvantage, pure petrol for automobile driving. Once this fact was established, research work was directed to find out the most suitable composition of the mixed fuel. The practical difficulty was due to the comparative instability of rectified spirit and petrol mixtures, especially in winter temperatures in Europe. It was observed, however, that the range of miscibility improved with the addition of benzol. Later on it was found that absolute alcohol and petrol have a very wide range of miscibility even at low temperatures and the mixed fuels in certain proportions are in no way inferior to pure petrol for use as fuel in motor cars.

With the success achieved in the manufacture of absolute alcohol, the problem of "motor spirit" was not only simplified, but as a matter of fact certain advantages were brought out. Henceforward most of the work in the matter of "power alcohol" was directed in finding out ways and means by suitable legislative, economic and financial measures to bring down the price of alcohol. In spite of vigorous efforts made by the State to encourage the use of "mixed fuels", success was achieved only when legislative measures were passed compelling petrol companies to buy a certain quantity of country-produced alcohol for mixing with petrol. Such compulsory mixing laws are now in force in France, Germany, Hungary, Czechoslovakia, Yugoslavia and Italy and a number of smaller States. Even in a country like America, where petrol is indigenous and very cheap, the production of alcohol for purposes of fuel has increased considerably, and it is understood that some of the States have under active consideration the introduction of legislation, making the blending of a certain amount of alcohol with petrol compulsory.

A brief account of the legislative measures and practices in other countries is given in Appendix II, paragraph 6.

8. The Committee would now refer to the problem in India.

As far back as 1918, the Indian Industrial Commission, under the chairmanship of Sir Thomas Holland, in their report made recommendations regarding power alcohol in the following words :

"It is undesirable that the fuel supply of the country should be derived from external sources . . . Petrol is chiefly used in motor cars and small engines which are only intermittently employed. As a source of industrial power it is unimportant, but the demand for it for other purposes is likely to grow, and the provision for a suitable substitute is generally recognized as desirable, if not actually imperative. On several occasions our attention was drawn to the possibility of making industrial alcohol from hitherto neglected vegetable materials, some of which appear to be sufficiently promising to justify investigation and experiment. We recommend that a more liberal policy should be followed by the Excise authorities in respect of the class of denaturant prescribed, and more regard might be paid to the likelihood rather than to the mere possibility of frauds to the revenue, when the requirements of the commercial users conflict with excise regulations." (*Paragraph 96.*)

9. In pursuance of the above recommendation, the Government of India appointed the Industrial Alcohol Committee of 1920 with the following two main terms of reference :

"(i) to consider and report to what extent and in what respect excise regulations now in force in the different provinces of India regarding the production, sale, storage and transport of industrial alcohol hamper the manufacture in India of such alcohol on a large scale ; and

"(ii) to make recommendations for such modifications in those regulations as may be considered necessary, due regard being had on the one hand to the necessity of protecting the Government revenue and also the public safety and on the other hand to the desirability of encouraging the development of the manufacture of industrial alcohol in India."

It may here be pointed out that the term "industrial alcohol" in that report was used in the broader sense, including what is now denoted by the term "power alcohol".

10. One of the recommendations of the Committee was as follows :

"We therefore suggest that to impose any tax on power alcohol would cripple the industry, which is already handicapped in comparison with petrol. When power alcohol or a mixture of power alcohol and either is mixed with any motor spirit on which duty is payable, the duty should be levied on that constituent only, and not on the power alcohol or on the finished product." (*Paragraph 125.*)

11. This recommendation of the Committee was accepted by the Government of India (resolution no. 6, dated 1st October, 1927, paragraph 4) to the effect that power alcohol should not be handicapped by the imposition of any excise duty except such as should be leviable upon any fuel adjunct which is separately liable to duty.

12. It may, therefore, be concluded that the desirability of encouraging the use of power alcohol in the form of alcohol-petrol mixed fuel had been recognized by the Government of India as early as 1922, when the Industrial Alcohol Committee came to the conclusion that the production of potable spirit and tobacco manufacture easily absorb the entire production of molasses in India, and a surplus for the manufacture of power alcohol was not likely soon to be available. (*Paragraph 124.*)

13. With the rapid growth of the sugar industry in India, molasses became available in large quantities and the prices went down considerably, with the result that the power alcohol question became a matter of vital interest to the cane cultivator and sugar industry. The United Provinces Government, realizing the importance of the problem, deputed in 1933 an officer for the study of the power alcohol industry in the various countries of Europe. In the meantime, the Sugar Committee of the Imperial Council of Agricultural Research as also several Chambers of Commerce in India and the Indian Sugar Mills Association continued from year to year to direct the attention of the Government of India to the urgent necessity for the establishment of this industry in India.

MOLASSES SITUATION

14. Molasses is the chief by-product in the sugar industry and it is produced in India from three types of factories, namely, cane-crushing factories, *gur*-refineries, and *khandsaris*. The tables given below have been compiled from official statistics :

(1) *Production of molasses by central factories working with cane*

	1936-37	1935-36	1934-35	1933-34	1932-33
	Tons	Tons	Tons	Tons	Tons
United Provinces	207,930	182,600	125,500	110,052	64,590
Bihar	133,650	97,200	71,878	61,025	57,868
All India	414,640	337,128	233,882	190,384	130,419

(2) *Production of molasses by factories working with gur.*

	1937	1936	1935	1934	1933
	Tons (estd.)	Tons	Tons	Tons	Tons
United Provinces	7,200	20,058	14,168	26,717	40,568
All India	10,600	32,556	21,935	39,770	56,239

(3) *Production of molasses by khandsaris.*

	1936-37	1935-36	1934-35	1933-34	1932-33
	Tons	Tons	Tons	Tons	Tons
All India	100,000	125,000	150,000	200,000	275,000

Khandsari molasses has uses different from factory molasses and the major portion of the former is absorbed in the areas, where it is produced.

15. It would be seen from the statistics that while there has been a rapid fall in the production of *khandsari* and *gur*-refinery molasses, from 275,000 tons and 56,200 tons in 1932-33, to 100,000 tons and 10,600 tons

respectively in 1936-37, there has been an extraordinarily large increase in cane factory molasses, namely from 130,400 tons in 1932-33 to 414,600 tons during 1936-37.

16. While the Committee is unable to ascertain with any degree of exactness the total quantity of surplus cane factory molasses per year in the United Provinces and Bihar, it appears from an official note placed before the Sugar Committee of the Imperial Council of Agricultural Research in 1935 that the internal market for molasses in the whole of India would not be more than 160,000 tons. It is, therefore, estimated that the quantity of surplus molasses produced by the cane factories in India is at present in the neighbourhood of 265,000 tons.* But, due to the fact that about 82 per cent. of the production is in the above-mentioned two provinces, the problem of the utilization of surplus molasses is more serious there than elsewhere.

17. *Export of molasses from India*—In 1935, the sugar industry was given to understand that the Government of India had before them proposals by a firm of standing which had been long engaged in the molasses trade for the installation of the storage and transport equipment necessary for an annual export to the United Kingdom and other countries of about 200,000 tons of molasses. The firm considered that a steady and permanent market was available abroad for the whole of India's surplus molasses, and the Government of India was informed that it would take steps to complete its arrangements for taking up all surplus Indian molasses from the 1935-36 season and onwards. In consequence the Government of India decided not to initiate experiments for the production of power alcohol from molasses on a commercial scale, although advised to do so by the Sugar Committee of the Imperial Council of Agricultural Research in 1933. But they were understood to have given an assurance that they would do so, if at any time in future it should appear that the export scheme referred to above did not provide an adequate solution of the problem of molasses disposal.

18. The hope so entertained by the Government of India regarding the success of the export scheme seems to have fallen far short of the expectations. It is reported that this matter was discussed in May 1937 in the Sugar Committee of the Imperial Council of Agricultural Research, and in view of the disappointing results of the molasses export scheme, a resolution was adopted requesting the Government to issue licences for the production of power alcohol for use as motor fuel in admixture with petrol, to permit the sale of prescribed mixtures of petrol and alcohol for motor fuel, and to modify denaturants so as to permit the substitution of a denaturant suitable for use in motor engines.

19. The following table summarizes some of the information available in connection with the export of molasses in India :

Contracts made by the Molasses Exporting Company	With sugar factories situated in the United Provinces		With sugar factories situated in Bihar	
	1935-36	1936-37	1935-36	1936-37
Quantity purchased (approximate) ..	31,000 tons.	38,000 tons.	12,500 tons.	41,000 tons.
Average price paid f. o. r. factory ..	Rs. a. p. 0 1 0	Rs. a. p. 0 1 0	Rs. a. p. 0 2 1.7	Rs. a. p. 0 1 3.4
Number of factories† reporting sale of molasses	9	12	9	14

*This figure requires modification. Latest statistics for 1937-38 (*Ind. Trade Journal*, May 19, 1938) regarding the production of molasses is as follows :

United Provinces	215,700 tons.
Bihar	80,800 "
All India	364,000 "

†NOTE—It is possible that a few other sugar factories may have sold molasses to the exporting company, but this information was not available.

20. It is significant to note that though the total quantity of molasses purchased by this company during the sugar seasons 1935-36 and 1936-37 was at least 122,500 tons, the quantity actually exported out of India during the period 1st April, 1935 to 31st January, 1938, was only about 88,000 tons. In the event, therefore, of some of this molasses being sold within the country, the relief given to the *surplus* molasses situation becomes to that extent more apparent than real.

PROPERTIES, MANUFACTURE AND COST

21. *Definition*—For purposes of this report, power alcohol is defined as “Dehydrated Ethyl Alcohol of at least 99·4 per cent. by volume.” The Committee also suggests that for purposes of measurement, the strength of power alcohol should be reckoned by volume per cent. of ethyl alcohol and not on the basis of London Proof Spirit.

22. *Properties*—Among the common criticisms which have been made against alcohol-petrol fuels in general, the following two seem to have attracted a good deal of attention :

(i) Since alcohol has a calorific value lower than petrol, and since in internal combustion engines the heat energy content of the fuel is converted into power, it follows that alcohol-petrol mixtures must necessarily be less efficient than straight petrol fuels.

(ii) Since alcohol is hygroscopic in nature, there is the possibility of absorption of moisture from the atmosphere, specially in the rainy season by the alcohol-petrol mixture in the storage tanks, even to the extent of the separation of diluted alcohol from petrol into two layers.

23. The essential part of the theoretical and scientific principles regarding the relationship between calorific value of the fuel and power output from it in ordinary motor car engines has been given elsewhere (Appendix I-A). The power value of alcohol-petrol mixed fuel, which is still a subject under controversy, has however been fairly summed up in the following words of Professor A. W. Nash and Donald A. Howes (*The Principle of Motor Fuel Preparation and Application*, Vol. I, paras. 421—24) :

“ A point of outstanding importance is that concerning the relationship which exists between the alcohol content of a petrol-alcohol blend and the fuel consumption for a given power output. If the latent heats of petrol and alcohol were the same, this relationship would be linear for any given compression ratio, the fuel consumptions of alcohol and petrol being inversely proportional to their calorific values. However, the large difference existing between these two substances in latent heats is almost as important as the large difference in calorific value and it is the cause of very noteworthy, if somewhat unexpected results.

“ The latent heat of a fuel determines, to a large extent, engine volumetric efficiency, and consequently has an effect upon power output. In the case of alcohol fuels, latent heat is of great importance, and has a noticeable effect upon the fuel consumption for a given power output. Professor Hubendick (World Power Conference, London, 1928) made an examination of a range of petrol-alcohol mixtures and showed that the fuel consumption, in terms of heat units, was not appreciably greater with a 20 per cent. ethyl-alcohol blend than with petrol alone, whereas blends containing higher amounts of alcohol gave fuel consumption in proportion to the

alcohol content. As in these tests, no changes in the engine conditions, other than an alteration in carburettor jets, were made, it follows that in blends containing up to 20 per cent. of alcohol, an increase in overall engine efficiency must be compensating for the lower calorific value. This higher overall efficiency is solely caused by the higher latent heats of the alcohol which causes the air consumption per cycle to be increased and so increased the power output.

“ With regard to the behaviour of alcohol fuels in ordinary automobiles, therefore, if the alcohol content is kept below 20—25 per cent. by volume, such mixtures may be used with satisfaction without any alteration in carburettor setting and without any alteration in any way to the engine. Such blends will give approximately the same fuel consumption as ordinary petrol and will give about the same power output. Neither starting properties nor engine flexibility will be impaired to any marked degree. If, on the other hand, the alcohol concentration is increased above these limits, power output will be decreased and fuel consumption correspondingly increased, with the result that the blend will not give satisfaction as instanced by the marked unpopularity of “ Carburant National ” in France, which contains 50 per cent. ethyl alcohol, and the success of “ Lattbentyl ”, containing only 25 per cent. ethyl alcohol, in Sweden.”

24. The Committee has examined some of the data available on the influence of moisture on alcohol-petrol mixed fuels (Appendix I-C). It appears that the absorption of moisture which is likely to take place under ordinary atmospheric conditions in India would not cause the separation of the fuel into two layers, so that as shown by Contant and Mariller [Appendix I-C(2)], there is practically no danger of such separation ever taking place. Besides this, the Committee understands that a mixture of 65 parts of alcohol (96 per cent. by volume) and 35 parts of petrol has been found to be quite stable in Mysore even under monsoon conditions.

25. *No necessity for carburettor changes*—Another point which the Committee thought it advisable to examine in some detail was about the necessity of making any alterations in the adjustment of carburettor of a motor car, when changing over from straight petrol to alcohol-petrol mixed fuel. Opinions of two experts on this subject are as follows :

(1) “ The combustion of 1 gramme of alcohol requiring less air than that of 1 gramme of petrol, it may at first sight appear that in running the engine, when pure petrol is replaced by alcohol fuel, the carburettor must necessarily be adjusted, either in increasing the inflow of the fuel or in diminishing the admission of air. Practice, however, has shown that the necessity of such adjustment does not appear. We can cite, for instance, the case of the Poznan Rally of 12th July, 1930, when all runners, having every one covered several hundred miles at high speed using alcohol fuel, stated that they had not had to make any alteration in their carburettors except the usual checkings which the driver can effect without leaving the wheel.

“ This fact is explained by the favourable influence of alcohol on combustion. As pure petrol never undergoes complete combustion in the cylinder, all carburettors are usually adjusted for a mixture richer than that established by the chemical theory of combustion, and this adjustment coincides with theory when a certain amount of alcohol is present.”—(Colonel Mayer’s “ Alcohol Fuels in Poland ”, published by the Polish State Alcohol Department.)

(2) Professor Hubendick writes as follows :

" It may be of interest to note that an engine can, without alteration, be operated by turns with petrol and petrol-alcohol blends, provided the alcohol percentage in the mixture does not exceed 20 per cent."

This remark is important in view of the fact that during the initial stages of the introduction of alcohol-petrol mixture, when it may not be available at all places, the motorist will not experience any trouble due to a change in fuel.

This has been amply demonstrated in Europe by motorists when travelling from countries using alcohol-petrol mixtures to those where pure petrol only is used.

26. The Committee would also record here its opinion that the following facts have been established in regard to the properties of motor fuels containing alcohol :

(1) *Alcohol has high anti-knock properties*, so that the addition of some power alcohol to petrol increases the " octane number " of the latter, converting it into a superior grade of motor fuel. This is a very important property, so much so that at present other properties remaining the same, the price of petrol is fixed on its octane number. Increasing the octane number of the fuel by the addition of power alcohol to petrol seems to be a more desirable method for adoption in this country than the addition of " dopes " or complicated blendings with petrol portions from different sources.

(2) *Alcohol has high latent heat and can bear high compression.*

(3) *The addition of alcohol to petrol generally increases the volatility of the latter*, so that engines can be started in the cold more easily with certain alcohol-petrol mixtures than with petrol alone.

(4) *Alcohol-petrol mixed fuels deposit less carbon in the combustion chamber of the engine.* The following quotation from a publication of the Polish State Alcohol Monopoly is of considerable interest:

"The Polish State Alcohol Monopoly organized in July-August, 1930, a long distance automobile test in order to investigate the influence of alcohol fuels upon the wear of the engine.

The tests, strictly controlled by the Polish Automobile Club, was run with an ordinary Chrysler " 66 " car. This car, fed with a 70/30 petrol-alcohol mixture, covered 12,548 miles at an average speed of 34.582 miles per hour. The total time of running was 359 hours 36 minutes, together with an interruption period of 29 hours 20 minutes. The engine had been kept running all the time, even when the car was standing still. The fuel consumption amounted to 3,656 litres or an average of 18.28 litres per 100 kilometres, including halts when the engine was running idle.

At the end of the trial, the main parts of the engine were taken out and examined carefully by the Commission. The following remarks were made :

(a) The carbon deposit inside the compression chamber and on the pistons was found to be much less than that usually found when using petrol.

(b) The sparking plugs remained clean; the porcelain insulator had no carbon deposit.

(c) The valves also remained clean and showed an insignificant wear. A little carbon was found on the inlet valve.

(d) No attack whatever, which could be traced to the use of power alcohol, was found on the cylinder walls."

(5) *Power alcohol-petrol fuels mixed in proper proportions do not have any more corrosive effect, as is sometimes alleged, on the cylinder and valves of the engine than straight petrol. The following extract from the Oil and Colour Trades Journal, 11th August, 1933, confirms the statement :*

" Dr. W. R. Ormandy writes in *The Times* saying there was ample evidence put forward at the recent World Petroleum Congress in London that the work done by the Deutsche Benzole Verband—which distributes some hundreds of millions of gallons per annum—proves that anhydrous alcohol in admixture with petrol does not constitute a source of corrosion in motor car engines. It has been further shown, he says that a mixture of anhydrous alcohol properly purified with a good petrol in proper proportions gives a fuel with a much higher octane number than the petrol alone, and gives much smoother running in the engine."

27. *Manufacture of power alcohol*—Practically the whole of the world demand for power alcohol is being met by one or other of the two processes, namely, (1) The Azeotropic process and (2) The Salt-Dehydration process.

The following table (*International Sugar Journal*, March, 1938) gives the present annual world production of absolute alcohol by these and other processes :

I.—*Azeotropic Processes :*

(a) D. D. S. or Melle system	..	..	..	Hectolitres	5,250,000
(b) "Drawinol" system	..	..	..		3,000,000
			Total	..	8,250,000

II.—*Salt-Dehydration Processes :*

(a) Hiag system (Alkali acetates)	..	..	..	3,975,000
(b) I. G. F. system (Gypsum)	..	..	..	265,000
Merck Pressure system (Lime)	..	..	..	120,000
			Total	..	4,360,000

In Appendix VIII have been given the number and capacity of power alcohol plants working on the Melle Azeotropic and Hiag Salt-Dehydration systems throughout the world.

28. *Cost of manufacture*—An accurate estimate of the probable cost of manufacture of power alcohol in India is difficult to make, mainly on account of the fact that not a single distillery in India is at present engaged in its manufacture. The Committee has, however, been able to collect from different sources a number of estimates regarding the cost of manufacture of rectified spirit of about 9¢ per cent. by volume of alcohol.

The controversy regarding the estimated cost of manufacture of power alcohol in India started with the publication of the estimate submitted by the Secretary, Imperial Council of Agricultural Research, before the Sugar Committee of the Council in a note, dated the 29th September, 1933 (*see Appendix III*). In this note, the estimated cost was worked out at As.10-8-7 per gallon, a figure which was strongly criticized from all quarters as too high. Since this estimate still seems to hold the field in certain quarters, the Committee thought it necessary to examine it more thoroughly along with other estimates submitted to it.

29. *Estimate no. I*—The estimated cost of production referred to above in the note of the Imperial Council of Agricultural Research, dated the 29th September, 1933, is as follows :

		Per gallon of spirit		
		Rs.	a.	p.
Cost of molasses at 6 annas per maund, and freight on molasses	..	0	4	9
at 4 annas 3 pies per maund	..	..	..	..
Works cost	..	0	2	9.6
Cost of denaturant	..	0	1	4.4
Depreciation on drums	..	0	0	7.7
		<hr/>		
Cost of concentration (American figure)	..	0	9	6.7
	..	0	1	2
		<hr/>		
Total	..	0	10	8.7

Estimate no. II—Another estimate of the cost of production by a Government Expert is given below. It has been based on the cost of production for one gallon of rectified spirit and of absolute alcohol for a distillery producing about 1,500 gallons per day, based on Indian conditions and taking the cost of molasses at As.4 per maund delivered at the distillery :

		Per gallon		
		Rs.	a.	p.
(a) Cost of molasses	..	0	1	10
Consumption of steam	..	0	0	9.6
Chemical products	..	0	0	3
Labour and staff	..	0	0	6
Overhead expenses	..	0	0	3
Depreciation	..	0	0	6.4
		<hr/>		
Cost per gallon of rectified spirit	..	0	4	3
(b) Cost of rectified spirit	..	0	4	3
Consumption of steam	..	0	0	3.12
Loss of alcohol	..	0	0	0.08
Loss of entraining liquid	..	0	0	0.28
Staff	..	0	0	0.20
Royalty	..	0	0	5.50
Depreciation	..	0	0	2.1
Depreciation on warehouse plant and allowance for loss of spirit by evaporation during storage	..	0	0	6
		<hr/>		
Cost per gallon of absolute alcohol	..	0	5	8.28
If the distillery be an independent unit having no connection with the sugar factory, add depreciation on the increased capital expenditure for making the distillery independent of the factory	..	0	0	2.40
		<hr/>		
Total	..	0	5	10.68

It was further pointed out that absolute alcohol (power alcohol) can also be produced directly from fermented wash, without the intermediate stage of rectifying alcohol, by the Fourth Technique of the Melle process. The cost of obtaining a gallon of absolute alcohol by this method was estimated at As.4.6, practically the same as for rectified spirit.

Summarizing the individual items into groups, the above estimates may be put as follows :

		Per gallon		
		Rs.	a.	p.
Cost of molasses	..	0	1	10
Cost of steam, chemical products, labour and staff	..	0	1	6.6
Overhead expenses	..	0	0	4
Depreciation (independent distillery) and loss	..	0	1	2.8
		<hr/>		
Cost per gallon of rectified spirit	..	0	4	11.4
Cost of dehydration as in (b)	..	0	0	11.18
		<hr/>		
Cost per gallon of absolute alcohol	..	0	5	10.68

Estimate no. III—Below are given the actual figures of the cost of manufacture of rectified spirit received from a distillery in the United Provinces, producing both “drinking” and “methylated” spirits.

	Per gallon (100 per cent. strength)	
	Rs.	a. p.
Cost of molasses at 4 annas per maund	0	1 10-50
Cost of steam, chemicals, labour and staff	0	1 8-73
Warehouse expenses, repairs and renewals to plant, works building and residential quarters, etc.	0	0 5-49
Depreciation	0	0 5-0
Management and administration	0	0 7-72
Cost of per gallon rectified spirit	0	5 1-44
Cost of dehydration (estimated)	0	0 8-68
Total	0	5 10-12

Estimate no. IV—The following are the actual audited figures for the cost of manufacture of rectified spirit of 96 per cent. by volume in a distillery in South India producing 325,000 gallons in a year. The rectified spirit is subsequently made into drinking spirit, *ark* and methylated spirit :

	Per gallon of spirit	
	Rs.	a. p.
Cost of molasses at 4 annas per maund	0	1 7
Cost of steam, chemicals, power, etc.	0	1 6
Cost of labour	0	0 6
Depreciation, including that on containers	0	1 0
Cost of management	0	0 3
Cost per gallon of rectified spirit	0	4 10

An examination of Estimate no. I reveals that the high cost of manufacture of alcohol is due to (i) the cost of molasses having been taken at As.10-3 per maund, (ii) cost of denaturant at As.1-4-4 per gallon and (iii) cost of depreciation on drums at As.0-7-7 per gallon.

30. For purposes of comparison, therefore, all the estimates have been recast on a uniform basis of cost of molasses at As.4 per maund, while the costs of denaturant and depreciation on containers have been omitted, giving figures for the cost of manufacture of power alcohol, undenatured, in the distillery.

Particulars	Estimate no. I	Estimate no. II	Estimate no. III	Estimate no. IV
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Cost of molasses at 4 annas per maund.	0 1 10-3	0 1 10-0	0 1 10-5	0 1 7
Cost of steam, chemicals, power, labour and staff.	0 2 9-6	0 1 8-6	0 1 8-73	0 2 0
Warehouse charges, depreciation, etc.	..	0 1 2-8	0 0 10-49	0 1 0
Management charges ..	(Not given).	0 0 4-0	0 0 7-72	0 0 3
Cost of dehydration (estimated).	0 1 2-0	0 0 11-28	0 0 8-68	(Not given).
Total ..	0 5 9-9	0 5 10-68	0 5 10-12	..

The total costs in all these estimates received from different sources show close agreement among themselves and also agree almost exactly with the figure of As.5-11 per gallon estimated by the Director, Imperial Institute of Sugar Technology, and given in reply to a question put in the Central Legislative Assembly in March, 1938. The high figures of the estimate

given in the note, dated the 29th September, 1933, by the Secretary, Imperial Council of Agricultural Research (Estimate no. I), were therefore more apparent than real.

31. It would be seen that the cost of molasses is the vital factor in the estimated cost of manufacture of power alcohol. At present the distilleries estimate it at As.4 per maund delivered at the distillery which leaves some margin to themselves. Indeed, one of the distilleries in the United Provinces favourably situated in the sugar factories area, is understood to have contracted at only As.2 per maund, distillery delivery basis. Under the present market conditions, the average price for molasses accepted by the sugar factories from the Molasses Exporting Company is about As.1-2 per maund, so that contracts at As.2 per maund may be considered as quite normal. However, in view of the fact that some distilleries may be situated at a distance from the sugar factory areas, the general practice is to estimate on an average figure of As.4 per maund for molasses. While agreeing that this figure is quite reasonable and there would be no difficulty for the distilleries to get their requirements of molasses at this price, the Committee would like to allow for a high margin of safety, and take for its own estimate the cost of molasses at As.6 per maund delivered at the distillery.

32. After considering the above estimates carefully, the conclusion arrived at by the Committee is that, if a modern plant of sufficiently large capacity (a) is established at a suitable place, the cost of manufacture of power alcohol per gallon would be as follows :

	Per gallon of alcohol Rs. a. p.
Cost of molasses at 6 annas per maund at the distillery (with yield of alcohol average of the estimates I, II and III).	0 2 9.45(b)
Cost of steam, chemicals, power, labour and staff ..	0 1 8
Warehouse charges	0 0 3
Depreciation	0 0 7
Management	0 0 2
Cost of dehydration	0 0 11.3(b)
(average of the estimated figures).	
Total ..	0 6 5.48

In case the price of molasses is taken at As.4 per maund, at which it is at present being estimated by the distilleries, the total cost of manufacture of power alcohol would be As.5-6.33 per gallon.

The Committee has also been advised that in a distillery, producing power alcohol directly from fermented wash by the most modern technique, the cost of manufacture of power alcohol would be reduced by about 6 pies per gallon. In other words, the cost of manufacture per gallon of power alcohol would be about (i) As.6 with molasses reckoned at As.6 per maund, and (ii) As.5 with molasses reckoned at As.4 per maund.*

Lastly, the attention of the Committee has been drawn to one of the latest publications† showing in tabular form the comparative costs of dehydration to absolute alcohol by the more extensively adopted commercial processes. The figures given in this table are stated to have been arrived at after careful consideration of all the criticism received since the publica-

(a) About 3,000 gallons per day.

(b) Revised correct average figures; originally As. 3 and A. 1 respectively.

*Messrs. Ananthasubramanyam and Maker are of opinion that it should be possible to produce absolute alcohol (power alcohol) at price a much lower than what is here estimated, when once it comes into actual working but for purposes of calculation, the price here estimated as cost of production, could be accepted.

Needless to mention, the cost of production also decreases with increase in the capacity of the plant.

†M. Klar's monograph entitled, "Fabrikation von absolutem Alkohol-zweck Verwendung-als Zusatzmittel zu Motor-Treibstoffen," published by Wilhelm Knapp, Halle, II Edition, 1933.

tion of the first edition in 1936, and their verification from a large number of actual users.—(*Zeitschrift für Spiritusindustrie*, 3rd March, 1938.)

It would be seen that according to this authority the costs of dehydration calculated in rupees per gallon by the Hiag, Melle and Drawinol systems are as follows :

Starting raw material	Salt dehydra- tion Hiag system	Azeotropic Melle system	Azeotropic Drawinol system
	Per gallon Rs. a. p.	Per gallon Rs. a. p.	Per gallon Rs. a. p.
Raw spirit	0 0 9	0 0 8.3	0 0 9.2
Fermented wash .. .. .	..	0 1 0.5	0 1 5.5

33. *Preparation and distribution of alcohol-petrol mixed fuel*—The success of any scheme for the development of the power alcohol industry depends largely upon an efficient distribution arrangement at low overall cost. It appears to the Committee that this object would be achieved to some extent, if power alcohol is made available for mixing with petrol at a number of railside petrol depots in large consuming centres, the distilleries themselves being located in proximity to them in order to ensure low transportation charges. Further, the transport of power alcohol from the distillery to the petrol depot should be only under bond in tank wagons or lorries. The process of mixing power alcohol with petrol would have to be carried out under excise supervision in accordance with the rules and regulations framed for the purpose by the executive authority. The excise supervision over power alcohol would cease after the mixture has been properly made.

34. *Denaturation*—The question of a suitable denaturant for power alcohol is a matter of vital importance. The commercial success of any power alcohol scheme would depend considerably upon the choice of a denaturant cheap but effective enough to prevent any illicit use of power alcohol. A note on the denaturation of power alcohol, together with a list of denaturants used in various countries is given elsewhere (Appendix XI).

In recommending a suitable denaturant for power alcohol to be adopted in conjunction with the scheme given later, the Committee has been guided among others by the following main considerations :

(i) The denaturant is to be as far as possible an indigenous product easily available, or capable of being manufactured in India.

(ii) In view of the fact that the cost of denaturation is essentially an extra cost, not in any way indispensable in the process of manufacture, it should be kept as low as possible by the adoption of other means to gain the same object as is sought to be achieved by denaturation.

(iii) The recommendation of the Indian Industrial Commission of 1918 to the effect that "more regard might be paid to the *likelihood* rather than to the mere possibility of frauds to the revenue, when the requirements of the commercial users conflict with excise regulations," should be brought more into practice.

(iv) Power alcohol would be made available to the distributors, and through them to the public, only in the form in which it is to be mixed with a large volume of petrol, which is in itself a denaturant.

(v) The storage, distribution and sale of power alcohol in the form of alcohol-petrol mixed fuel would be subjected to the strict regulations and conditions of the Indian Petroleum Act. These would by themselves form an effective safeguard against any attempts at mal-practices or abuses.

In case it is found that the addition of a second denaturant (other than petrol itself) is absolutely necessary, the Committee suggests that a trial be given to one of the following :

- (1) "Coal-tar Benzole"—3 parts by volume;
- (2) "Wood Naphtha"—2.5 parts by volume.

These additions are to be made per 100 volumes of power alcohol. In the opinion of the Committee alcohol-petrol mixed fuels prepared with power alcohol denatured in this way, would not require any further denaturation. It must however be emphasized that the denaturation of alcohol is essentially a preventive operation against excise offences, and any expense involved in denaturation handicaps to that extent the economic development of the power alcohol industry—a principle which is now recognized in most countries. For example, in the United Kingdom, a denaturation allowance, called "Methylation Allowance", is given to "Industrial Power Alcohol" in order to compensate for the increased cost of the latter due to the compulsory addition of the denaturants.

35. *Sale price of power alcohol*—The Committee is of opinion that power alcohol should be delivered to the petrol distributors at a number of their large storage depots at a uniform price. It is therefore desirable to give an indication of what in its opinion would be a fair price for power alcohol and on the basis of which the retail price for the standard alcohol-petrol mixed fuel may be fixed. In connection with the latter it was necessary to find out the present average cost of distribution of petrol in the United Provinces and Bihar. Unfortunately, the evidence of the representative of the petrol distributing company has not been helpful in this connection. In his oral evidence before the Committee, in answer to the question, "What are your distribution charges per gallon for petrol in the United Provinces and Bihar, which include your capital expenditure, and your interest on the stock you keep and the service you provide on the petroleum distribution in these provinces?", his reply was, "Based on all-India charges—licence, inspection, evaporation, excise and commission, it comes to anna 1 per gallon. These charges are bound to change in different provinces. The cost for the United Provinces and Bihar alone, owing to their small petrol offtake, would almost certainly be much higher." Subsequent to the evidence, the Committee was informed that the charge of anna 1 per gallon referred to the extra cost over that incurred in the main ports, and averaged throughout India, of their manifold up-country facilities—such as depots, pumps, lorries, depot and inspection staff, licence, etc. Further inquiries showed that the petrol distributing company estimated that As.6-6 per gallon, when deducted from ex-pump selling price secured for the mixture, would be the maximum price at which power alcohol should be available at the petrol depots for admixture.

The Committee finds that the excise duty is annas 10, railway freight from Calcutta to Cawnpore is annas 4, and the retailers' commission is annas 2 per gallon of petrol. The total of these three items comes to Re.1. The ex-pump price of petrol in April, 1938 at Cawnpore was Re.1-6 per gallon, while the average price for the last year was Re.1-9. The cost of

petrol together with the distribution charges to the retailers' pumps, therefore, works out at annas 6 per gallon based on the present prices, and annas 9 per gallon on the last year's average price. Taking these figures into consideration, the Committee feels that the cost of distribution as given by the above-mentioned company is very high and cannot be accepted. Dr. Bhatnagar however regrets that, owing to certain assumptions in these calculations—such as the price of the petrol at ports and whether petrol always sells at a profit, he is unable to agree to the above argument. The only way open to the Committee, in his opinion, is either to accept the price quoted by the representative or bring more convincing evidence in favour of the change. After considering the above observation of Dr. Bhatnagar, the Committee in the last meeting held on 17th April, 1938, arrived at the following conclusion :

“Assuming the Customs declaration value of imported petrol to be annas 5 per gallon (*see* Appendix II, para. 3), and some profit made by the petrol distributing companies, the distributing charges should work out between As. 2-6 to annas 3 per gallon based on the price of petrol during the last few years. Indeed, according to the present price of petrol ex-pump at Cawnpore, (Re.1-6), the distributing charges can only be about anna 1 per gallon.

“On the above basis, and taking the normal sale price of petrol ex-pump as Re.1-9 per gallon, the estimated sale price ex-pump of power alcohol contained in the alcohol-petrol mixed fuel works out as follows :

	Per gallon
	Rs. a. p.
Cost of manufacture of power alcohol at the distillery ..	0 7 0
Profits to the distillery	0 1 0
Cost of denaturation	0 1 0
Transportation charges and loss by evaporation ..	0 1 6
Direction and administration charges	0 0 3
Excise duty	0 10 0
Price of power alcohol at the petrol mixing depot ..	1 4 9
<i>Add—</i>	
Distributing company's charges	0 2 9
Retailer's commission	0 2 0
Total ..	1 9 6

Subsequent to the meeting, however, certain facts came to light, which compelled the majority of the members to modify considerably the view expressed above. The c.i.f. price of petrol had been assumed to be annas 5 per gallon, while the Monthly Statistics for the Seaborne Trade in India gives for the period 1st April, 1937 to 31st March, 1938, the average price of petrol from Burma as As. 8-8 per gallon, and that from “Other Countries” as As. 7-9 per gallon.* These figures are considerably higher than the previously assumed figure of annas 5 per gallon, when the import was almost wholly confined to Soviet petrol, and no figures were available for petrol from Burma, as the latter then formed part of India.

The Committee now finds that in view of the Customs declaration made by the petroleum importing companies of the value of petrol at the port of

* *Import of Petrol into India.*

	Quantity	Value
	Gallons	Rs.
From Burma	63,395,010	3,42,58,430
From other countries	38,660,607	1,88,03,419

entry into India being at least annas 7 per gallon, and allowing for nominal profits only, the average distribution charges all over the country should work out at about annas 2 per gallon based on the price of petrol distributed by them during the last year. Indeed, according to the present price of petrol sold at Cawnpore and other up-country towns, the distribution charges per gallon must have been cut down to a very low figure.

In view of the above facts which make the item of the distributing company's charges an extremely uncertain and controversial item, the Committee thinks it advisable to estimate the sale price of power alcohol only up to the stage when it is delivered at the petrol depot for purposes of mixing with petrol. Further, in view of the fact that the profit of the petrol distributors at the current sale price of petrol appears to be small, the Committee does not feel justified to estimate the "profit to the distillery" at anna 1 per gallon, but to reduce it to pies 6. The cost of manufacture of power alcohol has also been calculated more accurately taking the average of the various estimates, while allowance has been made for the increase in volume due to the addition of the denaturing liquids.

36. The revised estimated sale price of denatured power alcohol delivered at the petrol depots is given below :

	Per gallon Rs. a. p.
Cost of power alcohol at the distillery (with molasses at 6 annas per maund).	0 6 5.5
Profits to the distillery	0 0 6.0
Cost of denaturation	0 0 11.7
Transport charges to petrol mixing depots, loss by evaporation, etc.	0 1 6.0
Direction and administration charges	0 0 3.0
Total	0 9 8.2
<i>Add—</i>	
Excise duty	0 10 0
Price of denatured power alcohol delivered at petrol depot	1 3 8.2

In case, however, molasses for power alcohol is taken at annas 4 per maund, the price of power alcohol estimated in the same manner as above would be Re.1-3 per gallon.

The Committee is therefore of opinion that after paying an excise duty of annas 10 per gallon, and incurring an additional burden of the denaturation expenses of about anna 1 per gallon, it would still be possible to deliver power alcohol at the various petrol mixing depots in the two provinces at a price of—

(i) Re.1-3-9 per gallon, after paying annas 6 per maund for molasses, or

(ii) Re.1-3 per gallon, after paying annas 4 per maund for molasses.

37. This may be compared with the cost of imported petrol at the railside petrol depot, say in Cawnpore, calculated as below :

	Per gallon Rs. a. p.
Minimum cost of petrol at Indian port	0 7 0
Excise duty	0 10 0
Railway freight	0 4 0
Total	1 5 0

The Committee thus feels satisfied that it would be possible to deliver power alcohol at the large petrol depots at a lower cost than what it takes to bring imported petrol from the port towns.

38. Lastly, it may be mentioned that the Chairman of the Committee has been given assurance that there are several parties who would be quite willing to take up the distribution of the mixed fuel on an overall charge basis of annas 2 per gallon, provided they receive sufficient protection against unfair competition.

ECONOMIC ASPECTS

39. The Committee now proceeds to examine in detail the fiscal and economic aspects of the power alcohol industry which, as recommended, should be developed in the United Provinces and Bihar. Some of the points examined in this connection, and given below, were also raised in the memorandum submitted to it by the representative of the Burma Shell Oil Storage and Distributing Company of India, Ltd.

(1) Legislation for compulsory use of alcohol in motor fuels in other countries has been introduced,

(a) to assist the depressed state of agriculture in the case of a few countries; but

(b) in most of the countries that have no large petroleum resources of their own, to make themselves less dependent on imported petroleum, and with the further object of economizing in foreign exchange.

(2) In no country the manufacture of home produced substitutes for petroleum spirit and their compulsory sale (mixed with petrol) as a motor fuel, can be justified on economic grounds.

(3) In all the countries the use of power alcohol has been encouraged by State subsidy, direct or indirect. For example, in England (where there is no compulsory legislation for mixing) power alcohol is not only free from the tax of 8d. per gallon levied on petrol, but also receives a subsidy from the treasury of 8½d. per gallon in the form a methylating allowance, thus entailing a loss of about £420,000 per year. In France, the annual loss is estimated at about Rs.93,000,000.

(4) The result of using power alcohol has been the same in all the countries, namely—

(a) additional expense to the motoring public, and

(b) frequently also to the general body of tax-payers.

(5) So long as petrol in sufficient quantities remains available for consumption in the Indian market at anything like the present price, no genuine demand for alcohol as a motor fuel can arise.

(6) It has been urged that the production of power alcohol cannot be profitably developed under present conditions on any material scale without a policy of subsidization.

(7) Burma, despite separation, remains and must remain closely linked to India.

(8) India's full requirements of motor spirit can be met from indigenous and nearby sources of Burma.

(9) If power alcohol is introduced in the United Provinces and Bihar, the total offtake of molasses would be quite small—only 22,000 tons.

(10) No economic advantage can accrue to India from the replacement by a national product (the lower efficiency of which as a motor fuel entails additional running costs) by one obtainable from Burma, Assam and the Punjab at a lower cost.

40. Before proceeding to discuss the various issues raised above, the Committee considers it desirable to review the petrol industry and market in India. Table I gives the annual production of petrol in India and Burma during the last few years.

TABLE I
Production of Petrol
(In gallons)

Official year	In India proper excluding Burma	In Burma	Total for India and Burma
1932-33	Separate figures not available.		68,034,467
1933-34	Ditto		72,612,080
1934-35	17,741,427	63,317,124	81,058,551
1935-36	17,243,341	74,455,879	91,699,220
1936-37	16,736,269	74,352,561	91,088,830
1937-38 (April—December)	11,257,892	..	..

It would be seen that during the period of five years, from 1932 to 1937, the production of petrol in India and Burma has gone up by 23,054,363 gallons. Moreover, since the production in India proper has remained substantially the same for a number of years, it may be concluded that during the period under review the production of Burma petrol has increased by this amount. Since India is the sole outside market for Burma petrol, a very substantial part of this increase must have been absorbed in the India market.

41. Table II gives figures for the import of petrol into India which, when added to figures of production given in Table I, serve to give a fairly accurate idea of the consumption of petrol in India.

TABLE II
Consumption of Petrol
(In gallons)

Official year	Import into India	Production in India including Burma	Total approximate consumption in India and Burma
1932-33	5,116,733	68,034,467	73,151,200
1933-34	1,605,884	72,612,080	74,217,964
1934-35	1,483,274	81,058,551	82,541,825
1935-36	2,077,775	91,699,220	93,776,995
1936-37	9,747,465	91,088,830	100,836,295
1937-38	*102,055,617	..	..

It seems, therefore, that the consumption of petrol in India (including Burma) had of late been increasing at an average rate of about 7 million gallons per year. It also appears that during the year 1937-38, the quantity of petrol of non-Burmese origin imported into India has been about 60 per cent. of that coming from Burma.

*See foot-note on page 35

42. The total offtake of petrol in the United Provinces and Bihar was estimated for the year 1937 by a petrol distributing organization to have been 5½ million and 2¾ million gallons respectively. The Committee, however, thinks that within a couple of years the total quantity for the two provinces would be about 10 million gallons. The estimated consumption of petrol in some of the large towns in the United Provinces and Bihar is given in Appendix X.

43. *Excise duty and the price of petrol at Calcutta*—Excise duty on "motor spirit" levied by the Indian Motor Spirits Duties Act of 1917 was annas 6 per gallon. In 1925, the rate was reduced to annas 4 per gallon, but was again raised to annas 6 per gallon by the Finance Act of 1929. On the recommendations of the Jayakar Road Development Committee, the Government of India Road Fund Resolution of 4th February, 1930, was passed creating a Central Road Fund from the proceeds of the increased amount of the petrol duty, namely annas 2 per gallon. Out of this fund, sums were to be distributed later *pro rata* amongst the different provinces. The Finance Act of September, 1931 increased the duty to annas 8 per gallon, upon which the Supplementary Finance Act of September, 1931 imposed further a surcharge of annas 2 per gallon, bringing up the excise duty to a total amount of annas 10 per gallon. Thus, the present excise duty of annas 10 per gallon on petrol is made up of the following different items :

	Per gallon
	Rs. a. p.
Excise duty proper	0 6 0
Duty allocated to Road Development Fund	0 2 0
Surcharge (¼th of the total duty)	0 2 0
Total	0 10 0

The prices of petrol per gallon in bulk at Calcutta, reported in the *Indian Trade Journal*, were as follows :

Period	Price including duty	Rate of duty	Price charged by distributors
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Up to February, 1931	1 1 0	0 6 0	0 11 0
From March, 1931	1 3 0	0 8 0	0 11 0
From October, 1931	1 5 0	0 10 0	0 11 0
From August, 1932	1 5 6	0 10 0	0 11 6
From 10th December, 1937	1 2 0	0 10 0	0 8 0

The above table shows that in spite of a large increase in the volume of the trade between 1931 and 1937, the consumer had not been benefited by a reduction in the price he had to pay for his petrol.

44. It has already been shown that power alcohol can be manufactured in the United Provinces and Bihar at a cost of about As.6-6 per gallon, paying annas 6 per maund for molasses. This compares favourably with the present average Customs declaration value of about As.8 per gallon for imported petrol. When the railway freight to up-country towns is also added on to it, there appears considerable advantage in costs in favour of power alcohol.

The Committee, therefore, is definitely of the opinion that without any kind of subsidy, power alcohol can be marketed in the United Provinces,

in Bihar, and also in other adjoining inland areas at substantially the same price at which petrol is now being sold.

45. The considered views of the Committee on some of the other foregoing points are as follows :

(1) Burma has been separated from India. Imports from Burma cannot therefore be considered as indigenous products of India.

(2) Petrol from indigenous Indian sources, namely—Assam and the Punjab, is hardly sufficient to meet even one-fifth of the requirements of India.

(3) The suggestion that replacing a part of petrol by power alcohol would give a fuel of lower efficiency, entailing additional running costs seems to be contrary to reliable published information on the subject.

46. *Power alcohol and excise duty*—From the Note dated the 29th September, 1933, by the Secretary, Imperial Council of Agricultural Research (Appendix II), it appears that as a result of the examination of this question with the other departments of the Government of India, the following point amongst others was brought out :

“Alcohol used for motor spirit must pay the same duty as petrol— It is not possible for Government to agree to the loss of revenue which any other course would involve, nor would it be reasonable to protect the sugar industry indirectly at the expense of the indigenous oil industry.”

But a number of arguments had been placed before the Committee showing the reasons why power alcohol should not be taxed with the same amount of excise or customs duty as petrol. Of these the more important ones are given below :

(i) Power alcohol is essentially an agricultural product manufactured from indigenous sources. The development of this industry is the only practical and economically sound method of supplementing the meagre resources of indigenous motor fuel in this country.

(ii) The indigenous petrol industry of India is not likely to be prejudicially affected by any encouragement given to power alcohol.

(iii) At the rate of annas 6 per maund for molasses at distillery, the indirect help given to the sugar industry would be negligible, especially if the use of power alcohol were to remain confined in the United Provinces and Bihar.

(iv) Between the years 1933 and 1937, the consumption of petrol in India has increased by about 27 million gallons, so that the revenue under petrol excise and customs has increased substantially. A slightly smaller rate of duty on power alcohol would therefore mean only an insignificant loss of revenue to Government. For example, an excise duty at three-quarters the rate on, say, 4 million gallons of power alcohol would affect the revenue to the same extent as if the increase in consumption of petrol had been by 26 million instead of 27 million gallons.

47. Be that as it may, the Committee has estimated that under certain conditions power alcohol, undenatured, can be manufactured at a cost of As.6-6 per gallon, so that power alcohol is in a position to bear the full duty in the interior markets of India of annas 10 per gallon, should the Government require to levy it at the same rate as on petrol.

LEGAL ASPECTS

48. *Power alcohol legislation in foreign countries*—A summary of this is to be found in the Note by the Secretary, Imperial Council of Agricultural Research, to which reference has been made before. The information contained therein has been supplemented further by the Committee (Appendix II-6).

49. *Legislation regarding alcohol-petrol mixed fuel*—This is one of the controversial questions on the subject, and the Committee proposes to deal with it in detail, so as to offer some explanation for the recommendations subsequently made. At the outset it may be said that the Committee considers it desirable that the distribution and sale of the alcohol-petrol mixture should be done through the petrol distributing organizations existing in the country.

The next point to decide is whether there should be some sort of binding obligation for the petrol importers and distributors to use a quantity of alcohol for mixing with petrol. The experience of other countries in this matter has served as a valuable guide to the Committee in coming to a decision.

Of all the countries, Germany struggled very hard not to enforce compulsory mixing legislation, chiefly because the indigenous benzol industry, combined with the State Alcohol Monopoly, undertook the distribution and sale of "Monopoline", the alcohol-benzol mixture. But the foreign petrol groups not only refused to co-operate in any way, but also started an active anti-propaganda against it, so that the Reichskraftverwaltung found a definite setback in the sale of "Monopolin." Therefore the obligatory laws were brought into force from August, 1930. But, as has already been stated, to avoid hardship in special cases, a certain amount of latitude had been left for the petrol importers, in that they had the option of returning the obligatory quota of purchased alcohol to the State at a reduced price; in other words, of compounding the offence of not mixing alcohol with petrol by paying a certain amount of penalty in cash. But this penalty did not act as a deterrent; on the contrary the evil continued to increase so that the privilege had ultimately to be withdrawn and the compulsory mixing had to be rigorously enforced.

In France, on the other hand, though the law of 28th February, 1923, had fixed 10 per cent. as the obligatory quantity of alcohol to be taken by the petrol importers, yet the production of alcohol in the country had been such that the petrol companies were never asked to take more than a fraction of the obligatory quantity. Even then every device was adopted to avoid taking even this small quantity of alcohol, forcing the Government to pass the law by which "Heavy petrol" could not be sold in France except in the form of an alcohol mixture in definite proportions.

The experience of France and Germany about the attitude of petrol groups which follow a uniform policy has been sufficient for other countries like Yugoslavia, Hungary, Italy and others interested in the development of power alcohol to introduce straight away compulsory mixing laws.

50. Taking into consideration various other matters peculiar to conditions in India, as also in view of the fact that almost all the Chambers of Commerce and other commercial bodies have advocated the compulsory mixing of power alcohol with petrol, the Committee is of the opinion that the development of the power alcohol industry requires, during the initial stages at any rate, the sanction of some kind of legislation for the compulsory mixing of power alcohol with petrol before it is retailed to the consumer.

51. *The form of legislation for mixing power alcohol with petrol*—There are three different types of legislation prevailing in Europe enforcing the compulsory use of power alcohol-petrol mixed fuel, namely—

(i) All petrol of a certain grade, whether produced in the country or imported from abroad, is to be marketed only after it has been mixed with alcohol in definite proportions.

(ii) No petrol can be marketed unless it has been mixed with alcohol.

(iii) The petrol companies are obliged to take a quantity of alcohol equal to a certain percentage of the quantity of petrol imported by them during the previous month, and mix it with petrol under definite conditions. Pure petrol can therefore be marketed at the same time as the mixture.

It should be mentioned here that in many European countries there are a large number of special brands of motor fuels, known as super fuels, made of petrol, benzol and alcohol in definite proportions. About 80 per cent. of power alcohol is used in Germany for the making of these special mixtures, every petrol company having its own special brand. There is thus a considerable demand for the special qualities of mixed fuels. Even in the case of petrol, there are marketed several grades differing in specific gravity, volatility and octane number. But, in India the public is accustomed to only one fuel and it would be difficult, at least in the beginning, to get the public accustomed to the idea that an alcohol-petrol fuel is at least as good as pure petrol. It is therefore advisable to have only one kind of mixed fuel for general use.

The form of legislation that may conveniently be adopted should be of the type in which the petrol distributing companies are obliged to take a certain fixed percentage of power alcohol to be mixed with petrol in proportions regulated by executive authority from time to time, and to distribute this mixture in definite localities within which pure petrol should not be distributed.

52. *Industrial and power alcohol under the Government of India Act of 1935*—The Committee has thought it desirable to make a general survey of the legal position with regard to the Government of India Act of 1935.

There seems to be considerable doubt about the extent to which the industrial and power alcohol industry can be controlled by provincial legislation. Prior to the Act of 1935, the alcohol industry, both for human consumption and for other purposes was entirely a provincial matter, and provincial legislature had also the right to impose and appropriate to the revenues of the province any excise duty levied on alcohol used for all purposes. For example, in the United Provinces, while alcohol for drinking purposes is subjected to heavy excise duty, methylated spirit or industrial alcohol is free from excise duty. (The recent imposition of a "Sales Fee" is a different matter.)

Section 100, read with Schedule VII, item no. 45, of List I (Federal Legislative List) and item no. 40 of List II (Provincial Legislative List) of the Government of India Act of 1935, now brings about this change that duties of excise on alcoholic liquors for human consumption and alcohol used for "medicinal and toilet preparations" only, can be levied and appropriated by the province where it is manufactured so that by implication or exclusion, duties of excise on alcohol used for other industrial (methylated spirits) and power purposes are to be levied by Federal Legislation and appropriated to the Federal revenues.

53. The Committee is of opinion that with the exception of the rights to levy any excise duty and appropriate it to the provincial revenues, the provincial legislatures and provincial Governments have full rights to control the production, manufacture and development of the alcohol industry for any purpose whatsoever.

This view seems to receive support from the answer given by the Secretary for Education, Health and Lands, Government of India, on 7th September, 1937, in the Central Legislative Assembly to the starred question no. 323, when he said that the Punjab Government had addressed the Government of India in April, 1937, regarding the installation of a plant for this purpose by a certain firm subject to certain conditions, and the answer given by the Government of India was that, in view of the conditions of manufacture mentioned by the firm, the mixture would be liable to the motor excise duty.

54. As regards the question of any provincial legislature to enforce compulsory mixing of power alcohol to petrol, the Committee finds that item no. 32 of the Federal Legislative List makes petroleum a subject of Central legislation, *but only so far as regards possession, storage and transport*. The Petroleum Act (XXX of 1934) deals with the import, transport and storage of petroleum. The tests which petroleum has to undergo under this Act are for the purpose of classification into "dangerous" and "non-dangerous" according to flash point determination. The only restrictive measures contained in the Act regarding the addition of another substance to petrol or the "blending" of petroleum are to be found in the following sections :

(i) Section 4(k), which prescribes the proportion in which any specified poisonous substance may be added to petroleum, and prohibiting the import, transport or storage of petroleum in which the proportion of any specified poisonous substance exceeds the prescribed proportion;

(ii) Section 5, which prohibits the production, refining and blending of petroleum save in accordance with the rules made under sub-section (2). These rules nos. 130 to 147, relate only to the building, plants, location of storage tanks, drainage, etc., of the refinery, where the process of distillation or blending is performed.

Power alcohol is not a poisonous substance, and as there is at present no restriction in India regarding the quality of the petrol that may be marketed, except with respect to the amount of tetraethyl lead that may be present in it, the Committee is inclined to hold the view that there is nothing either in the Petroleum Act of 1934 or in the Federal Legislative List of the Government of India Act of 1935, which is repugnant to any legislation that may be passed by the provincial Government enforcing the addition of a quantity of power alcohol to all petrol before it is retailed to the public.

55. *Power alcohol industry and Government control*—The Committee has given careful consideration to the question of the advisability of Government control over the power alcohol industry, which has been advocated in some form or other in the memoranda received from the various commercial bodies and associations. Some of the more important arguments advanced in this connexion are given below :

(a) The national importance of the industry, the reasons for which it has to be developed in these two provinces, and the diversity of

interests involved in it, demand that the organization and control of the industry be to a large extent under the supervision of the Government.

(b) The control of prices and the sanction of law for mixing power alcohol with petrol can be best administered without abuse through the agency of a Government department.

(c) The alcohol industry as a whole is so intimately connected with economic and social questions of vital importance to the country that in practically every country in the world the power and industrial alcohol industry is now either under direct State control or is administered through a semi-official organization.

The Committee fully endorses the force of these arguments and is of opinion that the power alcohol industry should be established under the control of the provincial Government with a Power Alcohol Advisory Board to advise the Government generally on all matters connected with the industry. It further holds the view that for the success of the power alcohol industry it is essential that there should be some kind of Government control not only over the manufacture of power alcohol, but also over the distribution, use and retail price of motor fuels within the province. For it is obvious that no amount of Government control over the price of power alcohol delivered at the petrol mixing depots would offer any reasonable protection to the consumer unless there is also some control over the retail price of the mixed alcohol-petrol fuel.

CONCLUSION

56. The Committee has, in the foregoing pages, dealt with the subject of power alcohol, tracing its growth in the various countries of the world, and also with reference to the importance it has now assumed so far as India is concerned. It has endeavoured to deal with the properties of power alcohol and has, with the materials available, forecasted what the cost of manufacture would be. The Committee has also suggested that it would be possible for power alcohol being produced at a price, which would enable it to bear, if necessary, an excise duty equal in amount to that on petrol without imposing any additional burden either on the tax-payer or the motor owner.

It would be seen that if the entire surplus quantity of molasses, estimated at 265,000 tons, be converted into power alcohol, about 15 million gallons of it can be produced, calculating one ton of molasses as equivalent to 57 gallons of power alcohol. The total consumption of petrol being as high as 100,000,000 gallons, the above-mentioned quantity of power alcohol can be easily utilized, particularly as there would be little difficulty in the disposal of power alcohol in the interior parts of the country, where it can be sold at the same price as petrol. Thus the replacement of 15 million gallons of imported petrol by indigenous power alcohol would mean a saving of about Rs.40 lakhs per year to the country.

The Committee would like to observe here that the case for the development of the power alcohol industry within the country has assumed particular importance with the separation of Burma from India. It appears to be in national interests to encourage the manufacture of power alcohol, and thus to get rid, to such extent as is possible, of the dependence of the country on imported petrol, the regular supply of which cannot be assured during an outbreak of hostilities, when it would be in greatest demand.

Power alcohol is an ideal fuel having great flexibility, which makes it possible to be used in higher proportions for heavy types of vehicles. If, therefore, for some reasons, there is a serious shortage of petrol in the country, or if imports are obstructed, or if the price of petroleum which is dependent to some extent on political considerations is enhanced to an uneconomical level, the country would have an alternative supply of fuel, namely power alcohol, to fall back upon.

The Committee estimates that the quantity of petrol consumed in the United Provinces and Bihar will soon reach a figure of 10 million gallons,* so that the requirements of power alcohol for the two provinces will be in the neighbourhood of 2·5 million gallons, for the manufacture of which about 44,000 tons of molasses will be required. But there is no doubt that if a start is made, it will be possible to supply power alcohol to the neighbouring areas as well, and the quantity of molasses so utilized will increase gradually. Although therefore the relief given to the molasses situation in this manner in the initial stages would not be very substantial, there is the certainty that once the industry is established, it will be possible to extend considerably the use of "industrial alcohol" and "methylated spirit", as has been indicated in the following section (Section II). The Committee is thus convinced that the power alcohol industry satisfies all the necessary conditions required for the establishment of a new industry, namely a cheap and abundant supply of raw material in the form of molasses, an adequate supply of labour, and an extensive home market—present as well as potential.

57. *Findings*—The findings of the Committee on various important questions appertaining to the inquiry regarding power alcohol are given below to facilitate reference :

(a) The quantity of surplus molasses per annum is estimated at about 265,000 tons† for the whole of India.

(b) The scheme for the export of molasses from India has virtually been a failure. The average price received by the sugar factories for molasses in this scheme was anna 1 and pies 2 per maund during 1936-37.

(c) (i) The use of power alcohol-petrol fuels mixed in proper proportions in place of straight petrol is not likely to give rise to any trouble and would not ordinarily require any change to be made in the adjustment of the engine or carburettor.

(ii) The use of a 50 : 50 power alcohol—heavy petrol mixture in motor lorries and buses may be found to give more satisfaction in tropical countries like India than in Europe.

(iii) Straight alcohol, even of the usual rectified spirit strength, can be used without much trouble in specially designed stationary engines or for running tractors and other agricultural machinery.

(d) There are two recognized processes for the manufacture of power alcohol, namely, the Azeotropic and the Salt-dehydration processes. Judging from the number of installations all over the world, both the processes seem to be quite satisfactory.‡

* In 1937, the off-take of petrol was estimated at 5½ million gallons in the United Provinces and 2¾ million gallons in Bihar. For figures of consumption of petrol in the various provinces see Appendix II.

† See footnote, paragraph 16.

(e) The conditions in the United Provinces and Bihar are very favourable for the manufacture and use of power alcohol made from molasses.

(f) The power alcohol industry can be established without a subsidy from the Government. But, even if it were slightly more costly, the industry should be encouraged, as it would lead to the development of other industries.

(g) Power alcohol can be marketed in the United Provinces and Bihar, as also in the other adjoining inland areas at substantially the same, if not lower, price at which petrol is now being sold.

(h) The average price of petrol, *ex-pump* calculated for most of the large towns in the United Provinces during the greater part of 1937, was Re.1-9 per gallon.

(i) Power alcohol can be manufactured at such a cost that an excise duty almost equal to that on indigenous petrol can be levied on it.

(j) The manufacture of power alcohol seems to be a subject under the control of the provincial Governments.

(k) (i) The cost of manufacture, by the Azeotropic or the Salt-dehydration process, of power alcohol, starting from rectified spirit and excluding the cost of denaturation, would be about As.6-6 per gallon, when the cost of molasses is annas 6 per maund delivered at distillery. By adopting a modified process, it may be possible to bring down the cost to about annas 6 per gallon. Again, in case molasses is available at annas 4 per maund, these prices would further go down by about anna 1 per gallon respectively.

(ii) The price at which power alcohol may be delivered at the petrol mixing depots in these two provinces may not be higher than Re.1-4 per gallon, after paying annas 6 per maund for molasses, anna 1 for denaturants, and annas 10 as excise duty.

(l) The average cost of imported petrol at the railside petrol depot in the United Provinces works out at about Re.1-5 per gallon.

RECOMMENDATIONS

58. The Committee, therefore, make the following recommendations :

(a) The power alcohol industry should be established under the control of the provincial Government.

(b) A Power Alcohol Advisory Board should be established consisting of the following :

Chairman.

(1) The Hon'ble Minister in charge of Excise.

Members.

(2) The Excise Commissioner.

(3) The Director of Industries.

(4) One representative of the Provincial Legislative Assembly.

(5) One representative of the Provincial Legislative Council.

(6) One representative of the commercial community nominated by Government.

(7) Two representatives of the Indian Sugar Mills Association.

(8) One representative of the Indian Sugar Syndicate.

(9) One representative of the distilleries manufacturing power alcohol, nominated by Government.

(10) One representative of the distilleries manufacturing industrial alcohol, nominated by Government.

(11) One representative of the motor-fuel distributors in the province, nominated by Government.

(12) One expert nominated by Government.

(Mr. Dickson, however, is of opinion that one representative of the Upper India Chamber of Commerce, and one of the United Provinces Chamber of Commerce should be included in the Board.)

(c) The duties and functions of the Board would be to advise the Government generally on all matters connected with the industry.

(d) Necessary legislation should be enacted at an early date for the compulsory mixture of power alcohol with petrol.

(e) Petrol should not be allowed to be retailed until it has been mixed with power alcohol.

(f) The present petrol distributing organizations in these two provinces should be required to take up the distribution of the mixed fuel. Failing satisfactory arrangements being made with them, the Government should make alternative arrangement for the same.

(g) Power alcohol should be made available at all petrol depots at a uniform price contracted with the Government, inclusive of any excise duty.

(h) Petrol used for admixture with power alcohol should conform to specifications laid down by the Government.

(i) The denaturants for power alcohol may be one of the following :

(1) "Coal tar Benzole"—3 parts by volume, or

(2) Wood-spirit—2·5 parts by volume,
per 100 volumes of power alcohol.

(j) The Government should explore the possibilities of promoting the use of alcohol-mixed fuels for power purposes in agricultural operations, especially in sugarcane areas.

SECTION II

Industrial Alcohol and Agricultural and other uses of Molasses

59. *Introduction*—Having reported in Section I on all the Terms of Reference regarding Power Alcohol, the Committee would now proceed to discuss about the remaining Term of Reference, namely—to explore the other possible uses of molasses and their practical applications.

The more important uses to which molasses may be put—apart from the manufacture of power alcohol for making alcohol-petrol mixed fuels for motor cars—may be classified as follows :

- (1) The manufacture of Industrial Alcohol.
- (2) Agricultural purposes, e.g.—
 - (a) Cattle-food preparations.
 - (b) Addition to normal soils as a manure.
 - (c) Making fertilizers.
 - (d) Reclaiming *usar* soils.
- (3) Other industrial purposes, such as, for—
 - (a) Burning as a fuel,
 - (b) Making compositions and surface coat preparations for roads,
 - (c) Making plastics and artificial resins,
 - (d) Making fermentation products other than alcohol.

The Committee has made an attempt to get as much information on each of these uses as could be had within the limited time at its disposal. Its Findings and Recommendations in this Section of the report are therefore necessarily subject to this limitation.

I—INDUSTRIAL ALCOHOL

60. *Definition*—The term “Industrial Alcohol” has been used by the Committee to denote all kinds of alcohol which can be obtained by the ordinary rectification of fermented wash without the use of any special devices for bringing about more complete dehydration. It therefore includes “rectified spirit”, “methylated spirit”, “specially denatured alcohol”, in fact all spirits of which the strength is not more than 96 per cent. by volume. Wherever reference has to be made to specially dehydrated alcohol of strength higher than this, the term “absolute alcohol” has been used.

In view of the fact that “industrial alcohol” as defined above is also extensively used for the generation of power in internal combustion engines, the Committee suggests that the term “Industrial Engines Alcohol” be adopted to denote this kind of alcohol in order to distinguish it from “Power Alcohol” as defined in Section I. This distinction in name is being suggested solely from the point of view of convenience in excise administration; for it has been recommended later that this kind of alcohol should be practically free from any excise duty.

61. *Manufacture and cost*—The manufacture of industrial alcohol is at present being carried out in all distilleries in India, which are equipped with patent continuous stills. In fact, the alcohol as it comes out of these stills is what is known as “rectified spirit” and the strength varies generally from 90 per cent. to 96 per cent. by volume. The subsequent manipulation of this

spirit in warehouses by the addition of water, chemicals, or other substances, converts it into various forms of drinking spirit, "methylated spirit", or "specially denatured spirit". It may be mentioned that distilleries equipped with plant for the manufacture of power alcohol can also produce industrial alcohol, but not *vice versa*.

It is estimated, from what has been shown in Section I, para. 32, that the cost of manufacture of industrial alcohol, undenatured, would be about Re.0-5-6 per gallon, after paying for molasses at the rate of 6 annas per maund delivered at the distillery.

62. *Uses*—The various uses of industrial alcohol may be grouped under the following heads :

- (1) *As a liquid fuel*, for generating power in slow speed engines mainly for agricultural purposes.
- (2) *For household purposes*, chiefly for heating, lighting and cleaning, in the form of what is commonly known as "methylated spirit".
- (3) *As a raw material*, required in the manufacture of—
 - (a) Vinegar,
 - (b) Medicinal preparations, such as, tinctures and extracts,
 - (c) Toilet preparations and perfumed lotions,
 - (d) Transparent soap, and
 - (e) Chemicals and other solvents of the ester type;
- (4) *As a solvent by itself for*—
 - (a) Shellac and other spirit-varnish preparations,
 - (b) Extraction of oil from seeds and cakes,
 - (c) Extraction of essential oils, and
 - (d) Nitrocellulose preparations.

63. Most of the above-mentioned uses of industrial alcohol are fairly well known, with the possible exception of the use of straight alcohol as a liquid fuel for power generation in internal combustion engines, though this may become an important outlet for industrial alcohol, especially in view of the possibility of the latter becoming available in the United Provinces and Bihar at a low cost. Appendix IV gives the consumption of industrial alcohol for various purposes in some of the more important countries in Europe and America.

It is an established fact that industrial alcohol can be successfully used in internal combustion engines designed for petrol, provided minor adjustments are made and slight difficulties in "starting cold" be neglected, though in specially designed engines with high compression ratio this fuel can be used with better efficiency, and in spite of the considerably lower calorific value the excess fuel consumption per brake-horse power-hour may not be more than one-third that obtained with petrol. (See Appendix I-A). The only impediment to the extended use of industrial alcohol for power generation in motor trucks and small engines for agricultural purposes in most countries has been its high cost compared to petrol. But wherever the difference in price is not high, industrial alcohol has been in general use for this purpose as in Poland, Brazil, and the Philippines.

It is understood that experimental work has been undertaken by the Mysore Sugar Company, Limited, on its transport system in the use of an alcohol fuel consisting of spirit of 96 per cent. strength by volume, denatured with $2\frac{1}{2}$ per cent. of petrol and $\frac{1}{2}$ of pyridine and the results obtained are reported to be encouraging. There have been practically no carbon

deposits in the engine, and the high gear performance of the vehicles run on this fuel was found to be very satisfactory.

Reliable data about the cost of generating power in engines specially designed for running on alcohol are not available, but the investigations of Professor Wawrizonik given in Appendix I-A show that if industrial alcohol be used even in the ordinary low compression petrol engine, the consumption of this fuel would not be more than 0.143 gallon per brake-horse power-hour. There is no doubt that when used in specially designed high compression engines, the fuel consumption would be much better. It therefore, appears that there are great possibilities in the extended use of industrial alcohol for running trucks, agricultural machinery, water-lifting pumps, and small power-plants in isolated rural areas, specially where sugar factories are located.

64. *Household purposes of heating and lighting*—Evidence has been adduced to show that in countries like Czechoslovakia, intensive propaganda has resulted in increasing considerably the use of industrial alcohol for household purposes, such as, for heating and lighting. A certain quantity is also used for cleaning windowpanes and glass showcases. Most of the fully denatured alcohol in Europe is consumed for these purposes. The propaganda for increasing the consumption of the so-called "methylated spirit" has been in the shape of the introduction of cheap but efficient spirit stoves, burners, and lamps. In India also there seems to be considerable scope for the extended use of methylated spirit in this direction and there is no reason why a determined effort should not be made to replace a part of imported kerosene by indigenous alcohol. Modern designs of spirit stoves are in many ways superior to and safer than kerosene stoves, for firstly, they do not work under pressure, and secondly, burning alcohol fire can be easily quenched with water. It is interesting to find that during 1936-37 about 124,500 stoves were imported into India.

The gas mantle industry is getting established in India, and it should be a comparatively easy matter to introduce spirit-burning mantle-lamps. It is possible to make these lamps almost as cheap as the ordinary kerosene ones, and yet get practically as bright a light as is given by the so-called "Petromax" lamps. The price of white kerosene in Cawnpore in bulk is about Re.0-12-6 per gallon, so that it may be possible for methylated spirit to be put in the market at a price which would compare favourably with kerosene even in terms of cost per calorie. This point deserves careful consideration in the problem of street lighting in municipal areas not served by electricity.

While on this subject the attention of the Committee has been drawn to certain experiments carried out in France by the Conservatoire National des Arts at Matiers, in July 1922, with regard to the comparative lighting effect of refined kerosene and a mixture of the same containing 10 parts by volume of absolute alcohol. The results are given below :

Products	Intensity of luminosity in 'candle powers'	Consumption in grammes	Calorific power in calories
(1) Refined kerosene	49	27	11,065
(2) Refined kerosene 90 c.c. Alcohol (99.8 per cent.) 10 c.c. ..	49.9	25	10,600

These experiments seem to receive a certain amount of support from work carried out on the same lines at the Imperial Institute of Sugar Technology. The Committee therefore suggests that this problem may be more thoroughly investigated. If the results are confirmed, a very large field for the consumption of alcohol would get opened up in these two provinces, for the statistics show that the quantity of kerosene imported into the United Provinces during 1936-37 was over 22 million gallons.

65. *Alcohol as a raw material for other industries*—There is no doubt that one of the best and most profitable uses for molasses would be to make alcohol and supply it to the various industries that require it as a raw material. The use of alcohol in medicinal preparations and in making transparent soap is fairly well established in this country. Of the others, the manufacture of vinegar is likely to meet with immediate commercial success. Considerable quantities of alcohol are utilized in Europe for this purpose. In Germany alone, over 2 million gallons of alcohol are converted per year into vinegar. The manufacture of acetic acid and its products is closely related to that of vinegar, and there are considerable potentialities for it, in case the artificial silk industry by the "Acetate process" is established in this country. At the present time, the requirements of acetic acid in India are comparatively small. Attention must also be drawn to the fact that the manufacture of acetic acid by synthetic processes is being largely developed abroad at a price at which it would become increasingly difficult for indigenous acetic acid to compete for use in industries.

Large quantities of alcohol are now being used in the manufacture of organic solvents of the ester type, which are used for dissolving nitrocellulose and resins in the preparation of lacquers. Unfortunately, the nitrocellulose lacquer industry in this country is not yet established and the demand for these commercial solvents in the near future is not likely to be anything substantial. However, it is desirable to keep a close watch over the market for these products and laboratory investigations may be taken in hand to study the commercial possibilities of their manufacture at competitive prices. The use of alcohol as a solvent for shellac and other gums in the preparation of spirit varnish is well known and considerable quantities are being used in India for this purpose. The Committee has been advised that the use of alcohol as a solvent for the extraction of vegetable oils from seeds and cakes is being developed in some countries, while similar investigations are also in progress in the United Provinces. There is no doubt that with a cheap supply of industrial alcohol in the country there are great possibilities for its use as a solvent for extraction and refining purposes. The Committee is of opinion that every facility should be given, from the excise point of view, to encourage experimental investigations for commercial possibilities in these directions.

66. In the matter of levying excise duty on industrial alcohol, the policy adopted should be similar to that prevailing in most of the countries of Europe, namely, freedom from or only nominal duty for all kinds of industrial alcohol with the exception of that used in toilet preparations. In support of this policy, the Committee would like to refer to the purchase and sale price of alcohol for different purposes fixed by the State in Germany (See Appendix XIII).

II—AGRICULTURAL USES

67. (1) *Cattle food preparations*—Various attempts had been made in the past to utilize molasses for feeding cattle, but the results had not been favourable, so that the consensus of opinion now generally held by the experts on the subject in India is that in the raw form it should not be used for this purpose.

Experiments have therefore been undertaken, financed by the Imperial Council of Agricultural Research, to make composite cattle-feed from bagasse screenings, oil-cake and molasses, and to investigate carefully the results of including this composite material in the daily ration of dairy cows and other cattle. The results of these experiments, so far received, have shown that in most cases animals have after a little persuasion been induced to take to it with no marked ill-effects on account of this change in diet from the standard ration. However, there seems to be considerable doubt regarding the economics of feeding molasses to cattle in this way. All that can at present be said is that in case these experiments prove successful and the economic aspects are properly worked out, a considerable outlet for the utilization of molasses through this channel may substantiate in the near future. The results of these experiments should therefore be closely watched by the Agricultural and Veterinary Departments of the two provinces.

In this connexion the attention of the Committee has also been drawn to the proposal of making cattle food from molasses in the form of yeast. Sir John Russell in his "Report on the work of the Imperial Council of Agricultural Research in applying science to Crop Production in India", 1937 (page 13), refers to this subject in the following words :

"The possibilities of utilization fall into three groups—

- (1) Conversion into food (including yeast) for human beings or for animals;
- (2) The making of fermentation products, such as industrial alcohol, acetic acid; and
- (3) Industrial utilization as fuel, road surfacing material, fertilizer, etc.

Of these I regard the first and second as the most important and the third as the least important; it seems unfortunate to divert so much potential food to other purposes."

68. Composite cattle-feed preparations are somewhat cumbrous to manufacture, and involve comparatively heavy expenditure on account of transportation charges. Yeast, on the other hand, is proteid matter in a highly concentrated compact form, easy to transport, while a very small quantity need be given at a time to the animal in the daily ration. The advantage of making cattle-food yeast is that the latter is a by-product of the alcohol industry, and its manufacture can be easily carried on in every distillery with a slight change in the early stages of the process. The manufacture of the two products—Alcohol and Yeast—can therefore be brought under one single organization, giving a certain amount of latitude for adjustment of their prices. The manufacturing process is also so flexible that the relative quantities of the two products obtained from a fixed quantity of molasses can be regulated to a large extent in order to suit marketing conditions. It may be interesting to note that to produce the same quantity of alcohol, almost three times the quantity of molasses may be utilized, if the manufacture of yeast is also being carried on at the time. It is thus possible that by a judicious organization of the manufacture and sale of alcohol and yeast, the problem of surplus molasses so acute in the congested areas of sugar factories may be capable of a comparatively easy solution.

69. The Committee therefore suggests that in initiating any comprehensive scheme for the development of the alcohol industry in these provinces, where there is likely to be an excessive surplus of molasses, the Government should seriously consider the economic possibilities of linking up a number of small yeast-making distilleries attached to sugar factories, with larger distilleries located at more central places, rectifying the raw alcohol supplied by the former.

70. (2) *Manure and fertilizer*, and

(3) *For reclaiming usar soils*—The utilization of molasses for these two purposes seems to have been the subject of a fair amount of experimentation in different parts of India and abroad. The subject has, in recent years, been widely discussed in scientific circles, leaving no doubt about the great interest aroused in the matter. The Committee therefore tried to get the most authentic information about the results of the experiments carried out by the Agricultural Departments in the various provinces, who were also requested to give their views regarding the extent to which they were prepared to recommend the use of molasses for these purposes. Unfortunately the reports received have been of a somewhat conflicting nature and the Committee feels considerable hesitation in arriving at any conclusions in these matters. It is reported that the Government of the United Provinces are thinking of appointing a special committee to enquire into the question of the manurial value of molasses. In the opinion of one of the members of the Committee (Dr. N. R. Dhar), the use of molasses as manure with a view to increase the yield of crops has been proved beyond doubt in the case of rice and possibly also in the case of sugarcane. The economic aspects of the proposition, however, need further investigation in view of the transport difficulties. As regards the application of molasses for reclaiming *usar* soils, he considers that it has met with uniform success in various provinces, particularly in Bihar and the United Provinces as also in Mysore, from where it has been reported to him that *usar* lands, which had been treated with molasses three years before, continued to give a good crop of paddy, average yield being 1,250 lb. per acre. Thus it seems that the proposal to reclaim *usar* soils by the addition of molasses has gained a certain amount of support from some quarters, and systematic field investigations have been taken up at many places to verify the results claimed for the process in comparison with other well known processes. Further, the Committee has been given to understand that investigations on this subject are shortly to be undertaken in the United Provinces, financed by a special grant made by the Government for the purpose.

A summary of the reports received from the various Agricultural Departments in reply to the enquiry made by the Committee is given in Appendix XVIII-(A—E).

71. The Committee as a whole is not in a position to express any definite opinion in the matter, but would like to mention that the Agricultural Departments of the United Provinces and of Bihar should take interest in the subject and continue their experiments with the reclaiming of alkali soils by the use of molasses or a mixture of molasses and press-mud.

III—OTHER INDUSTRIAL USES OF MOLASSES

72. (a) *As fuel*—Attempts had been made in some factories for burning molasses under the boiler as a supplementary fuel, when it could not be disposed of in any other way. Without entering into the merits or otherwise of molasses as fuel, the general opinion on this use of molasses is well expressed in the following words: "It is a pity to throw away molasses in this way"—an opinion with which the Committee finds itself in full agreement.

(b) *Road composition and road surfacing material*—A few years ago, attempts were made in Mysore to use solutions of molasses in water in consolidating roads subjected to heavy traffic, but were subsequently given up. The attention of the Committee was invited to the investigations in this

direction being carried out at the Imperial Institute of Sugar Technology, Cawnpore, and which were reported in the *Indian Trade Journal Supplement*, dated 10th February, 1938. The Committee however is of opinion that though the possibilities in this line of investigation are great, the work is yet in the early stages of experimentation, and it is not likely that in the immediate future a substantial outlet for molasses would be found for this purpose.

(c) *Plastics and resinous material*—The subject of utilizing molasses in the making of plastics and resinous material seems to be still in the laboratory stage and no information was available to the Committee in this matter.

(d) *Fermentation products other than alcohol or yeast*—It seems that a fair amount of work has been carried out in some countries on the production of substances other than alcohol and yeast by conducting the fermentation of molasses by special methods. Lactic acid, citric acid, and glycerine are reported to be some of these products which are being made commercially by the fermentation of molasses.

73. The Committee is not in a position to make any comments but feels sure that any commercial enterprise that takes up the manufacture of chemicals and commercial solvents from molasses is bound to extend its activities into the possibilities in this direction.

FINDINGS

74. The findings of the Committee on various important questions with regard to the uses of industrial alcohol and also of molasses for other industrial and agricultural purposes are given below :

(1) There is a large field in India for expansion in the use of alcohol for industrial purposes.

(2) The use of "methylated spirit" for purposes of heating and lighting may be considerably increased by suitable propaganda, especially when there is possibility of marketing it at a price competitive with kerosene.

(3) The "Vend-fee" of 8 annas per gallon levied on methylated spirit is very high as compared with the excise duty on kerosene.

(4) The high rate of "Vend-fee" on methylated spirit is a great handicap against its more general use.

(5) The present market in India for vinegar, acetic acid, commercial organic solvents, and such other products wherein alcohol is used as a raw material, is small, but is capable of being developed.

(6) The use of molasses as a fuel is unremunerative.

(7) The use of molasses for making road compositions is still in the early stages of experimentation.

(8) Investigations regarding the utilization of molasses for making composite cattle-feed have so far not given any discouraging result.

(9) Yeast for cattle-feed can be manufactured from molasses at the same time as alcohol, and the economic possibilities in this direction seem to be attractive.

(10) The use of molasses as manure in normal soils has not received much support from the majority of agricultural experts in India.

(11) The use of molasses for reclaiming *usar* soils has aroused considerable interest and is being tried in different parts of India. At many places encouraging results have been obtained and extended trials are being given to this process of reclamation.

RECOMMENDATIONS

75. (1) "Industrial Alcohol" for use in internal combustion engines should be (i) more heavily denatured than power alcohol; (ii) free from any kind of excise duty; and (iii) sold at almost the cost price.

(2) Research work should be undertaken by the Government on all technical matters connected with the use of industrial alcohol for power generation in stationary engines, tractors and lorries.

(3) Intensive propaganda work should be done to popularize the use of methylated spirit for household purposes, such as for heating and lighting.

(4) Facilities should be given by the Excise Department to encourage experimental investigations for the commercial use of industrial alcohol for solvent and other purposes.

(5) Investigation should be made into the commercial and practical possibilities of combining the manufacture of alcohol with that of yeast for cattle feeding.

(6) The results of the experiments now being carried out under the Imperial Council of Agricultural Research on (i) the feeding of cattle with bagasse-oilcake-molasses cakes, and (ii) road-making and surfacing compositions, should be closely watched by the Government, as these uses may form in future substantial outlets for molasses.

(7) The Agricultural Departments of the two provinces should give an exhaustive trial to the method of reclaiming *usar* soils by the application of molasses, and study carefully the economic aspects.

CONCLUDING REMARKS

76. The terms of reference to the Committee are as follows :

- (1) To advise on the manufacture of power alcohol out of molasses;
- (2) To report on the best method of manufacture;
- (3) To report on the best method of manufacturing petrol-alcohol mixture; and
- (4) To explore the possibilities of the use of molasses in other practical applications.

Under the first heading, the Committee has stated that the manufacture of power alcohol out of molasses is a feasible proposition, being an economic one, and that power alcohol could be manufactured and sold in the United Provinces and Bihar, and in other interior places, at a price which could be less than the present selling price of petrol, and which could bear, if necessary, the same excise duty as the Government of India may levy on petrol.

The Committee feels that the best method of developing this industry, which is an important one, would be by introducing legislation in the United Provinces and Bihar, and in such other provinces as would like to do so, making it compulsory for all petrol sold in these provinces, to be mixed with power alcohol in a definite proportion, say, 20 per cent. by volume of power alcohol.

The petrol-alcohol mixture should be prepared under Government supervision, which could be effectively done by the entire production and distribution being regulated by an Advisory Body referred to elsewhere.

As regards the best method of manufacture, there are two well-known processes—Azeotropic and Salt-dehydration—both of which can be tried in India.

The mixture of petrol and alcohol does not appear to present any serious difficulties. The best and the practical method of effecting this appears to be, for alcohol to be transported in bond from the various places of production, to places where there are bulk installations by the distributing agencies for effecting alcohol-petrol mixture, the actual mixing being done in a suitable manner, as may be decided upon to safeguard the interests of the Excise Department.

The Committee is of opinion that the other uses which molasses could be put to, e.g., for the surfacing of roads, for feeding cattle, and for reclaiming *usar* soils, are still in the experimental stage, and the various problems connected with them have not been sufficiently worked out.

The Committee therefore feels that from the economic point of view, the most profitable outlet for molasses—an important by-product of the sugar industry now running almost to waste—is in the manufacture of alcohol required for power generation and for other industrial purposes. It is also convinced that several other industries, such as the manufacture of commercial organic solvents, acetic acid, chemicals requiring alcohol as one of the raw materials or ingredients in their manufacture will develop in the country with the establishment of the power alcohol industry.

There can be no doubt that in modern times the production of motor fuel is a matter of vital importance to every country, and it would be desirable if India developed her resources for the production of a motor fuel which can be pressed into service, if and when necessary, for purposes of speeding up the mechanization of the army, and the development of air-craft. The early establishment of the power alcohol industry on a sound basis will enable India to become an object of strength not only to herself but also to the Empire.

77. The members of this Committee desire to place on record their high appreciation of the services rendered to the Committee by Dr. N. G. Chatterji, who combined the functions of a Secretary with those of a member. His wide knowledge, deep insight into the problems before the Committee, and his capacity for hard work have been of great use to them.

The Committee also desires to record its appreciation of the services so willingly rendered by Mr. G. D. Tripathi, the Stenographer.

The members of the Committee also desire to record their sense of gratitude to Lala Padampat Singhania, the Chairman of the Committee, for his courtesy, patience, and tact throughout its deliberations.

PADAMPAT SINGHANIA (*Chairman*).

*N. R. DHAR.

G. H. DICKSON.

R. ANANTHASUBRAMANYAM.

*P. S. MAKER.

*M. P. GANDHI.

S. S. BHATNAGAR.

N. G. CHATTERJI (*Secretary*).

CAWNPORE :

Dated June 15, 1938.

N. G. CHATTERJI,
Secretary.

*Signed subject to the note attached.

Note by Dr. N. R. Dhar

Molasses as a manure—In Java attempts have been made since 1911 to utilize molasses as a manure. Applying 1,600 gallons of molasses per acre an increased yield of paddy to the extent of 43 per cent. has been obtained in that country. In Mauritius, in Antigua, and in Queensland increased yield of sugarcane has also been reported. In the Bundeberg Farm in Queensland, Dr. Kerr obtained 37.1 tons of sugarcane per acre of land with 10 tons of molasses as manure whilst without molasses the yield was 22.7 tons per acre.

An increase in the yield of 36 per cent. has been reported of sugarcane at the Shahjahanpur Government Farm on applying 10 tons of molasses per acre. Messrs. Parry and Company, Limited, Madras, have also obtained an increase of 40 per cent. Several trials at Allahabad show that molasses produces highly beneficial result in the yield of paddy. But where molasses is added to the growing crop, no beneficial result is obtained. The value of molasses as a manure is chiefly due to the presence of carbohydrates, potash, phosphate, and calcium salts. The carbohydrates when added to the soil are oxidized and cause fixation of atmospheric nitrogen in the soil. Moreover, the same substances also help in the conservation of soil nitrogen. As the sugars have to be oxidized in the soil for the increase of nitrogen, there should be an interval of about 1 month or 5 weeks between the application of molasses and sowing of the crop. The cases of failures appear to be due to the neglect of the time factor required in the fixation of atmospheric nitrogen.

I am of the opinion that molasses should be used in improving the yield of paddy and sugarcane when applied 4 to 5 weeks before the sowing at the rate of about 10 tons per acre.

*Molasses in *usar* (kallar) land reclamation*—It is estimated that the total area of *usar* land in the United Provinces alone is more than 5,000,000 acres. Dr. J. A. Voelcker, who examined the extent of alkaline land in Northern India, stated in his "Improvement of Indian Agriculture" London, 1893, page 55, as follows: "Enormous areas, especially in the plains of Northern India, are thus affected, and in the North-West Provinces alone there are between four and five thousand square miles of *usar* land." In the Punjab, in Bihar and in the South of India, there are vast tracts of such unproductive lands. Naturally, the reclamation of these lands is a problem of great importance to India. The salts, which made these lands unfit for growing crops, are the carbonate, sulphate and chloride of sodium; sodium carbonate is chiefly responsible for the unproductiveness of such lands, which are generally heavy clay soils and are very often termed *Pattier* waste lands.

As early as 1874, the Irrigation Department of North-West Provinces was trying to reclaim *usar* land and in 1877 a "Reh" Committee was appointed to investigate the problem. Subsequently, experiments were started at Awa in 1879, at Cawnpore in 1882 and at Aligarh in 1885. Unfortunately, as no qualified chemist was associated in these experiments no substantial results were obtained as is evident from the following letter of 13th November, 1935:

"*Usar* reclamation experiments were carried out by this Department at Jubi (Cawnpore) and Abbaspur (Unao) without appreciable results and the *babul* plantations at the places were transferred to the Forest Department."

The late Dr. J. W. Leather, who was the Imperial Agricultural Chemist, carried on the analysis of the scrapings from *usar* fields near Aligarh and other parts of United Provinces and also tried to reclaim *usar* by applying gypsum. His results show that no wheat grows on soils containing 0.008 per cent. to 0.082 per cent. sodium carbonate even when treated with gypsum.

Leather's conclusions (Investigation on *Usar* Land in the United Provinces, by J. W. Leather, Allahabad, 1914, page 37) are as follows :

(1) The only experiment which can claim to have really reclaimed the *usar* land is the application of gypsum. The cost of sufficient gypsum to affect this was very great—about Rs.700 to Rs.800 per acre—and is obviously prohibitive. Even if the cost of gypsum could be reduced to one-half (what was employed cost about Rs.20 per ton), it would still be too expensive if required in the quantity that this land did require it.

(2) The effect of deep and good cultivation coupled with heavy manuring has not been either what is indicated to the unaided eye nor what might have been anticipated. The surface foot of soil has been apparently reclaimed, but below this the soil is as bad as ever.

(3) Scraping off the salts is practically useless.

Defects of alkali lands—The chief defects of alkali land are—

(1) *High alkalinity*—We have examined several samples of bad *usar* lands and we find that the pH is as high as 10.8. Neither azotobacter nor nitrite-formers are observed in cultures obtained with these soils.

(2) The amount of calcium compounds is less in these soils than in normal ones.

(3) The nitrogen content is small. In several samples examined by us the total nitrogen varied from 0.008 to 0.02 per cent. (normal soils contain 0.05 to 0.1 per cent. nitrogen).

(4) The soil is highly impermeable to water.

(5) The soil particles do not settle readily when shaken with water and become sticky.

(6) The soil lacks bacterial activity and organic matter.

Molasses containing acids, carbohydrates, soluble calcium salts, phosphates, potash, etc., can readily remove all these defects of alkaline lands.

Alkaline lands have been successfully reclaimed near Cawnpore, Allahabad, and in Mysore by the application of molasses at the rate of one to ten tons per acre and good crops of paddy and barley have been grown in these reclaimed areas, where no vegetation ever grew. The amount of molasses necessary for reclamation depends on the quality of the alkali soil.

The cost involved in reclaiming *usar* land by treatment with molasses appears to be less than what it is with either gypsum or sulphur.

Statistics show that only 0.75 acre of land under cultivation is available *per capita* in India as against 2.6 acres in United States of America and 2.3 in France. It appears that very little land under cultivation is available in this country and land reclamation is of vital importance for the welfare of the masses of India. I am of opinion, therefore, that as there is a future

for the application of molasses in alkali land reclamation, the Agriculture Department of the Provincial Government should go ahead with this problem of reclaiming *usar* land by the application of molasses.

My recommendations in this connection are—

(1) Molasses should be used as manure for the cultivation of paddy and sugarcane.

(2) The Agriculture Department should go ahead with alkali land reclamation by the application of molasses and grow paddy and barley in the reclaimed lands.

N. R. DHAR.

APPENDIX I

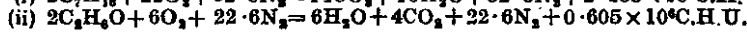
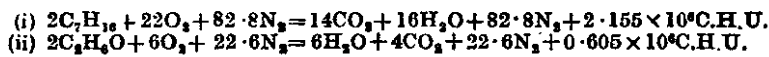
A Note on Some of the Properties of Motor Fuels containing Alcohol

A—ALCOHOL FUELS AND POWER DEVELOPMENT

1. Heat value of combustible mixtures in the engine and power output

Pye, in his "Internal Combustion Engine," 1931 (page 54), has shown that the calculated power of an engine would be proportional to the heat generated per standard cubic foot of the mixture sucked into the cylinder, multiplied by the volume ratio on combustion, which is the ratio of the number of molecules of the various products of combustion to those of the combustible mixture. This may be regarded as potential source of increased power from an engine; the higher the ratio the greater the assessment of the value of the mixture as a working substance.

By way of illustration, we may take the case of heptane, C_7H_{16} of calorific value 10,700 C.H.U. per lb. and Ethyl alcohol, C_2H_5OH , of 6,540 C.H.U. per lb. The combustion of the correct fuel-air mixtures, together with the heat generated, is as follows:



Hence, the quantities of heat generated per mol of the fuel-air mixture are:—

$$(i) \text{ For heptane: } \frac{2.155 \times 10^6}{106.8} = 20,180 \text{ C.H.U.}$$

$$(ii) \text{ For alcohol: } \frac{0.605 \times 10^6}{30.6} = 19,750 \text{ C.H.U.}$$

Taking into consideration the volume ratio of the products of combustion to the initial gas mixtures, the total energy of the fuel-air mixture would be—

$$(i) \text{ For heptane, with a volume ratio of } \frac{112.8}{106.8} \text{ or } 1.056 :$$

$$20,180 \times 1.056 \times \frac{1,400}{359} = 83,100 \text{ ft.-lb. per standard cubic foot.}$$

$$(ii) \text{ For ethyl alcohol with a volume ratio of } \frac{32.6}{30.6} \text{ or } 1.065 :$$

$$19,750 \times 1.065 \times \frac{1,400}{359} = 82,200 \text{ ft.-lb. per standard cubic foot.}$$

It would thus be seen that even though the calorific value of a substance is considerably lower than that of another, the correct combustible fuel-air mixture may have practically equal energy content on account of a smaller proportion of air required for combustion and consequently lesser dilution with the inert nitrogen. It is rather interesting to find that in the case of all the more common liquid fuels, the energy content of a correct mixture is almost identical, as shown in the following table compiled by Ricardo.*

Substance	Specific gravity at 15°C	Lower calorific value in C.H.U.		Latent heat of evaporation C.H.U. per lb.	Ratio by weight in correct mixture	Volume ratio on combustion	Heat liberated per S.C.F. of correct mixture	Total energy per S.C.F. of correct mixture C.H.U.
		Per lb.	Per gallon					
Petrol ..	0.76	10,430	79,200	73	14.6	1.047	57.0	59.7
Heptane (97 per cent.)	0.69	10,700	73,900	75	15.1	1.056	56.9	60.1
Benzol ..	0.88	9,640	85,200	95	13.2	1.013	57.6	58.4
Ethyl Alcohol (pure).	0.79	6,540	51,800	220	8.97	1.065	56.6	60.3
Rectified spirit (95 per cent.)	0.815	6,040	48,900	246	8.4	1.065	54.5	58.0

* Pye: "Internal Combustion Engine", page 242.

2. Power Development in Motors

The development of power in motors depends a good deal upon the construction and working of the carburettor. The work of Ricardo, Hubendick and others has established the following facts and general relationships :

(1) With most fuels, starting with low revolution speeds, the power developed at first rises quickly, reaches a maximum, and then falls down when the rate of revolution is still further increased.

(2) The maximum power is developed when the ratio of fuel to air is higher (4--6 per cent.) than that necessary for complete combustion.

(3) The maximum efficiency is obtained when the ratio of fuel to air is lower (about 4 per cent.) than the correct mixture.

(4) With alcohol the increase in power is very marked—much more than with petrol—amounting to nearly 10 per cent. with very rich mixtures.

(5) For smoothness and flexibility in running, multi-cylinder engine must be fed with mixture slightly on the over-rich side.

Comparison of the properties of petrol and alcohol-petrol mixed fuel in motor car engines

Professor Hubendick contributed a paper in the World Power Conference, London, 1928, on the Use of Ethyl Alcohol as Motor Fuel (Transactions—Vol. III, pages 724-748), based on the results of an exhaustive series of comparative experiments with petrol and petrol mixed with varying amounts of alcohol. For each mixture, the effect and the consumption of fuel per horsepower-hour for different sizes of the carburettor jet were registered graphically. The following is a summarized extract of a part of his paper.

“Series of experiments were carried out with undiluted gasoline and with gasoline mixed with 10, 15, 20, 25 per cent., etc. of alcohol, for each type of fuel tests were made with different sizes of carburettor jets. The series of graphs obtained in this manner is very instructive. It shows that, with a minimum fuel consumption, the results of the experiments with undiluted gasoline and with gasoline containing 10, 15 and 20 per cent. of alcohol very nearly coincide. In reality, the heat consumption decreases slightly within the above limits, as the percentage of alcohol in the fuel increases although the difference is very small. Hence in the case of a carburettor adjusted for use with gasoline, not more than 23 per cent. of alcohol must be present in the gasoline-alcohol mixture, if good results are to be obtained. This fact can be explained by assuming that the characteristic properties of the alcohol do not exert themselves appreciably until the proportion of the alcohol has increased to 23 per cent. If the percentage of alcohol be still further increased, the physical properties of the alcohol commence to exert their influence, and it becomes necessary to readjust the carburettor. It may be mentioned that the results given above do not refer to those obtained on one engine only, but are entirely consistent with results obtained with different types of motors, showing only slight variations in actual quantities.

“Summarizing, it has been shown that gasoline can be mixed with alcohol in such proportions that the mixture contains up to 25 per cent. of alcohol without this proving detrimental to its use as fuel for petrol engines. It is therefore possible to use such a mixture in these engines without taking special precautions, and to obtain with it results as good as those obtained

when using gasoline. To verify this statement, tests have been made in automobile engines of different makes and running under climatic conditions unfavourable for the use of alcohol mixture, that is, at a low air temperature. These experiments have shown that the engine runs as well on such a mixture as it does on gasoline alone, and that the driver has been unable to say which fuel was being used."

Experiments performed by Lichty and Phelps at the Yale University, and published in the *Industrial and Engineering Chemistry*, February, 1938, confirm in a general way these results obtained by Professor Hubendick. They write as follows:

"Applying the multi-cylinder power and fuel consumption data to motor vehicles on the highway, and using air-fuel ratios equal to or richer than maximum power for gasoline and without adjustment of air-fuel ratio on substitution of the 10 and 20 per cent. blends, a decrease in volumetric fuel consumption of about 2 and 3 per cent. for the 10 and 20 per cent. blends respectively should be obtained."

The following table gives the results of the experiments:

Brake thermal efficiencies (in per cent.) at comparable conditions

Fuel	Maximum power			Richest complete combustion		
	1,000 r.p.m.	2,000 r.p.m.	3,000 r.p.m.	1,000 r.p.m.	2,000 r.p.m.	3,000 r.p.m.
<i>Full load</i>						
Gasoline	20.3	21.4	19.6	22.8	24.0	22.0
10 per cent. blend	20.7	21.2	19.7	23.2	24.4	21.5
20 per cent. blend	21.4	22.0	20.0	24.0	24.8	22.2
<i>Two-thirds load</i>						
Gasoline	18.0	18.7	17.4	22.2	21.2	19.0
10 per cent. blend	18.8	18.8	16.9	21.6	21.2	18.8
20 per cent. blend	19.5	19.0	17.4	21.8	20.5	19.2
<i>One-third load</i>						
Gasoline	14.1	14.1	12.4	15.9	14.2	..
10 per cent. blend	14.0	13.9	12.3	16.1	13.3	..
20 per cent. blend	14.4	13.9	12.6	15.9	14.2	..

Use of Industrial Alcohol (95 per cent. Ethyl Alcohol) in internal combustion engines

1. Lichty and Ziurys (*Industrial and Engineering Chemistry*, September, 1936) from a theoretical study of the subject came to the following conclusion:

The mixture which results in the larger power output per unit volume of the correct mixture induced in the gaseous state, would have the lower specific fuel consumption on a gaseous mixture volume basis. However, alcohol is at a distinct disadvantage, since in equal volumes of correct gaseous mixtures of the two fuels, there would be 60 per cent. more alcohol by weight. On a liquid volume basis, the specific gravities indicate that 56 per cent. larger quantities of alcohol would be required.

Alcohol can be used in engines with higher compression ratios, which will reduce the fuel consumption. Theoretically, increasing the compression ratio from 5.45-1 to 8-1, should increase the indicated efficiency about

18.7 per cent. and should reduce the indicated fuel consumption by 15.7 per cent.

Compared to gasoline in a 5.45-1 compression ratio engine, the alcohol engine with a 8-1 compression ratio would theoretically require 35 per cent. more fuel by weight and 31 per cent. more fuel by liquid volume.

2. The following results were obtained by Professor Wawrzyniak* in experimenting with 96 per cent. spirit and petrol in different makes of motor car engines. The engines were of the following make :

	Power	Compression ratio	Volume of the engine cylinder
I.—Daimler, motor lorry	35 H. P. ..	4.0	5.5 litres.
II.—Adler, private car	10/30 H. P. ..	4.2	2.62 „
III.—Elite, ditto	10/40 H. P. ..	5.5	3.14 „

The results are tabulated below:

Engine	Fuel	Effective power developed by—		Average consumption of fuel	
		500 r.p.m.	1,000 r.p.m.	Kg/H.P.—hr.	Litre/H.P.—hr.
I	(i) 96 per cent. spirit	17.4	27.1	0.517	0.630
	(ii) Petrol	18.5	31.25	0.331	0.440
II	(i) 96 per cent. spirit	800 r.p.m. 10.80	2,000 r.p.m. 24.40	0.645	0.789
	(ii) Petrol	11.75	28.00	0.443	0.590
III	(i) 96 per cent. spirit	700 r.p.m. 14.2	2,000 r.p.m. 37.60	0.512	0.626
	(ii) Petrol	25.0 (1150 r.p.m.)	38.05	0.347	0.461

*Mittcilungen der Technischen Hochschule, Dresden, IV Sammelband; Tables I and IV.

3. Experiments conducted at the Yale University during 1934-35 showed that in a multi-cylinder Chevrolet engine, about 50 per cent. more fuel was required, when 95 per cent. spirit was used in place of petrol.

B—PROPERTIES RELATING TO THE INFLAMMABILITY OF ALCOHOL AND PETROL

1.—Flash Points:

'Dangerous Petroleum' (Indian Petroleum Act)—	Below 76°F.
(a) Absolute alcohol	55.3°F.
(b) Rectified spirit—	
60° O. P. (91.4 per cent. by volume)	56.3°F.
50° O. P. (85.5 per cent. by volume)	59.3°F.
40° O. P.	64.3°F.
30° O. P.	66.0°F.
20° O. P.	70.0°F.

10° O. P. (62·8 per cent. by volume)	..	..	..	72·0°F.
Proof spirit (57·1 per cent. by volume)	..	..	..	74·0°F.
(c) Alcohol denatured with 0·5 per cent pyridine and 0·5 per cent. light caoutchoucine—				
60° O. P.	..	..	..	56·3°F.
50° O. P.	..	..	..	62·0°F.

2. Temperatures of Spontaneous Ignition.

(Moore—J.S.C.I.—1920)

Fuel	Sp. Gr.	In oxygen	In air
Petrol	·710 to ·729	270°C—279°C.	361°C—390°C.
Lamp oil	·787	253°C.	367°C.
Alcohol (95 per cent.)	·817	395°C.	518°C.
Turpentine .. .. .	..	275°C.	275°C.

3. Limits for the Downward propagation of Flame. Air and Fuel Mixture

	Lower limit	Upper limit
Alcohol	3·95	13·65
Petrol	2·4	4·9
Turpentine	0·73	..

This shows that explosion wave is formed with a leaner mixture in the case of petrol. Incidentally, it also shows that in an alcohol engine the strength of the mixture may be varied within wider limits without causing miss-firing.

4. Vapour Tension—

	10°C.	20°C.	30°C.	40°C.	50
	mm	mm	mm	mm	mm
Alcohol 100 per cent. .. .. .	..	44	78	140	221
Alcohol 90 per cent. .. .. .	..	39	75	135	221
Alcohol 80 per cent. .. .. .	..	..	73	133	221
Petrol, grade I	90	133	185	265	320

5. Loss in weight of various fuels by passing air for 5 minutes at 25°C

Petrol (0·700)	..	..	..	..	20·5 per cent.
Alcohol (95 per cent.)	..	..	..	..	1·9 per cent.
Alcohol (80 per cent.)	..	..	..	..	1·85 per cent.

This shows that, if air at 15°C be bubbled through alcohol, the quantity of vapour taken up is insufficient to form an explosive mixture. Air bubbled through hexane or benzene takes up so much vapour that the mixture is richer than the upper explosion limit for these substances.

6. "The miscibility of alcohol and water must obviously reduce greatly the risk of fire during storage and transport, since burning alcohol can be immediately extinguished if sufficient water be at hand to reduce it below a certain strength. This would, however, not apply to mixtures of alcohol and petrol." (Monier William's "Power Alcohol"—page 255.)

C—HYGROSCOPICITY OF ALCOHOL FUELS

It has also been established that the extent of miscibility of alcohol and petrol are regulated by the three following more important factors :

(i) The lower the strength of the alcohol from the " Absolute " grade, the more difficult it is to form a homogeneous mixture.

(ii) The lower the temperature to which the mixture is subjected, the greater is the tendency for the latter to separate.

(iii) Petrols of different origin exhibit different extent of miscibility with alcohol of the same strength.

As a rule, the higher the specific gravity of petrol, the poorer is its miscibility, though this is not strictly true in every case, for the presence of aromatics in petrol seems to favour the miscibility, but that of the naphthenes has the opposite effect.

It therefore follows that a perfectly homogeneous mixture of alcohol and petrol may have a tendency to become first opalescent and finally to separate into two layers on account of one or both of the following reasons, namely, (i) lowering in the strength of the alcohol due to gradual absorption of water from the atmosphere, or (ii) a fall in temperature of the surroundings.

A study of the literature on the subject revealed that a number of careful experiments had been conducted in this direction. The results of some of the more important of these having a direct bearing on the point at issue are summarized below :

1. *Absolute alcohol is only slightly more hygroscopic than rectified spirit*

Soriette (*Chimie et Industrie*, May 1923) made an experiment to compare the hygroscopic properties of technical absolute alcohol and of rectified spirit under identical conditions when exposed to an atmosphere of relative humidity 80 per cent. and temperature 15°C. His results showed that in 21 days the absorption of water was 5.1 by absolute alcohol of 99.7° G.L. and 4.35 by rectified spirit of 95.5°.

2. *The hygroscopicity of an alcohol-petrol mixture is very low and of little practical consequence*

(a) Hubendick (*Spiritusmotoren*, page 28, Table XXI) has shown that the extent of miscibility of heavy petrol and alcohol of different strength can be judged from the following table giving the temperatures at which separation just begins to take place.

Mixture in volume per cent.		Temperature in° C of opalescence with spirit of strength				
alcohol	Petrol	99.7	99	98	97	96
		under	under			
10	90	—30	—18.4	+15.4	+23	+30
20	80	—30	—26	+9.8	+22.5	+30
30	70	—30	—30	+2.6	+12.6	+30
40	60	—30	—30	+3	+10.5	+24.3

(b) Contant and Mariller (Bull. Assoc. Chim. Suc., et Distill. 1923 page 298) prepared a Mixture of 15 per cent. by volume of 99.9° absolute alcohol and 85 per cent. heavy petrol. Of this mixture 170 c.c. were exposed in an open glass vessel of 450 c.c. capacity, 160 mm. high with mouth of 34 mm. diameter, in a room containing air of humidity 80 per cent. The extent of water absorption was indirectly estimated by finding the temperature at which milkiness (showing incipient separation) took place. They found that after 43 days of exposure, the mixture had to be cooled to -8°C . to produce any milkiness.

(c) Engineer Eckström (Hubendick's Spiritusmotoren, page 30) made several experiments which consisted in adding to mixtures of "Shell" petrol and absolute alcohol (99.5 per cent.) at a temperature of 17.5°C . such quantities of water as are needed to cause the mixture to become opalescent and finally to separate into two layers. The following table gives the results of his experiments :

Composition in volume per cent.		Specific gravity	Addition of water in per cent. to the mixture		Percentage of decantation	Degree of alcohol in the separated layer	Percentage of petrol in the separated layer
Alcohol	Petrol		Opalescence	Separation			
10	90	0.7350	0.26	0.33	2.3	96.3	20.0
20	80	0.7423	0.70	0.76	7.3	95.9	40.9
30	70	0.7494	1.20	1.30	32.0	95.3	56.2
50	50	0.7592	2.70	2.80	92.0	94.2	47.1

A little reflection would show that on the assumption that 0.76 per cent. of water is required to bring about separation in a 80 : 20 mixture, it would require 345 c.c. of water to get into the fuel tank of a motor car containing 10 gallons of the mixture before any separation is likely to take place. Such an accident is not likely to happen normally.

"The incidental admixtures of water which sometimes happen are in fact very insignificant. For instance, it was shown that the amount of water remaining inside a 5-litre petrol tin after it has been washed and carelessly rinsed, does not exceed 2 c.c., that is 0.05 per cent. And experiments have proved that this quantity is insufficient to bring about separation even in the case of a fuel containing only 2.5 per cent. alcohol. The danger of separation of alcohol fuels has thus been very much exaggerated.

"It seems strange that these efforts are obstinately limited to considering exclusively the consequences of a possible admixture of water to fuels containing alcohol without thinking of the trouble such an admixture may create in case of pure petrol. The least admixture of water to petrol occasions the formation of a layer of pure water which settles down in the pipe and stops the running of the engine. On the contrary, if the petrol contains even 5 per cent. of alcohol, the addition of even 45 c.c. of water to 10 gallons of the carburant does not bring about separation at ordinary temperatures. Separation takes place only at about 0°C ., but the aqueous layer separating contains enough alcohol and petrol to keep the engine running." (Charles Schwetzer--"Power Alcohol Question in Its Present State". Niort, 1937.)

Commenting on the experimental results quoted above, Professor Hubendick said that the lower aqueous layer was mainly composed of alcohol

containing such a percentage of petrol that *the mixture, even in its separated condition, would be able to keep the engine working. Consequently, if by accident a small quantity of water gets into the fuel tank, no trouble whatever should be feared in the running of the engine.*

(d) Petrilik, before the International Congress of Industrial Chemistry, Paris, 1920, described his experience in this connection in the following words :

“We purposely added to the tank of our motor car, containing 20 litres of 80/20 petrol-alcohol mixture, 200 c.c. of water, without any the slightest effect being noticeable in the working of the engine.”

APPENDIX II

Note by the Secretary, Imperial Council of Agricultural Research, dated the 29th September, 1933, on Subject No. 2: Utilization of Molasses—Power Alcohol.

At its fifth meeting held in March, 1933, the Sugar Committee considered certain representations regarding the increasing difficulties encountered by sugar factories in India in finding an outlet for their molasses. The Committee came to the conclusion that the power alcohol question was most important and recommended that the Secretariat of the Council should take up the matter unofficially with the departments of the Government of India concerned. A summary of the present position by the Agricultural Expert to the Council is attached (Annexure).

2. The question as to the next step to be taken is now for the consideration of the Sugar Committee. It is suggested that the matter might conveniently be referred to a sub-committee to meet and report during the present session of the Sugar Committee.

ANNEXURE

Our examination of this question in consultation with the other departments of the Government of India concerned has brought out the following points :

(a) Alcohol used for motor spirit must pay the same duty as petrol. It is not possible for Government to agree to the loss of revenue which any other course would involve, nor would it be reasonable to protect the sugar industry indirectly at the expense of the indigenous oil industry.

(b) The question of the cost of production of power alcohol from Indian molasses is of fundamental importance and before legislation would be justified, a fuller study of the economics of the question is essential. The landed cost of petrol in bulk *ex-duty* (and before any distributing costs have been incurred) is approximately 4 annas to 5 annas per gallon. If power alcohol is more expensive than this, the price of the mixture will be higher than the present price of petrol.

(c) The question of distribution arrangements and costs is of great importance. The sugar factories, and thus to a considerable extent the distilleries, are remote from the ports and thus from the centres from which petrol is distributed and where mixing could best be done : they are also remote from the areas of greatest petrol consumption.

(d) In the event of legislation being introduced requiring a certain percentage of quantity of alcohol to be used, price control might be necessary to protect the consumer.

(e) The possibility of other forms of assistance than legislation for compulsory mixing should be examined.

(f) In view of the experience of other countries, the technical difficulties should be fully studied.

2. In regard to the cost of production, it should perhaps be emphasized that alcohol for mixing with petrol must be about 99½ per cent. absolute at least, i.e., *practically anhydrous*, otherwise difficulties due to water separation

will arise. By modern processes of re-distillation (adding Benzol and distilling off first removing the two azeotropical mixtures) alcohol of 99.7 per cent. to 99.9 per cent. purity is obtained. The following estimate of the cost of manufacture *omitting the cost of raw material* is given for a modern installation in America :

				Per American gallon
Manufacture of 95 per cent. spirit	..	..	..	8 cents,
Concentration to Anhydrous ..	..	..	..	2 ..
				<u>10 ..</u>

At normal exchange this is 6d. or Re.0.5-4 per Imperial gallon.

3. The sub-committee appointed by the Sugar Committee calculated that with molasses at 9 annas per maund, power alcohol would cost 14 annas per gallon. Working on the basis of figures supplied to the Tariff Board (which assume an output of 33,063.4 gallons of rectified spirit from 15,322 maunds of molasses) the cost of production has been calculated as follows :

					Per gallon spirit
					Rs. a. p.
Cost of molasses at 6 annas per maund, freight on molasses at Re. 0.4-3 per maund.					0 4 9
Works cost	..	..	..	..	0 2 9.6
Cost of denaturant	..	..	..	..	0 1 4.4
Depreciation on drums	..	..	..	..	0 0 7.7
Cost per gallon rectified spirit	..	..	..	..	<u>0 9 6.7</u>
Cost of concentration (American figure)	..	..	..	..	0 1 2
					<u>0 10 8.7</u>

or say 11 annas per gallon at the distillery. If no freight has to be paid on molasses, costs would be reduced to, say, 9 annas per gallon, but the above includes nothing for overhead charges or for freight on spirit to concentrating and distributing centres. The C.I.F. price of petrol at ports with which the above figure has to be compared may be taken at some 5 annas per gallon—this is exclusive of all storage and distribution costs. I understand that a similar figure has been adopted at Calcutta for the calculation of Port Trust dues. The current price of petrol at ports in Western Europe in April, 1933, was between £5 per ton (4 annas per gallon). Though this figure is low compared to the average declared value for dangerous petroleum shown in the seaborne trade returns for previous years which averaged 13 annas in 1921-32, 11½ annas in 1932-33 it compares closely with the average declared value for April to July, 1933, viz. 4½ annas per gallon (588,296 gallons value Rs.1,66,690).

Average declared values for imported petrol do not form an entirely reliable guide to the basic prices of petrol at ports in India because the imports include some special grade not used as motor fuel and in any case are a small fraction of the total consumption. The 1933 import values are probably abnormal, due to rate-cutting, but the figure of 5 annas per gallon at ports is probably not far wrong as a first cost figure. Any comparison with up-country prices should be made with caution as the storage, carriage and distribution of petrol is expensive and most of these expenses would be equally high for power alcohol. It seems obvious that admixture with power alcohol will not reduce the cost of motor fuel materially and in most localities will raise it.

4. This conclusion is borne out by the prices at which power alcohol in bulk is sold wholesale to the oil companies in various countries. It

also furnishes the reason why legislation has been found necessary. The principal figures are given below :

(Sterling prices calculated on exchange rate current in May, 1933)

	Per ton	Per gallon
SWEDEN—	£	Rs a. p.
Cost of production (raw material practically free) ..	16.15	0 12 9
YUGOSLAVIA—		
Control price (consumption tax of £ 16 to be added) ..	22.10	1 1 2
LATVIA—		
(From molasses) cost of production (monopoly selling price £ 16) ..	41	1 15 3
ITALY—		
(Control price in bulk but does not pay the petrol duty) ..	30	1 6 10
GERMANY—		
(Control price delivered to oil companies) ..	45	2 2 3
HUNGARY—		
(Control price delivered to oil companies) ..	45.10	2 2 8
CZECHOSLOVAKIA—		
Control price delivered to oil companies (includes turn-over tax) ..	40	1 14 5
FRANCE—		
.. .. .	41	1 15 3

5. These figures bring out the importance of distribution costs and railway freight. The real cost of power alcohol at the distillery under favourable circumstances is several times the cost of petrol at ports. The carriage of alcohol and petrol is expensive and distribution cost high due mainly to evaporation losses. The most recently available figures for the petrol consumption in different areas are shown in the attached table.

It will be seen that in 1931 (omitting Burma and Assam which export petrol) of 63.2 million gallons, the maritime provinces accounted for 35 million gallons. The three principle sugar-producing provinces—United Provinces, Bihar and Orissa and the Punjab—took less than 13 million gallons. If a 20/80 mixture were adopted, Upper India would only account for some 3 million gallons of alcohol whereas an outlet is desired for anything from 10 million to 20 million gallons. Making due allowance for present and future molasses production in Madras and Bombay, it is still clear that to make any real impression on the molasses problem, power alcohol would have to be used even in the ports. The railway freight in India on petrol in bulk works out approximately as follows :

Freight per tank wagon of 5,000 gallons—approximate

Distance	On E.I. Railway	On N.-W. Railway	On B.B. & C.I. Ry. from Bombay	Per gallon, annas and pies
300 miles ..	560	600	475	1—5 to 1—9
600 miles ..	840	890	805	2—5 to 2—8
1,000 miles ..	1,040	1,100	920	2—9 to 3—5
Calcutta-Delhi ..	850 to 900	..	..	2—9

6. As regards the form in which assistance might be given, the following statement shows what is being done in other countries :

(Modified by more recent information)

AUSTRALIA—A mixture of 17 per cent. alcohol 83 per cent. petrol is used on a small scale—legislation contemplated.

AUSTRIA—Compulsory mixing legislation brought into force from July, 1934. The motor fuel is to contain at least 20 and at most 40 parts by weight of power alcohol. The price of the mixed fuel is to be based on the price of power alcohol fixed by the State (about 80 Austrian shillings per 100 litres in 1935). Power alcohol is free from excise duty.

BRAZIL—The Law of April 1, 1931, makes it obligatory to mix 10 per cent. power alcohol to petrol. This has recently been brought into force when a sufficient number of power alcohol distilleries got established. Power alcohol is exempted from the payment of any kind of tax or duty.

CHILE—The Decree of September 28, 1933, fixed the quantity of power alcohol to be purchased by all importers of petrol at 6.25 per cent. of the quantity of petrol imported, the price of alcohol being fixed by the State. The percentage to be taken may be varied annually up to a maximum of 25 per cent.

ENGLAND—Specially denatured alcohol for use as motor fuel has not to pay any excise duty, and moreover enjoys a "Methylation Allowance" of 8.9d. per gallon. The Chancellor of the Exchequer has so far refused to put any duty on power alcohol in spite of repeated question in the Parliament, though it was admitted that the loss of revenue due to the exemption from tax of alcohol used as motor fuel was about £30,000 for the year 1934-35.

EQUADOR—The Decree of December 6, 1933, makes it compulsory for all petrol to be mixed with 20 per cent. its weight of power alcohol. This is for the purpose of helping the producers of sugarcane.

HUNGARY—Petrol over 735-S.G. must be mixed with 20 per cent. alcohol (unless used for agricultural purposes); about 90 per cent. of the motor fuel used is this "Motalco".

(2) The duty on light petrol (below 735-S.G.) is 4d. per gallon higher than that on "Motalco".

IRISH FREE STATE—The Government have taken up the control of the manufacture of industrial alcohol and commercial trading in the product. A number of distilleries have been erected within the last two years.

ITALY—Under the Four Years' Plan, all industrial alcohol produced from sources other than vine and fruits are under State control. All petrol must be mixed with 20 per cent. of power alcohol, the production of which was about 21.8 million gallons in 1936, and is expected to reach double the figure in 1938. Power alcohol is exempted from many of the duties levied on petrol.

LATVIA—The mixture of 25 per cent. alcohol 75 per cent. petrol is compulsory. The alcohol is a State monopoly.

PANAMA—The Decree of August 17, 1933, (i) put the duty on the mixed fuel containing 25 per cent. power alcohol at half the rate on straight petrol and (ii) fixed a maximum sale price for the mixed fuel.

PHILIPPINES—The mixed fuel is made by the sugar manufacturers and forms about one-third of the total quantity of motor fuel sold in the country. The mixed fuel is sold cheaper than petrol.

POLAND—The Law of July 2, 1932, created the State monopoly for alcohol, empowering the Government to impose compulsory mixing of power alcohol to petrol. There has so far been no necessity to impose this, as an agreement was reached by which the petroleum syndicate would buy alcohol for mixing with petrol to the extent of 9 per cent. of the quantities sold, and put the mixed fuel on sale in the country.

SWEDEN—There is no legal regulation, but power alcohol is free of all duty. The mixture used is 25-75. The quantity of alcohol used for motor fuel is about 2.5 million gallons.

YUGOSLAVIA—The Ordinance of November 22, 1933, repealed the Decree of September 27, 1932, making it compulsory to mix 20 parts of power alcohol with 80 parts of petrol. The mixed fuel is favoured by the imposition of a heavy duty on petrol, from which power alcohol is exempted.

FRANCE—At the present time, the three principal fuels used in France for motor vehicles are the following :

Touring spirit—This can be either a pure petrol, or mixtures of petrol and absolute alcohol with or without benzol. The presence of the alcohol is not obligatory. The proportion of alcohol lies between 11 and 15 per cent. of the volume of the hydrocarbons. Its octane number should not be less than 60.

Heavy spirit—This must consist of a mixture of petrol and alcohol. The proportion of alcohol is 25 per cent. of the volume of the petrol. Its octane number should not be less than 62.

Super spirits—These are used principally by the owners of modern cars with a very high compression. Their constitution depends largely on the ingenuity of the manufacturers. Actually they nearly always contain a certain proportion of absolute alcohol. Their octane number should be at least equal to 75.

7. It will be seen that whilst in several countries the use of a specified mixture has been made compulsory in others the principle has been adopted of requiring the oil companies, by law, to buy annually a quantity of power alcohol corresponding to a certain percentage of their imports and production of petrol and benzol; in some countries also of their kerosene. This method leaves the petrol distributing companies a considerable amount of latitude in distribution and in practice the mixture is sometimes sold at a lower price than pure "light" petrol despite the fact that it actually costs more. This modification is worth consideration—it would be essential that, at any rate until considerable experience has been gained, the compulsory purchase percentage should not be placed too high.

8. Another modification of the compulsory mixing method is to require all heavy petrol (i.e. all petrol), below a certain density (S.G. 735 in Hungary) to be mixed with alcohol and to make light petrol relatively expensive by a heavier duty; this is the method adopted in Hungary, the price differential being about 4d. per gallon. The applicability of this method to India is doubtful where heavier petrol is used: the petrol usually distributed is of a specific gravity of about 0.752 at 30°C (equivalent to about 0.765 at 15°).

9. Yet another method of encouraging the use of alcohol as a motor fuel is the remission of duty as in Sweden—this method must be ruled out, for financial reasons.

10. The conclusion seems inevitable that the admixture of alcohol with petrol will raise the price of the mixture above that of pure petrol. This is due to the fundamental fact that under the most favourable circumstances the cost of production of alcohol is several times the cost of production of petrol—including delivery by sea to ports in bulk. The figures given below would seem to indicate that the cost of mixture containing 20 per cent. of alcohol will be something like 7 annas per gallon at the ports made up as follows :

	Annas
0.8 gallon petrol at 5 annas	4
0.2 gallon alcohol at 11 annas	2.2
Freight on .2 gallon of alcohol for say 600 miles at 2 annas and 8 pies per gallon.	0.6
Total	6.8

Duty and distributing costs being the same, cost of petrol would be increased by about 2 annas per gallon. At up-country centres the difference would be appreciably less if mixing stations were suitably sited, though there would naturally be an increase in distributing costs with an increase in the number of mixing stations. It is clear that the cost of production and distribution of power alcohol in India require considerably more accurate determination before legislation could be proposed.

11. *Technical considerations*—Certain difficulties have been met with in other countries but appear to have been got over. The main facts may be summarized as follows :

(1) For successful admixture with petrol, alcohol must be of at least 99½ per cent. purity; 98 per cent. spirit will not do (this is clearly shown by Brazil and Cuban experience as well as by experiment). Modern plant for the production of anhydrous alcohol can produce by this distillation a purity of 99.8 to 99.9 per cent.

(2) Mixtures of alcohol and petrol for successful commercial use must be between comparatively close limits. Mixtures containing less than about 15 per cent. alcohol are unworkable for several reasons whilst mixtures containing above 20–25 per cent. call for special engine adjustments and the fuel consumption is higher.

(3) Alcohol absorbs water readily and the addition of quite small quantities of water to an alcohol-petrol mixture results in separation and cloudiness. Fortunately these difficulties are mainly met with at low temperatures and the percentage of water required to produce separation is higher with increased alcohol content; this is illustrated by the following figures :

Composition of mixtures	Percentage of water sufficient to cause separation	
	At 0°C.	At 10 °C.
Alcohol 10 per cent., petrol 90	0.25 per cent.	0.20 per cent.
Alcohol 15, petrol 85	0.50 ..	0.49 ..
Alcohol 20, petrol 80	0.60 ..	0.48 ..

Figures are also required for +10°C and for mixtures up to 25 per cent. alcohol—these determinations could easily be made.

It is clear that the degree of concentration of the alcohol used is of very great importance as the separation of a watery layer, e.g., at pumps would mean the loss of a considerable proportion of the added alcohol. For example, at 24°C with a 20/80 mixture once separation has begun, 1 per cent. of water would cause about 12 per cent. of alcohol to separate out.

(4) Information is required as to the rate at which different petrol-alcohol mixtures will absorb moisture under Indian conditions of storage, temperature and humidity. These data would be essential to the formulation of a distribution scheme.

(5) For a given power output more alcohol is necessary than petrol due to the lower calorific value of the former. In practice the addition of 15 per cent. alcohol leads to no noticeable increase in fuel consumption, an addition of 30 per cent. alcohol means an increase in consumption of about 10 per cent. This would not be a serious consideration with a 20/80 mixture since alcohol is a good "anti-knock" fuel.

12. Whatever form legislation might take, it is clear that Government might have to fix the sale price of power alcohol and possibly the price of the mixture. The cost to the consumer must be determined before legislation could be proposed. Hence the most important requirement at present is to get accurate figures for the cost of producing anhydrous alcohol in India. The type of plant required and most suitable to Indian conditions has to be settled; also the difficulties, if any, in operating it have to be ascertained. It is understood that the Mysore State contemplated experiments of this nature and it might be possible to secure their co-operation in obtaining the necessary data. If not the question of providing an experimental factory somewhere in British India will have to be taken up. The oil companies are willing to co-operate in the distribution of power alcohol if a workable scheme can be devised and doubtless their co-operation could be secured during experimental distribution at some such centre as Delhi. Power alcohol would have a freight advantage of about 3½ annas per gallon and the cost of the mixture would be (omitting duty and distribution charges):

				Annas per gallon
0.8 gallon petrol at 8 annas ..	--	..	--	6.4
0.2 gallon alcohol at 11 annas ..	..	--	--	2.2
		Total	..	8.6

as compared to petrol at 8 annas so that the addition to the price of petrol would be small.

The first step, therefore, is to get an experimental scheme going in some suitable area.

B. C. BURT.

The 22nd September, 1933.

*Statement showing the petrol sales in the various provinces for the years
1929, 1930 and 1931*

Province	Gallons		
	1929	1930	1931
Madras	10,331,000	11,248,000	10,896,000
Bombay	11,936,000	12,971,000	13,182,000
Bengal	9,913,000	10,976,000	10,782,000
United Provinces	3,753,000	4,476,000	4,553,000
Burma	7,623,000	7,756,000	7,137,000
Shan States	550,000	663,000	621,000
Punjab	4,602,000	5,397,000	5,560,000
Bihar and Orissa	2,537,000	2,940,000	2,730,000
Central Provinces	2,317,000	2,660,000	2,247,000
Assam	1,285,000	1,599,000	1,764,000
North-West Frontier Province	1,263,000	1,514,000	1,660,000
Rest of British India and Indian States	9,767,000	11,460,000	11,723,000
Total	65,877,000	73,660,000	72,861,000

(In round figures corrected up to the nearest thousand gallons.)

APPENDIX III

Production of Alcohol from different sources in various countries

In Hectolitres of 100° G.L. Alcohol

Country	Year	From beet	From molasses	From potato	Total from all sources (round figures)
1. Austria ..	1936-37	..	141,200	..	201,000
2. Belgium ..	1932	..	89,300	..	187,000
3. Czechoslovakia ..	1933	54,000	250,000	506,000	968,000
4. Denmark ..	1936	..	25,000	35,000	94,000
5. England ..	1932	..	500,000	..	738,000
6. France ..	1935-36	2,863,300	1,088,400	..	5,827,000
7. Germany ..	1936-37	..	127,743	2,331,000	3,634,000
8. Hungary ..	1934	..	..	..	303,000
9. Italy ..	1936	383,500	328,000	..	1,095,000
10. Philippines ..	..	..	178,000	..	179,000
11. Poland ..	1933	..	11,900	257,000	269,000
12. Yugoslavia ..	1931	..	118,000	31,900	140,300

APPENDIX IV

Consumption of Alcohol (in Hectolitres) for different purposes
in various countries(Modified from Mons. Collerot's Paper to the III International Congress
of Technical and Agricultural Chemistry, Paris, 1934)

Country	Year	For drink- ing and flavouring wines	Vinegar making	Per- fumery	Chemical industries	Heating and lighting	Motor fuel
1. Austria	1933	72,236	7,323	210	5,186	74,507	4,990
2. Belgium	1932	63,800	15,000	4,976	22,584	14,800	440
3. Czecho- slovakia.	1932	162,000	20,062	..	14,035 (1)	181,781 (2)	586,116
4. Denmark	1935	15,476	..	..	19,718	51,050	..
5. England	1933	230,000	..	10,000	..	507,000	17,800
6. France	1932-33	1,365,366	50,781	111,032	195,353	722,050	1,937,938
7. Germany	1936-37	689,379	134,134	41,376	..	565,191	1,823,686
8. Hungary	1934	23,700	15,100	..	20,800	43,900	98,900
9. U.S.A. ..	1933	Prohibition	130,000	30,000	951,000	866,000	..

Remarks—(1) Industrial spirit and (2) Denatured spirit.

(Note— 1 Hectolitre = 22 Imperial gallons.)

APPENDIX V

Consumption of power alcohol in various countries

(Ind. and Eng. Chem., News Edition, 20th July, 1936)

Country	Year	Quantity in Imperial gallons	Remarks
1. Austria	1934 ..	1,018,000	
2. Brazil	1935 ..	10,455,000	
3. Cuba	1934 ..	2,367,000	
4. Czechoslovakia	1934 ..	13,190,000	
5. France	1934-35 ..	81,524,000	
6. Germany	1936-37 ..	40,121,000	
7. Hungary	1934 ..	2,106,000	
8. Italy	1934 ..	1,402,000	Rapid increase since 1934.
9. Latvia	1934 ..	1,350,000	
10. Poland	1934 ..	1,700,000	
11. Spain	1935 ..	2,400,000	
12. Sweden	1934 ..	2,400,000	
13. United Kingdom	1935 ..	1,242,000	

APPENDIX VI

Comparative prices of power alcohol in various countries in 1936

(Tokayer, "World Petroleum," 7th June, 1936)

Country	Price of power alcohol per gallon	
	In American cents	Equivalent in Indian currency
		Rs. a. p. |
1. Austria	57	1 10 3
2. Czechoslovakia .. .	76	2 3 0
3. France	27	0 12 6
4. Germany	76	2 3 0
5. Hungary	79	2 4 4
6. Italy	88	2 8 6
7. Yugoslavia	40	1 2 5
8. Latvia	59	1 11 2
9. Poland	19	0 8 9
10. Spain	52	1 7 11
11. Sweden	31	0 14 3

APPENDIX VII

Alcohol-petrol mixed fuels in different countries

Country	Commercial name of the mixed fuel	Composition			Whether alcohol mixing is compulsory
		Petrol	Benzol	Alcohol	
1. Austria ..	..	80	60	20—40	Yes.
2. Australia ..	Shellkol ..	85	..	15	No.
3. Brazil ..	..	..	..	..	Yes.
4. Bulgaria ..	..	75—70	..	25—30	Law not enforced.
5. Chile ..	..	..	..	..	Yes.
6. Cuba ..	Mofuco ..	37	3	60	No, but favourable.
7. Czechoslovakia	Dynalkol(1)	(i) 80	..	20	Yes.
		(ii) 70	4	26	
8. Denmark ..	..	75	..	25	No, but State monopoly.
9. England ..	Cleveland Discol.	70	15	15	No, but favourable.
10. Ecuador ..	..	80	..	20	Yes.
11. France ..	..	Various proportions			Yes, State monopoly.
12. Germany ..	Monopoline	Ditto			Ditto.
13. Hungary ..	Motalko ..	80—70	..	20—30	Yes.
14. Italy ..	..	80	..	20	Yes.
15. Lettonia ..	Latol ..	(i) 50	..	50* (1)	Yes, State monopoly.
		(ii) 67	..	33(2)	
16. Lithuania ..	Motoria ..	75	..	25	Yes.
17. Natal ..	Natalito ..	50	..	50	No, but favourable.
18. Panama ..	..	80	..	20	Ditto.
19. Philippines	Gasanol ..	70	..	30	
20. Poland ..	..	(i) 85—	..	15—30*(3)	No, State monopoly.
		70	..	85—70(4)	
		(ii) 15—			
		30			
21. Sweden ..	Lattbentyl	75	..	25	No, but favourable.
22. Yugoslavia ..	..	80	..	20	Legislation favourable.

*(1) Summer time mixture.

(2) Winter time mixture.

(3) For motor cars.

(4) For tractors.

APPENDIX VIII

Power alcohol plants installed in various countries

Country	Azeotropic process (1)		Salt-Dehydration process (2)	
	Number	Capacity per day (In hecto- litres)	Number	Capacity per day (In hecto- litres)
1. Argentine	1	300	..	..
2. Australia	1	150	..	..
3. Austria	1	220	..	..
4. Belgium	3	400	..	..
5. Bulgaria .. .. .	..	..	2	180
6. Brazil	13	2,750	3	190
7. Chile	2	120	..	..
8. Columbia .. .. .	..	..	2	60
9. Czechoslovakia	24	3,236	14	1,360
10. Denmark	1	40	..	..
11. England	3	580	..	..
12. France	45	14,535	2	1,200
13. Do. Colonies	5	430	..	..
14. Germany	10	3,900	1	300
15. Holland	1	3	..	..
16. Hungary	6	700	..	..
17. Irish Free State	5	150	..	..
18. Italy	14	3,455	1	40
19. Lettonia	2	440	..	..
20. Lithuania	1	75	..	..
21. Panama	1	40	..	..
22. Poland	3	530	..	..
23. Portugal	1	60	..	..
24. South Africa	3	360	1	60
25. Spain	1	30	4	900
26. Sweden	1	30	2	180
27. Yugoslavia	5	425	2	280
Total	153	32,959	34	4,750

(1) Information available up to the end of 1936.

(2) Information available up to 1935.

APPENDIX IX

I.—Properties of petrol marketed in Europe and India

Petrols	Sp. Gr. at 60°F.	Initial B. P. °C.	Per cent. by vol. up to 100°C	Final B. P. °C	Octane number
<i>I—Standard Oil Company Petrols imported into European countries</i>					
1. Premium grade* ..	0.745—0.770	30°—35°	40—45	Below 200°	80
2. Standard grade ..	0.725—0.735	30°—35°	40	Below 200°	66
3. Heavy grade (Commercial).	0.740	35°	28—33	200°	64
<i>II—Petrols marketed in the United Kingdom</i>					
1. No. 1 grade* ..	0.732—0.743	32°—41°	38—42	185°—197°	70—72
2. No. 3 grade (Commercial).	0.737—0.749	34°—38°	32—36	196°—205°	65—66
<i>III—Petrols marketed in India</i>					
"A"	0.741 at 30°C.	38°	31	215°	64—67
"B"	0.729 at 30°C.	48°	47	194°	67—69
"C"	0.714 at 30°C.	42°	53	191°	..
"I"	0.738 at 30°C.	44°	30	183°	65—67
"B"	0.740 at 30°C.	43°	30	205°	..
<i>IV—Alcohol fuel marketed in England</i>					
	<i>At 60° F.</i>				
Standard grade (containing 15—20 per cent. alcohol).	0.750—0.755	38°—46°	51—56	195°	76

* Sometimes contains Tetraethyl Lead.

II.—Properties of Racing Fuels containing Alcohol

(Marketed in United Kingdom by Solvents Products, Limited)

Specific gravity at 15°/15°C	..	..	0.828	0.822
Hydrocarbons	..	..	23%	10%
Acetone	..	..	Trace	9%
98 per cent. Ethyl Alcohol	..	..	77%	79%
Initial Boiling Point	..	..	68.5°C.	64°C.
95 per cent. Distillate at	..	..	78°C.	78°C.

(Nash and Howe—"Motor Fuel." Paragraph 816)

APPENDIX X

Consumption or sale of petrol in 1937 in some district towns
(In 1,000 gallons)

UNITED PROVINCES

Lucknow..	..	..	..	..	..	601
Cawnpore	..	..	..	..	..	580
Allahabad	..	..	..	..	..	301
Agra ..	..	..	..	..	..	299
Meerut ..	..	..	..	..	..	265
Muttra	..	..	..	..	..	257
Benares ..	..	..	..	..	..	220
Bareilly ..	..	..	..	..	..	165
Aligarh ..	..	..	..	..	..	149
Jhansi ..	..	..	..	..	..	113

BIHAR

Bankipore (Patna) ..	..	..	..	..	..	293
Jamshedpur	..	..	..	..	..	286
Ranchi ..	..	..	..	..	..	265
Gaya ..	..	..	..	..	..	192
Dhanbad..	..	..	..	..	..	164
Hazaribagh	..	..	..	..	..	145

APPENDIX XI

Note on the denaturation of power alcohol

The denaturation of such alcohol is a matter of great importance.

The ideal denaturant should possess the following properties.

THE IDEAL DENATURANT

1. It should be a volatile, combustible liquid soluble in alcohol (and petrol), having an unpleasant taste and smell and not easily separable from the spirit by physical or chemical means so that regeneration of alcohol for drinking purposes is practically impossible.

2. It should be harmless for the industrial purposes for which the alcohol is used.

3. It should contain an "earmarking" substance so that, if potable alcohol is regenerated from the denatured alcohol, it would make it possible to identify the origin of the regenerated potable alcohol.

4. It should be relatively cheap.

5. It should be available in large quantities.

6. For India it is desirable that it should have no deleterious effect on the human system.

DENATURANTS USED IN VARIOUS COUNTRIES

The denaturants used for power spirit to be used as motor fuel in various countries are as follows :

<i>Bulgaria—</i>	<i>Per 100 litres of alcohol</i>	
Crotonaldehyde	0.2 gm.	
<i>Chile—</i>		
Petrol	5 litres	
Ethyl borate	20 c.c. (containing 0.2 gm. of boron).	
<i>Czechoslovakia—</i>		
Methyl alcohol	2 litres	per 98 litres of ethyl alcohol.
Petrol	" "	
<i>Denmark—</i>		
Methyl spirit	2 litres	
Pyridine bases	0.5 "	
Petrol	0.25 "	
<i>England—</i>		
Ethyl alcohol	92 parts	
Wood naphtha	2½ "	
Pyridine	¼ "	
Petrol or benzol	5 "	
Spirit red III dye	¼ oz. by weight per 1000 gallons.	

This mixture is issued in the United Kingdom free of duty or restriction when mixed with 25 per cent. of petrol, benzol, denatured ether or some other substances approved by the Commissioners of Customs and Excise.

Estonia—

Benzine 25 litres.

France—

90 per cent. benzol 1 litre.

Benzine standard 0.3 litre.

Anthracene 6.0 grammes.

Ethyl borate 20 c. c.

Italy—

A mixture supplied by the State containing acetone and complex hydrocarbons.

Lattonia—

Crotonaldehyde 0.5 litre.

Complex hydrocarbons 5 litres.

Poland—

1 per cent. mixture of solvent naphtha with 15 per cent. of naphthalene, pyridine methyl alcohol, oil of creosote and croton oil.

For aviation fuel, petrol 5 per cent.

Sweden—

Crotonaldehyde 1 per cent.

Petrol or benzol 5 per cent.

Yugoslavia—

Petrol 3 litres (density 0.730—0.740, distilling between 75—185°C.)

APPENDIX XII

**Comparative road tests with petrol and alcohol-petrol mixed fuels conducted
by Mr. J. Charlton, M.Sc., F.I.C., I.A.S., Agricultural Chemist to
Government, Burma**

(Extract from Agriculture Survey Bulletin no. 24 of 1936, Department of Agriculture, Burma)

“Absolute alcohol-petrol fuels not being available in Burma, in January, 1935 the writer prepared such mixture on the small scale in the laboratory and tested them in a 20·9 H.P. car using a special small tank, so that consumption could be accurately recorded. The carburettor had been previously adjusted for economy and was not altered in any way for the tests. A circular course of approximately eight miles was arranged to minimize wind resistance effects and as far as possible a steady speed of 25 m.p.h. was maintained. Results were as follows :

		Mile per gallon	Equiva- lent to
(1) Burma Oil Company Petrol (pump)	..	21·13	100
(2) 15 : 85 mixture	.. ..	22·50	106·5
(3) 25 : 75 mixture	.. ..	22·73	107·6

Maximum speed was in all cases 57 m.p.h. and no difference could be distinguished in acceleration from 10-30 m.p.h. Speed and acceleration tests were mean results obtained by running in opposite directions. It was noticed that with the 25 : 75 mixture it was impossible to make the engine pink (detonation); the 15 : 85 mixture was almost free from tendency to pink while using petrol alone careless opening of the throttle caused severe pinking. The car had done a considerable mileage at the time of the test and was in need of decarbonization and valve grinding. The greater economy of the alcohol-petrol mixtures was beyond all doubt and driving was very much simplified since pinking disappeared.”

APPENDIX XIII

Purchase and sale prices of alcohol transacted through the State monopoly
of Germany

PRICES OF SPIRIT DURING 1937-38

Purchase prices

(a) For distilleries with a regular production up to 600 hls. (both yeast factories and molasses distilleries)—			
For 50 per cent. of the annual production	..	52.00	Rm.
For over 50 per cent.	..	40.00	"
(b) For distilleries over 600 hls.	..	46.00	"
For molasses distilleries	..	42.00	"
For yeast factories	..	39.50	"

Sale prices

Drinking spirit	..	400.00	Rm.
(a) Fully denatured spirit	..	45.00	"
(b) Industrial spirit (partially denatured)	..	40.00	"
Motor spirit	..	39.25	"
Acetic acid making spirit	..	85.00	"
Spirit for toilet preparations	..	240.00	"
Export spirit	..	20.00	"

N.B.—During this period the price of molasses varied between 8.00 and 8.09 Rm. per 60 Kg., equivalent to about Rs.26 per maund.

APPENDIX XIV

Production of molasses in cane factories during 1936-37

(Based on a statement supplied by the Director, Imperial Institute of Sugar Technology)

Province and district	Quantity (in 1,000 maunds)	Number of factories	Remarks
UNITED PROVINCES			
Dehra Dun	88	1	
Saharanpur	87	1	
Muzaffarnagar	401	4	
Bijnor	427	5	
Meerut	598	8	
Bareilly	301	3	
Etah	101	1	
Pilibhit	210	1	
Kheri	200	2	
Shahjahanpur	60	1	
Sitapur	337	3	
Bara Banki	61	1	
Lucknow	57	1	
Gonda	287*	3	*One factory did not submit its figures.
Basti	384	5	
Gorakhpur	1,734†	22	†Four factories did not submit their figures.
Jaunpur	66	1	
Allahabad	53	1	
Hardoi	112	1	
Deoria	82	1	
BIHAR			
Champaran	1,023	8	
Saran	922	10	
Muzaffarpur	315	3	
Darbhanga	605	6	
Bhagalpur	8	1	
Purnea	83	1	
Shahabad	358	4	
Patna	152	1	
Gaya	83	1	

APPENDIX XV

Distilleries in the United Provinces and Bihar

Name of distillery	Proprietor or Managing Agents	Remarks
UNITED PROVINCES		
1. Cawnpore Sugar Works, Limited.	Messrs. Begg, Sutherland & Co., Limited, Cawnpore.	Patent Stills.
2. Unao Distillery ..	The Punjab National Bank ..	Patent Still (not working at present).
3. Lucknow Distillery ..	M. Dyer Meakins Breweries, Limited.	Patent Stills.
4. Rosa Distillery ..	M. Carew & Co.	Ditto.
5. Meerut Distillery ..	The Central Distillery and Chemical Works, Limited, Meerut.	(To start shortly.)
6. Indian Distillery, Cawnpore	L. M. B. L. Singhanian, Cawnpore	Patent Still.
7. Fyzabad Distillery ..	The Fyzabad Distillery Co., Limited.	Pot Stills.
8. Allahabad Distillery ..	The Allahabad Distiller's Association, Limited.	Ditto.
9. Saharanpur Distillery ..	The Co-operative Co.'s, Limited..	Ditto.
BIHAR		
1. Cawnpore Sugar Works, Limited, Marhowrah (district Saran).	Messrs. Begg, Sutherland & Co., Limited, Cawnpore.	Patent Stills.
2. Manpur Distillery (Gaya)..	K. B. Chowdhury Muhammad Baksh, Manpur.	Ditto.
3. Manikatha Distillery (district Monghyr).	M. Lakshmi Narain Ram Narain, Manikatha.	Ditto.
4. Ranchi Distillery ..	Ditto ..	Ditto.
5. Sultanganj Distillery (district Bhagalpur).	Khau Bahadur Habibur Rahman, Sultanganj.	Ditto.

APPENDIX XVI

A—Production of industrial alcohol in India in 1936-37

					Methylated spirit (Calculated in gallons of absolute alcohol)	Rectified spirit
United Provinces	..	..	..	..	270,000	24,000
Bihar	..	..	..	..	103,000	..
All-India	..	..	..	..	1,325,000	235,000

B—Import of denatured spirit into India

Year					Quantity (gallons)	Value Rs.
1934-35	..	..	..	..	413,429	5,58,224
1935-36	..	..	..	..	296,405	3,25,462
1936-37	..	..	..	..	337,426	2,75,699
1937-38	..	..	..	..	379,010	3,14,042

APPENDIX XVII

**Some interesting data regarding power alcohol plants and their working
(Compiled by the Secretary)**

(1) A 1,000-ton cane crushing factory produces about 4,550 tons of molasses during one season.

(2) A distillery producing 1,500 gallons of power alcohol requires about 25 tons of molasses per day.

(3) The capital cost required for a complete power alcohol distillery with building and with a rated daily capacity of 1,500 gallons is about Rs.2,60,000.

(4) The cost of supplementary plant (Melle Azeotropic system, capacity 1,500 gallons per day) for manufacturing power alcohol from rectified spirit made in a modern patent still distillery is about Rs.35,000.

(5) Working data for the plant may be taken approximately as follows :

(i) Consumption of steam

	Per gallon of power alcohol
(a) When rectification and dehydration carried separately ..	52—56 lb.
(b) When direct from fermented wash	32—36 lb.

(ii) Loss of the "entraining liquid"

Used in Azeotropic process	0.0004—0.00045 gallon.
------------------------------------	---------------------------

(iii) Consumption of cooling water

(a) Salt-dehydration process	9—12 gallons.
(b) Azeotropic process	30—34 gallons.

(6) A 1,500 gallon distillery produces enough carbon dioxide to turn out about 3.5 tons of dry ice per 24 hours.

APPENDIX XVIII-A

Report from the Agricultural Chemist in Mysore, Bangalore, forwarded under his letter no. A.C.837/37-38, dated 21st/22nd February, 1938

Question 1—Have you or your department any experience in the use of molasses as (i) manure for ordinary soils growing common crops, like rice, wheat, sugarcane, etc.?

If so, please give details of its economic aspects.

Answer—Very little—a few pot experiments and small-scale plot trials were conducted. The results were hardly encouraging. Paddy and ground-nut were the crops under test. In view of the inconclusive results obtained further experiments are under way.

Question 2—Have you any experience of the use of molasses in the reclamation of *usar* (alkaline soils) in India? If so, kindly give as far as possible details of the field and large-scale experiments conducted in this direction giving—

(a) Amount of alkali in the soils.

(b) The amount of molasses and the number of application required to get the optimum results.

(c) The period for which the land so treated may continue to be in a fit condition for agricultural purposes.

(d) Whether it results in any ultimate harmful effect (after some years) to the soil thus treated.

Answer—Yes, purely experimental and exploratory. Copy of *letter to the Director of Agriculture, United Provinces, is enclosed which covers most of the points raised in (a) and (b). As regards (c) and (d), no opinion can now be advanced as we are still experimenting.

Question 3—What are your views in general regarding the utilization of molasses in India for the above two purposes? To what extent are you prepared to advise the Committee to recommend the use of molasses for these purposes under the present agricultural and economic conditions in India based on the experimental work done so far in this country?

Answer—Molasses can be used for reclaiming *usar* soils. The only objections to this, so far as we know are—

(1) the cost of transport,

(2) the extreme discomfort to man and beast in its application to land, and

(3) the time-lag period which must elapse after application of molasses before the land is fit for cropping.

*See Annexes.

ANNEXE

Copy of the letter no. 712-3/Encl. 2, dated 2nd February, 1938, from the Bio-Chemist, Agricultural Laboratories, Bangalore, to the Director of Agriculture, United Provinces, Lucknow

I AM desired by the Director of Agriculture to acknowledge with thanks your letters no. 13098/1—544(B) of 20th December, 1937 and 14724/1—373 (A)104 of 17th December, 1937. The delay in replying is deeply regretted.

As is to be noted from my letter no. AC, no. 430/17—48 of 4th November, 1937, to Professor N. R. Dhar, D.Sc., of Allahabad, our experiments in the first instance have been purely qualitative and largely exploratory of the possible use of molasses for reclaiming alkali soils.

A bad patch of 17 acres of alkali land on the Government Farm at Mandya—Mysore—with a pH varying from 7.5 to 9.0 was selected and planned to be cropped with paddy. The land was treated with 2 to 3 tons of molasses per acre not less than 9 to 12 weeks before transplanting flooded and ploughed dry at least 3 to 4 times. A bulk crop of paddy was then taken. During the first year, a small crop of 476 lb. of paddy grain per acre was obtained and a re-treatment of the land during the following year gave a grain yield of 1,250 lb. per acre. The yield of straw was equally good. A third untreated crop of 1,250 lb. paddy grain was harvested during 1936-37 and the yields of the current year are awaited. It may be mentioned that the land in question has had no other crop grown on it and had little or no vegetation at all prior to being "molassed". Few stray blades of grasses appeared in pocket of low alkalinity and the rest of the land was distinctly bare. These qualitative experiments were so encouraging that a further 5 acres of land of high alkalinity are under treatment.

As regards trials on *ryot's* lands, the results have hardly been satisfactory as returns have not been reliable. A more organized collection of returns are in contemplation and will be taken up during the coming year.

As stated earlier all these experiments have been purely qualitative and exploratory. It was only at the beginning of this year that two sets of experiments (i) to study the optimum dose of molasses for reclamation and (ii) to study its fertilizer effect were started. These experiments have been laid out in a randomized latin square, a well recognized statistical method. A preliminary soil survey of the plots in question had been done with reference to the nature and degree of alkalinity and the initial fertility level.

For the reclamation experiments, paddy has been selected and will have a rotation of fodder *jola* (*Sorghum*) sann-hemp and paddy. Molasses varying from 0 to 4 tons per acre has been applied and a paddy crop is now standing on the plots. Results will be communicated immediately they are available. There are four treatments and four replications. The pH of these soils have been from 7.5 to 9.0.

As regards experiments on the use of molasses as a fertilizer, a few qualitative studies in the earlier years using paddy or ground-nut were inconclusive and hardly encouraging. Experiments have however been laid out during the current year on approved statistical lines with ground-nut as the test crop. The trial consists in measuring the fertilizer effect of molasses

against a standard mixture of fertilizer on the one hand and that of molasses and fertilizers on the other. The crop is yet to be harvested and the results are therefore not yet available. These also will be communicated as soon as they are ready. An unmanured cotton crop will be taken up on these plots after harvesting ground-nut and preparing the land. Fertilizer trials with paddy as a test-crop are also in contemplation and will be conducted during the coming year. It may be mentioned in passing that the pH of these plots are round about ± 7 , i.e. somewhere near neutrality. It is also necessary to add that all these experiments are being conducted in an irrigated tract; no experiment in dry lands are under way.

With reference to the economic use of the question, I regret to say that we are as yet unable to give a definite opinion. It may however interest you to know that this aspect of the question was discussed in some detail at a Symposium on "Cane Molasses" under the auspices of the Society of Biological Chemists—India, held in Bangalore early in September, 1937. It was then agreed on all sides that the use of molasses in its present form was only possible within a limited distance from source (e.g. a sugar factory) and that means should be found to minimize the time-lag that must occur before any cropping can be done after an application of molasses to the land. A summary of the papers presented at the meeting together with a brief synopsis of the discussion has been published as a bulletin of the Society. Their Headquarters Office at Hebbal—Bangalore, may be addressed with advantage for a copy of the same. I may add that Professor N. R. Dhar has recently suggested the use of a mixture of equal quantities of press-mud and molasses which is expected to diminish the discomfort involved in the use of molasses on the field. Trials on this are being arranged.

APPENDIX XVIII-B

Report from D. R. Sethi, Esq., M.A., B.Sc. (Edin.), I. A. S., Director of Agriculture, Bihar, Patna, forwarded under his letter no. 1373/Y—24-38. dated 31st January, 1933.

WITH regard to the question of cattle food, it is doubtful if molasses as cattle food would be utilized to any large extent by the cultivators. In their raw form, molasses cannot be used for this purpose. They have to be turned out in some suitable manner mixed with other fodders so that they could be transported and handled easily. The economics of feeding molasses as cattle food as compared to other materials such as oil-cakes have also yet to be worked out, and until detailed experiments are carried out on this important point and definite results achieved, it would be, in my opinion, not right to make any broad recommendation on this point.

With regard to the use of molasses as a fertilizer, I should like to point out that the experimental work carried out by this Department so far indicates that while the molasses from sulphitation factories do give positive results on light soils in this province, the carbonitation molasses definitely depress the yield. A clear distinction will, therefore, have to be made so far as Bihar is concerned that only sulphitation molasses are useful as a manure. The economics of molasses as fertilizers yet remain to be worked out. We have so far been working on the basis that molasses have no value at present and can be had for the asking. Once this material finds a widespread use as a manure, the factories would be perfectly justified in asking for a reasonable price. Whether the use of this material at a price as fertilizer would be equally as economical as other manures has yet to be investigated. The greatest difficulty in the widespread use of this material as a manure appears to me to be the extreme difficulty in transporting and handling. While it may be quite easy for a sugar factory to use this stuff on its own cane lands, the average cultivator will find it rather difficult to transport it to his fields which may be situated anything from 2 to 10 miles away from the factory. Indications are that molasses may prove of very great assistance in reclaiming alkaline soils. Here again the quantity that could possibly be used would be limited by the area that could be reclaimed and brought under cultivation.

APPENDIX XVIII-C

Report from Dr. B. K. Mukerji, Ph.D., D.Sc., Agricultural Chemist to Government, United Provinces, Cawnpore, forwarded under his letter no. 810 R.C./I.B., dated 9th February, 1938.

1. *Molasses as fertilizer*—The Department of Agriculture of the United Provinces started in the year 1932 investigations regarding the use of molasses as manure for ordinary soils. The experiments have been confined mainly to the sugarcane crop, and conducted at Shahjahanpur, Cawnpore, Gorakhpur, Bahraich and Muzaffarnagr. The investigations at Cawnpore also included a trial with wheat.

The data so far available indicate that molasses must be applied at the rate of about 10 tons per acre two months before sowing sugarcane in order to gain appreciable increase in the outturn. As regards the sucrose content, there is in the case of planted cane no significant difference between the canes obtained from the molasses-treated plots and those from the unmanured plots. With ratoon canes, molasses has given higher yield at Gorakhpur and Cawnpore, and fares favourably with fertilizers at Muzaffarnagar. This increase is statistically significant as compared to control, but the sucrose content with the molasses treatment is definitely lower than with the no-manure treatment.

With wheat our experience has been that molasses gives a lower yield than either dung or compost although it is appreciably higher than the control.

Molasses is generally supposed to promote nitrogen fixation in a normal soil, but this is not consistently realized in actual practice as is evident from the conflicting results obtained by us.

As is well known, apart from the intrinsic merits of any fertilizer, the cost at which it is available to the cultivators makes all the difference between its success and failure. In the case of molasses we have also to bear in mind the cost of transport in addition to its price per maund at source. Even if the factory price is as low as annas 2 per maund, the purchasing cost of 10 tons molasses alone would come to about Rs.34-4. Add to that the cost of transport which is approximately Rs.2 per ton for a distance of 10 miles from the factory, the total cost of 10 tons of molasses, meeting the requirements for only one acre, works out under the most economical conditions to Rs.54-4. In view of the high cost it is extremely doubtful whether the additional gain in the shape of increased outturn would be commensurate with the expenditure on account of the molasses applied to the soil.

It might be noted here that while success is recorded at Bangalore, negative results have been obtained for sugarcane at Padegaon (Bombay-Deccan) and Risalewala (Punjab). Experiments with paddy conducted at Sabour (Bihar) during the year 1934-35 failed to establish the superiority of molasses over the no-manure treatment even though the dose of molasses was equivalent to 20 lb. nitrogen or 8,000 lb. per acre.

2. *Reclamation of usar (alkaline) soils by molasses*—Small scale experiments conducted by the Agricultural Chemist to Government, United Provinces, some years ago showed that molasses had a definite ameliorative effect upon *usar* soil from the Cawnpore District. More detailed work upon this is being conducted by Professor Dhar in co-operation with the Department of Agriculture, United Provinces. These experiments have not been in progress

sufficiently long to warrant any expression of opinion on either of the points, 2(c) or (d) raised in the questionnaire, that is, whether molasses brings about a lasting improvement or if it causes by prolonged application any harmful effect on the soil.

During Professor Dhar's absence from India a field experiment on systematic lines was laid out during the last *kharif* season by the Agricultural Chemist at the Government Model Farm, Unao, to study the effect of applying molasses to *usar* land on the outturn of rice. The soil which is typically *usar* having a pH value (alkalinity) 9.3—9.6, was treated three weeks before transplantation of paddy with molasses at the rate of (i) 5 tons, (ii) 10 tons and (iii) 15 tons per acre. Two more treatments, one control and the other press-mud at the rate of 5 tons per acre, were also included. All the 5 treatments were laid out in four randomized blocks, the area of each sub-plot being 1/40th acre. The yield figures have now been statistically treated both in regard to grain and straw. The main conclusions are as follows :

(a) *Grain*—(i) Molasses at 10 tons per acre gives highest yield of grain, and

(ii) There is no significant difference among the grain yields obtained with 5 or 15 tons molasses, 5 tons press-mud and the control.

(b) *Straw*—(i) Molasses at 15 tons per acre gives the highest yield of straw and molasses at 10 tons comes next.

(ii) There is no significant difference in the straw yields between the 5 tons molasses and the 5 tons press-mud treatments; but either of these is superior to control which shows the poorest yield.

Of all the treatments in this experiment, molasses at the rate of 10 tons per acre appears on the whole to be the best. Although there are *priori* reasons to believe that it would be necessary for the satisfactory reclamation of *usar* land to apply molasses at the rate of about 10 tons per acre, yet it is too early to say anything about the number of applications which may be required to get the optimum results.

Here again, it is clear that much of the ultimate success of the method would depend on the cost involved. The total cost of 10 tons of molasses at the rate of only 2 annas a maund, ex-factory, will be as shown above at least Rs.54-4. If the price of molasses be more than 2 annas a maund or if more than one application becomes necessary, then there would obviously be a proportionate increase in the total cost of the treatment.

Excepting for the experiment referred to above, I am not aware of the detailed results obtained from any other large-scale field trial which might have been systematically undertaken in the United Provinces or elsewhere to assess the value of molasses for reclaiming alkali lands. In the Punjab the application of molasses to *kallar* (alkali) soil has failed to yield satisfactory results, whereas it is recorded that by systematic treatments with calcium salts, such as gypsum and calcium chloride, those soils have improved considerably within three years.

3. *General*—On account of the high cost as shown above, molasses does not promise to be of great value as fertilizer for ordinary crops in normal soils. It is extremely doubtful if the use of molasses as ordinary fertilizer could ever be recommended as an economic method of disposing of the large quantities of the stuff available in this country. It is obvious that as a nitrogenous manure, molasses is not likely to be of direct value. It

contains potash in somewhat large quantities, but even in this we would get more by conserving our ordinary wood ashes. The chief value of molasses as fertilizer can lie only in its ability to stimulate direct fixation of nitrogen. But so far our experience has been that the direct or indirect gains accruing out of the application of molasses to normal soil do not justify the cost of the treatment.

The use of molasses of reclaiming *usar* or alkali lands seems to be an interesting and useful proposition. But in this too, the limiting factor appears likely to be the considerable cost of obtaining, carting and applying the treatment. The method appears to require the application of large quantities and the permanence of the effect has not yet been established. It is, therefore, too early to launch out into any extensive application. As a concrete instance, it may be cited that in our Western Circle the proportion of *usar* to normal soil is highest in the Mainpuri District; but the cost of molasses near about Mainpuri, Etah and Aligarh being somewhat excessive, it has not been found possible to adopt the use of molasses on any large scale for reclamation purposes. Whatever molasses is available from open-pan sugar factories is being used with considerable success by private individuals in the middle Doab, notably Mainpuri and Etah districts. The method consists in leaching the soil with monsoon, well or canal irrigation water combined with the application of molasses.

It is now well known that types of mild *usar* are capable of reclamation, at least for successful rice crops, by flooding and leaching combined with the application of organic manures; either green manure, or farm-yard manure, or compost. For agricultural application this is the only method which can at present be recommended. This method has been the subject of grants-in-aid from the Board of Agriculture and by the Director of Agriculture as well as of experiments on agricultural farms and demonstration plots. Thus the Unao farm and the Bara Banki model farm were located in *usar* tracts, with a considerable proportion of *usar* soil within their boundaries, for demonstration of the possibilities of such ameliorative measures; while considerable demonstration has been conducted in the Sarda area by the co-operative effort of the Agricultural and Irrigation departments. The Unao farm has shown that *usar* soil can be reclaimed for profitable growth of rice and other crops by leaching combined with organic manuring, the application of sugar factory press-mud cake, or dressing of *nala* silt. On the Cawnpore Research Farm mild *usar* has been reclaimed without heavy leaching by cultural methods including the growth of deep-rooted legumes, green manuring, or trenching with *juar* and sugarcane roots and the like, and by manuring with large doses of compost combined with good cultivation. The demonstration of the efficiency of leaching combined with green manuring on mild *usar* has been so impressive that the Irrigation Department are providing free irrigation water, up to the surplus supplies available for reclamation by this method during the first season of operation and there has already been a response from zamindars particularly in Unao District. It is expected that the coming *kharif* will show a very much greater area under reclamation in this way.

APPENDIX XVIII-D

Report from Dr. P. E. Lander, I.A.S., Agricultural Chemist to Government, Punjab, Lahore, forwarded under his letter no. 439, dated 10th February, 1938.

I.—Experiments on the use of molasses as manure for sugarcane, wheat and cotton have been carried out by the Deputy Director of Agriculture at Lyallpur and, considering conjointly the yields of the three crops raised successfully from the same plots after the application of molasses, he was in no case able to obtain increased yields. On the contrary the application of molasses in amounts from 40—150 maunds per acre exhibited a distinct tendency to depress yields. He found that even when molasses is valued at one anna and six pies per maund, financially the application of molasses has resulted in loss.

In 1936, the Agricultural Chemist in conjunction with the Deputy Director of Agriculture carried out a fresh trial with molasses as a fertilizer for sugarcane, and kept a full record of the changes that take place in the physical and chemical nature of the soil following the use of molasses, which was applied one and two months respectively before sowing sugarcane. It was also applied in two different ways, firstly by direct addition to the soil with the irrigation water and secondly after being composted with the soil during the above period. The quantity applied was 150 maunds (5.5 tons) per acre and the chemical changes in the different nitrogenous constituents of the soil were studied at monthly intervals. The results obtained may be summarized as follows :

- (1) The application of molasses resulted in a slight improvement in the texture of the soil as indicated by an increase in the water holding capacity.
- (2) There was a fall in the pH value from 8.10 to 7.85.
- (3) There was practically no increase in the amount of nitrogen fixed, although there was a great increase in the number of azotobacter in soil treated with molasses.
- (4) As the figures given below show, the quality of the cane suffered by the application of molasses.

Analysis of sugarcane : Variety—Co 285

Percentage on cane

Manure	Juice	Sucrose	Glucose	Total solids	Glucose ratio	Purity co-efficient
Control	59.8	9.36	0.49	10.8	5.2	86.7
Molasses applied one month before sowing.	60.6	8.64	0.47	10.5	5.4	81.8
Molasses applied two months before sowing.	60.7	8.52	0.53	10.4	5.6	82.8

- (5) The outturn of sugarcane, as shown below, was adversely affected by the application of molasses :

Average yields in maunds per acre

	Cane	Gur
	Mds. srs.	Mds. srs.
Control	621 0	72 30
Molasses applied one month before sowing ..	520 10	57 15
Molasses applied two months before sowing ..	513 0	56 10

It is clear from the above that under the climatic and soil conditions of Lyallpur, the use of molasses as a fertilizer for sugarcane has a negative value.

II.—A series of trials to study the effect of molasses as a reclamation agent for alkali soils (Bari) was started at Montgomery in 1936. It is too early to draw any conclusions from the one year's results so far obtained which are given below :

Yields per acre

(From average of 6 plots, each 1/22 acre in size)

	Grain	Straw
	Mds. srs. ch.	Mds. srs. ch.
Control	0 2 12	0 9 10
Molasses at 50 mds. per acre	0 23 6	1 2 10
Molasses at 100 mds. per acre	1 2 10	2 14 4

The cost of molasses at Montgomery was 12 annas per maund, and at this value, it is extremely doubtful if the reclamation of the Bari type of alkali soil will be an economic proposition.

The abovementioned soil received an additional similar dose of molasses in 1937, and wheat was again sown last October. The results of yields will be available after April.

(a) The composition of the soil is as follows :

Complete chemical and mechanical analysis of Bari soil

(Per 100 parts of soil)

						Water extract analysis
Total solids .. .. .	..	..	..	..	..	0.5935
Sodium carbonate .. .. .	..	..	..	..	..	0.0325
Sodium bicarbonate .. .. .	..	..	..	..	..	0.1730
Sodium chloride .. .. .	..	..	..	..	..	0.1490
Sodium sulphate .. .. .	..	..	..	..	..	0.2110
Calcium .. .. .	..	..	..	..	..	Nil.
Magnesium .. .. .	..	..	..	..	..	Nil.
Sodium .. .. .	..	..	..	..	..	0.1693
Potassium .. .. .	..	..	..	..	..	0.0075
						Mechanical analysis
Clay .. .. .	..	..	..	..	..	19.39
Silt .. .. .	..	..	..	..	..	27.28
Fine sand .. .. .	..	..	..	..	..	52.47
Coarse sand .. .. .	..	..	..	..	..	0.67
Kankar .. .. .	..	..	..	..	..	Nil.
						Available analysis (1 per cent, citric acid extraction)
Potash .. .. .	..	..	..	..	..	0.0609
Phosphate .. .. .	..	..	..	..	..	0.0984

						Exchangeable basis (Milli equivalents)
Calcium (Ca)	..	..	..	..	..	0.65
Magnesium (Mg)	..	..	..	..	..	Nil
Sodium	..	..	..	..	..	5.09
Potassium	..	..	..	..	..	0.04
Degree of alkalization	..	..	..	..	..	88
pH value	..	..	..	..	..	9.66
						(hydrogen Electrode)
Organic matter	..	..	..	..	..	0.2480
Total nitrogen	..	..	..	..	..	0.0325
Total carbonates as (CaCO ₃)	..	..	..	..	..	5.14

Regarding (b), (c) and (d) of the Questionnaire, I am not in a position as yet to make any statement.

III.—On the basis of the limited experience that I have of the use of molasses, I do not feel justified in offering any definite views regarding the utilization of the material in India for the above two purposes. The results obtained so far in the Punjab are not very encouraging. Some of the other methods of reclaiming alkali soils which I have tried seem to be more promising and economic. The indications at present are that for the Punjab soils the use of molasses by itself may not be very successful.

I still consider that, as I recommended years ago, the most effective manner of disposing of molasses would be to convert it into power alcohol.

APPENDIX XVIII-E

Report from Rao Bahadur B. Viswa Nath, F.I.C., F.C.S., Director and Imperial Agricultural Chemist, Imperial Agricultural Research Institute, New Delhi, forwarded under his letter no. 220 of 1938, dated 28th February, 1938

Question 1—Yes. I have experience in the use of molasses as manures for rice and sugarcane. The experiments with rice were carried out when I was Agricultural Chemist at Coimbatore, with the following results :

Treatment	Yield per plot of 4 cents		Yield per acre	
	Grain	Straw	Grain	Straw
	lb.	lb.	lb.	lb.
(1) Control	137	134	3,417	3,350
(2) Molasses—5 tons per acre	140	139	3,492	3,475
(3) Molasses—7½ tons per acre	156	137	3,888	3,425
(4) Molasses —4 tons per acre plus 1 cwt. ammonium sulphate per acre.	151	138	3,783	3,458

The increase in the yield of grain over "no manure" was significant in the cases of (3) and (4).

The experiments with sugarcane were carried out at Pusa. The scheme of experiments is below:

- (1) 100 lb. N as mustard cake + 20 lb. K_2O and P_2O_5 .
- (2) 100 lb. N ,, ,, ,, + 50 lb. K_2O only.
- (3) 100 lb. N ,, ,, ,, + 100 lb. P_2O_5 only.
- (4) 100 lb. N ,, ,, ,, + 50 lb., 100 lb. K_2O and P_2O_5 .
- (5) 100 lb. N as molasses and ammonium sulphate + 50 lb. K_2O .
- (6) 100 lb. N ,, ,, ,, ,, + 50 lb., K_2O and 100 lb. P_2O_5 .

The quantity of molasses used was 1,000 lb. to the acre and analysed 5.27 per cent. K_2O , 0.5 per cent. nitrogen and 0.23 per cent. P_2O_5 .

The final harvest results and analyses showed that the application of the manure was justified economically. Complete manuring gave 187 lb. of *sucrose* per plot of 0.25 acre, as against 104.7 lb. for the plot receiving no manure. The combination of ammonium sulphate and molasses gave as good a result as with mustard cake, potassium sulphate and super.

Question 2—I have not conducted specific field experiments on the use of molasses in the reclamation of alkaline soils, but from observational results, I have formed the opinion that they will do very well as correctives for alkaline lands which are not too alkaline, and in checking alkalinity. The use of molasses with gypsum is definitely more efficacious than gypsum alone in reclaiming very bad alkaline soils.

I have investigated the biological changes that take place in swampy soils. An enormous increase in the microbiological population and the production of organic acids occurs on the addition of molasses and these contribute to the beneficial effect on alkaline soils following the application of molasses.

Question 3—If it could be arranged I would unhesitatingly recommend the use of molasses in agriculture. The crop response as judged by immediate increases on application varies with conditions of soil and climate. While I am not prepared to say that crop increase would invariably follow the application, I am prepared to assert that the use of molasses does improve and build up the fertility of the soil. From this point of view, I consider that molasses possess a higher value as manure than as alcohol.

**Annexures to the Report of the Joint Power Alcohol and Molasses Inquiry
Committee (Bihar and the United Provinces), 1938**

Note of dissent by DR. S. S. BHATNAGAR, on paragraph 37 of the Report

Dr. Bhatnagar is of the opinion that the changed figures which take into consideration the cost of power alcohol up to the stage of bulk delivery at the petrol depot are not what the public are concerned with. It is the cost of the mixed fuel which matters to them. In any case to the figures for the cost of alcohol up to the stage of bulk delivery will have to be added the cost of mixing which should include the losses in mixing and the charges on the capital outlay on mixing appliances. Thus while whole-heartedly supporting the mixed fuel as a national measure, which will lead to the development of other industries, he wishes to convey without hesitation his considered opinion that the measure will have to be adopted without any hope of great profits either to the consumer or the peasant.

Note by DR. N. R. DEAR

From time immemorial alcohol has been produced by fermentation of materials containing sugars. As molasses is rich in sugars, it is certainly a suitable starting material for the production of alcohol for power and industrial purposes. But so far no firm or private individual in India has produced in bulk dehydrated alcohol suitable for mixing petrol for running motor vehicles. Moreover the cost of dehydration, mixing with petrol and loss due to evaporation are not known accurately in this country, hence the sale price of petrol-alcohol mixture is difficult to ascertain definitely. The figures therefore in paragraph 36 and some other sections of the report are only approximate. However, from the national viewpoint, manufacture of power alcohol is of vital importance; but from the point of view of profit either to the consumer, manufacturer or the peasant, it is not very satisfactory. Naturally other channels for the utilization of molasses have to be worked out. I have discussed this problem in detail in my presidential address to The Science Academy, United Provinces, on 19th December, 1935.

Note by MR. M. P. GANDHI

In this note, I propose to deal with one or two important issues concerning the *raison d' être* of the Power Alcohol Industry in the United Provinces and Bihar.

In view of the known attitude of the petroleum interests towards the development of the Power Alcohol Industry in India, and the great influence which the oil interests exert on the Governments of various countries all over the world, I feel apprehensive that even in spite of our clear pronouncement* in favour of the commercial practicability of utilization of molasses for the manufacture of power alcohol in the United Provinces and Bihar, and our recommendation of this method of utilization of molasses as a sound proposition from the economic point of view, the Government of India may be chary on creating conditions for, and look askance upon the immediate establishment of this industry†. The development of the Power Alcohol

*The Government of India are awaiting the pronouncement of the Joint Committee appointed by the Governments of United Provinces and Bihar before deciding about giving licences permitting the manufacture of power alcohol and about making it compulsory for petrol to be mixed with power alcohol. *Vide* interpellations in the Central Legislative Assembly, nos. 973, 975, 976, 981, dated the 24th March, 1938, and no. 1163, dated the 4th April, 1938.

†For a detailed discussion of the views held by the Government of India in this connection, *vide* "The Indian Sugar Industry Annual", 1936 and 1937, by Mr. M. P. Gandhi.

Industry which incidentally, satisfies all the conditions necessary for the establishment of a new industry, viz. cheap and regular supply of raw material, adequate supply of labour and the availability of a vast home market is a question of paramount importance to the United Provinces and Bihar in view of the imperative necessity of finding a suitable and profitable outlet for molasses, an important by-product of their largest industry, in the safety and progress of which they are vitally interested, particularly, due to its effect on the ryots, to whom the cane crop is a very important cash crop, the annual value of which runs into millions of rupees and which has, therefore, a great bearing on their welfare and wellbeing.

Being far removed from the sea-ports of India, these two Provinces are denied the opportunity of developing certain industries which Provinces near the sea-board can develop, and it is, therefore, only meet that the United Provinces and Bihar Governments should evince an anxiety (and indeed, should on that account be helped by the Central Government) to utilize this opportunity that has offered itself, as a result of the marvellous development of the sugar industry in both these Provinces*, of the establishment of the Power Alcohol Industry, and of thus creating at once a new channel of employment for indigenous capital and a new avenue for harnessing the energy of a few educated and middle class people in this as well as other subsidiary industries which are bound to spring up as a consequence of the development of this industry and of thus utilizing an important by-product of great potential value which far from being a source of profit, as it should be, causes some expenditure in its disposal and what is more, threatens to be a menace to the public health in the surrounding districts on account of its disagreeable smell and pollution of water if it is allowed to run into an adjacent water course.

Power alcohol has been produced on a commercial scale from molasses in various countries of the world like Austria, France, Phillipines, Czechoslovakia, Germany, United States and England, and there seems to be no particular technical complication in the manufacture of absolute alcohol which the industrialist may have to tackle. I am convinced that under the present circumstances and conditions, the manufacture of power alcohol is one of the most profitable directions for the utilization of molasses, from the economic point of view. I have little doubt that the Indian Tariff Board (Sugar) which conducted a comprehensive inquiry in the year 1937 (whose report although submitted to the Government of India in December, 1937 is not yet published) in this subject, will also endorse this view wholeheartedly.

While the development of this industry has been commenced, and indeed, carried out in most other countries at considerable expense to the State, which has even given subsidies of large amounts for a number of years, India is in the fortunate position of being able to develop this industry without any loss whatsoever to the revenue either of the Provincial or the Central Government. Indeed, it may bring some revenue to the Provincial Governments.

I also feel that the only way of reducing the huge and increasing drain of the national wealth on account of the imports of petroleum, methylated spirit and of varnishes, lacquers, etc., lies in the development of the Power and Industrial Alcohol Industry within the country. The annual import of petrol into India is of the order of 102,000,000 gallons valued at over five

*Specially in the case of the United Provinces, where there are no coal deposits another important consideration is that power alcohol is the only indigenous fuel that may become available there, at a competitive rate with other liquid fuels

crores, and of methylated spirit of the order of 379,000 gallons valued at over three lakhs, and such imports mean a drain of a very large amount of money. The replacement of every gallon of imported petrol and methylated spirit by indigenous power alcohol and industrial alcohol will mean an indirect increase in the national wealth which is greatly needed in view of the appalling poverty of millions in India*.

I further feel that if the Government of India should choose to levy the same excise duty on power alcohol as is levied on import of petrol, viz. annas 10 per gallon, they should allocate a suitable portion of the proceeds of such duty to the United Provinces and Bihar for purposes of development, just as they do in the case of revenues from income-tax from which portions are allocated to the Provinces, in the case of the import duty on petrol from which allocations are being made to the various provinces for road development, and in the case of the excise duty on sugar from which allocations are made to the various provinces for development of cane.

The establishment of this industry would also be helpful in checking any unwarranted increase in the price of petrol which, it may be observed, is dependent not upon the cost of production, but upon many other extraneous factors difficult to gauge. The availability of power alcohol in the country, would, therefore, give us a certain amount of independence from the monopolistic position of producers of petrol, and would at the same time give us a substitute motor fuel, which is vitally necessary for a nation, under modern conditions†.

I also feel, particularly, after the separation of Burma from India in April, 1937, that it is eminently desirable for India to develop an alternative source of motor fuel inside the country, to ensure supplies of petroleum in the event of there being difficulties due to sea blockage or other reasons in bringing petrol from Burma or from other countries from where imports have been steadily increasing‡.

The development of the Power Alcohol Industry is particularly to be welcomed, because, a perennial supply of cheap and excellent raw material, viz., molasses produced in sugar factories is assured. The development of this industry would also render it less necessary to exploit at once our indigenous mineral oil resources in the Punjab and Assam. These oil resources are, after all, wasting assets, and indeed, may well be preserved for the future, if possible.

I do feel that United Provinces and Bihar can supply power alcohol for use as fuel to other areas in the interior of the country like the Punjab, North-West Frontier Province, Rajputana, Central India, Northern Central Provinces, portions in Bengal adjacent to Bihar, etc. at competitive rates

*If the recommendations made in the Report are accepted at least 2.5 million gallons of Power Alcohol would be made in the two Provinces and about Rs.12 lakhs will remain in the country. To produce this quantity of power alcohol, about 7,000 tons of coal, 600 cwts. of sulphuric acid and 900 cwt. of Ammonium sulphate—all of Indian manufacture would be required.

†Past experience has shown how the petroleum interests are prepared to make an abnormal reduction of rates of petrol, for temporary periods and in restricted areas to meet competition of any competitor on the field, with a view to make it impossible for him to carry on profitably for any length of time.

‡The import of petrol from Burma during the year 1937-38 was 69,995,010 gallons valued at Rs.3,42,58,490 and from "other countries" 38,660,607 gallons valued at Rs.1,88,03,419. The total import of petroleum during 1937-38 was 102,055,617 gallons valued at Rs.5,30,61,849. It is a matter of interest to note that the import of petroleum from "other countries" has increased considerably during the last 3 years. In 1935-36 it was 2,077,775 gallons, in 1936-37 9,747,486 gallons, in 1937-38, 38,660,607 gallons. The average value of imported petrol as declared before the Customs Department during the year 1937-38 works out to 8 annas 4 pies per gallon, while the average declared value of petrol imported from Burma alone works out to 8 annas 8 pies per gallon at the ports.

under present conditions, without any difficulty, if the requisite legislation for compulsory admixture of power alcohol with petrol is passed.

It is needless to say that if power alcohol is required for the whole of India for purposes of admixture with petrol as motor fuel, it will be possible to produce the entire quantity required for use in the country. The addition of a percentage of power alcohol to the petrol will improve the quality of the petrol (by increasing the Octane number) and I therefore trust that the petroleum companies will readily agree to do so.

I hope that other Provinces in India will also lend their unstinted support to this scheme for the development of this industry, and thus enable the establishment of a new industry which will be an important step leading to a further industrialization of the country, ever so necessary to reduce the pressure of population on the land.

I would like to warn the Governments of United Provinces and Bihar, however that there is a danger of the petroleum interests reducing their prices of petrol to an unduly low level for a short time with a view to hamper or check the development of this industry, to prevent the use of power alcohol as a substitute by making over a reduction (it will only be for a temporary period remembering the object for which it is needed). They may even gain the sympathy of the consumers, and indeed, the bogey of protection of consumers' interests might also in all probability, be put forward from various quarters with a view to defer action for establishment of this industry. In such an event, however, the Government should be fully ready and equipped to face this situation and take suitable and prompt action.

I hope, however, that the petroleum distributing organizations who have benefited considerably from their monopoly in this trade for several decades, will take a farsighted and businesslike view, and will not let such a situation arise. In fact, their market will be taken away only to a very small extent due to the admixture of power alcohol, and the effect on them will be negligible, particularly, as the consumption of petrol is consistently and steadily increasing. On the other hand, the ungrudging co-operation of the Petroleum Distributing Organizations, with this new Power Alcohol Industry, which the Governments are anxious to develop, in the matter of marketing the mixed fuel, will be appreciated by the Governments, whose help and goodwill may be of considerable value to the Distributing Companies in the smooth running of their business.

Minority report by MR. P. S. MAKER

The Government of Bihar, in consultation with the Government of United Provinces appointed a joint Power Alcohol Committee on 18th January, 1938, with the following terms of reference :

First—(a) to devise ways and means of starting the manufacture of power alcohol out of molasses.

(b) to report on the best method of manufacture and of mixing power alcohol with petrol.

*Second—*to explore other possible uses for molasses and their practical applications.

The manufacture of power alcohol had been widely discussed in India for the past several years, and with the recent development of sugar industry making available large surplus of molasses, this question has assumed an all India importance. The fact that the alcohol-petrol mixtures are being

successfully used as motor fuels, in most of the countries abroad, it was very appropriate for the two Governments to appoint the said Committee to draw up a practical scheme for the manufacture of power alcohol out of molasses and to report on the utilization of molasses for purposes other than power alcohol.

The majority report is based on a strictly literal interpretation of the terms of reference. Though it was clear that the power alcohol when developed in United Provinces and Bihar alone, would not solve the molasses problem still my colleagues preferred to restrict the scope and method of inquiry and treated the entire subject-matter in a more general way, with the result that the majority report does not present any definite scheme for the manufacture, mixing and distributing of power alcohol. My report on the other hand treats the molasses problem on all India basis and satisfies the requirements of the terms of reference. The report is presented in three parts—*Part I* deals with the manufacture, cost and distribution of power alcohol, and *Part II* takes up the production of Industrial alcohols and converting the same into Commercial Solvents and alcohol products that have a ready market in India, and lastly *Part III* summarizes the recovery of distillery by-products such as : Dry Ice, Yeast, Potash and Ammonium Sulphate Fertilizers, etc.

PART I

POWER ALCOHOL

1. Most of the vegetable crops containing starches, such as, cereals, potatoes, etc., and those containing ready formed sugars, such as sugarcane with its residual molasses, fruits of various kinds and other things like waste wood and straw from the basic raw materials for the manufacture of power alcohol. In Great Britain, power alcohol is manufactured mainly from cereals and imported molasses. In Germany potatoes are chiefly used, while in France Alcohol is chiefly made from beet molasses and in the United States of America, maize and Cuban molasses form the basic raw materials for alcohol manufacture. India with practically little petroleum resources of her own must industrialize her agriculture for the manufacture of power alcohol so that we may increasingly be less dependent on foreign petrol and kerosene oil.

Petrol consumption in India primarily by the motor transport, is steadily increasing and for the year 1937-38, it reached 110 million gallons. Imports of kerosene oil into British India for the year 1936-37 amounted to 182 million gallons of which 120 million gallons came from Burma and 62 million gallons from other countries. Fuel oil imports average to 140 million gallons a year. In different countries, depending upon the circumstances the percentage of power alcohol in alcohol-petrol mixture varies from 10 per cent. to 50 per cent. and in certain cases like France there are two or more alcohol-petrol compulsory mixtures that are marketed for different class of motor transport.

If the laws of economics and nationalism, permit most of the western countries to mix power alcohol with petrol the same laws must equally hold good for India, especially when India has little oil supplies of her own and has 350,000 tons of surplus cane molasses to dispose off and by further developing her agriculture she can produce any amount of Power alcohol at prices unheard of in the world's markets.

2. *Petrol replacement*—In the year 1936-37, India produced 18 million gallons of petrol, imported 73 million gallons from Burma and about 10 million gallons from Iran, etc. Estimated consumption for the year 1937-38 is 110 million gallons. Of this 19 million gallons are consumed by the Indian States and about 1 million gallons for aviation purposes. The balance of 90 million gallons of petrol has to be replaced partly or totally with power alcohol. Although the percentage of light cars running is considerably higher than the heavy type of vehicles, it is estimated that the light motor vehicles consume annually 50 million gallons of petrol and the heavy type like lorries and buses consume the balance of 40 million gallons. For the light motor vehicles and taxi cabs the following fuel mixture is recommended :

Mixture A

<i>Winter four months (N. W. India)</i> November, December, January, February	<i>Summer eight months</i>
Per cent.	Per cent.
20 Power Alcohol	25 Power Alcohol.
5 Ethyl Ether	75 Petrol.
75 Petrol	
<hr style="width: 50px; margin: 0 auto;"/> 100	<hr style="width: 50px; margin: 0 auto;"/> 100

This will provide annual outlet for 12½ million gallons of power alcohol. For the heavy type of motor vehicles like buses, lorries and vans, etc., the following mixture is recommended :

Mixture B

<i>Winter four months (N. W. India)</i>				<i>Summer eight months</i>			
November, December, January, February							
Per cent.				Per cent.			
40	Power Alcohol	..	..	50	Power Alcohol.		
10	Ethyl Ether	..	..	50	Petrol.		
50	Petrol	..	..		
<hr/>				<hr/>			
100				100			
<hr/>				<hr/>			

This will absorb another 20 million gallons of power alcohol thus leaving a balance of 57.5 million gallons of petrol to be imported every year. And it is suggested that the same be imported from Burma alone in exchange for Indian produce. Besides the above two Mixtures A and B absorbing nearly 32.5 million gallons of power alcohol a year, there should be a separate motor transport organization, on all India basis, for marketing straight power alcohol as motor fuel. This mixture C will consist of 80 per cent. power alcohol and 20 per cent. Ethyl Ether. This national fuel under State subsidy will sell at 2 annas per gallon less than Mixture B while Mixture A, which is really a luxury fuel for the rich man's car, will pay a sale tax of 2 annas per gallon. This national transport system, run exclusively on power alcohol will operate as separate economic units in each Province as Feeder to Railway Service, especially to handle inter-provincial goods traffic in Agricultural produce. Plying about 1,000 alcohol trucks and lorries throughout India yearly consumption of Mixture C will reach 5.5 million gallons, thus replacing a total of 38 million gallons of imported petrol with home made Power Alcohol and saving India nearly Rs.190 lakhs a year.

3. *Kerosene replacement*—Out of 182 million gallons of kerosene imported annually into India, it is estimated that 150 million gallons are used for illuminating or lighting purposes and the balance of 32 million gallons are used for fuel or as source of power generation, for water works, kerosene Engines and Farm Tractors.

4. Before the discovery of Petroleum and its refined products Alcohol was universally used for illuminating purposes. In the year 1860, America alone consumed over 13 million gallons of Alcohol of 95 per cent. straight for lighting purposes.

5. In the year 1900 and 1906 photometric tests were made to determine the comparative value of Alcohol and kerosene as illuminants. These tests included the French "Bovin" incandescent mantle alcohol table lamp and an ordinary flat-wick kerosene table lamp using a good quality of alcohol (95 per cent.) and kerosene.

TABLE I

Lamp	One gallon will last		Candle power	Candle power hours
	H.	M.		
Alcohol	58	52	25	1,471
Kerosene	87	0	9	783
Alcohol	57	06	30.35	1,722
Kerosene	28	40	30.8	883

6. The test data conclusively prove that if we had two lamps of equal candle power and equal capacity, or one burning alcohol and the other kerosene alcohol lamp would burn nearly twice as long as the kerosene lamp or in other words a gallon of alcohol possesses about twice the illuminating value of a gallon of kerosene. Power alcohol, therefore, can compete successfully with kerosene at twice the cost per gallon. Outside of cost considerations, there are a number of other features in favour of alcohol lamp which are summarized below :

(1) The alcohol lamp is much safer than the kerosene lamp as fire started from Alcohol is readily extinguished by water which mixes with Alcohol in all proportions.

(2) The heat given off by radiation is much less in the case of Alcohol lamp.

(3) The white light furnished by the Alcohol lamp is a kind of day light in its quality and being also extremely steady and uniform it is preferable to the light of the Kerosene lamp.

(4) As the Alcohol lamp burns no wick it is free from this troublesome feature. The Alcohol lamp does not smoke and is practically odourless. The fitting on of the mantle is easy and simple. The lighting of the Alcohol lamp is more easily done with Kerosene as the removal of the chimney is unnecessary.

7. The only argument that may be advanced against the use of Power Alcohol in place of Kerosene, is of the prohibitive cost of Alcohol lamp and it is stated that an ordinary table type Alcohol lamp will cost Rs.10 while a Kerosene lamp of same type and size would cost Rs.5 only. The explanation is that there being no demand for alcohol lamps, their prices must be higher than of kerosene lamps. We all know that with the increase in demand, an ordinary hurricane lantern that used to cost Rs.3 a piece, can be had now at less than Re.1 in any corner of India and as a matter of fact there are two or three Indian establishments who are now manufacturing these lanterns by employing automatic machinery. Similarly, by creating demand for the Alcohol lamps same will be manufactured in India at popular prices including the Mantles. As a matter of constructional details there is nothing complicated in an Alcohol lamp. Its chief difference lies in its design of the burner which is easily regulated. Thus the amount of light furnished, and hence of Alcohol used, can be reduced at will. It would be the duty of the State to subsidize Alcohol lamp manufacture and so regulate the Alcohol Industry that it may eventually replace 182 million gallons of Kerosene and save India nearly Rs.550 lakhs a year.

As stated above, the declared value of a gallon of Kerosene Oil is 4 annas and 10½ pies and the excise duty is 2 annas and 9½ pies per gallon. On to this may be added 1 anna and 6 pies as transport charges and 1 anna and 10 pies to cover packaging, leakage, Sale Commission and other miscellaneous charges thus making a total of 11 annas a gallon for the consumers to pay. If the Power Alcohol be saved from Excise duty of 2 annas and 9½ pies a gallon it would compete nicely with Kerosene in any part of India and may eventually drive out Kerosene entirely; otherwise the State must subsidize to the extent of 2 annas for every gallon of Power Alcohol that may go to replace Kerosene. To begin with, campaign must be started in large towns and district headquarters and at the same time making it compulsory as far as possible for all Government purposes, District Boards and Municipal Institutions, the use of Power Alcohol in place of Kerosene. A moderate programme on all India basis to replace say 10 per cent. (150 million gallons) of our present Kerosene consumption for illuminating purposes, with Power Alcohol should be undertaken.

8. The balance of 32 million gallons of Kerosene used for Power purposes will be easier to replace with Power Alcohol, because the consuming units are larger and mainly employed by Municipal Water Works, Workshops, and small industries as well as for power farming. Germany has made the best progress in the design and manufacture of Alcohol engines for various industrial and Agricultural uses. Certain types of engines can be operated with petrol, Kerosene or Alcohol, simply by reducing the clearance space in the cylinder for proper compression. The feeding or carburetting devices require very little change.

9. Alcohol Engines for land and marine service, Alcohol Tractors, Alcohol Locomotive for use in Forests, Mines, quarries and in large agricultural estates, are widely used in all countries lacking Petroleum resources. Germany as far back as 1902, consumed yearly 20 million gallons of Alcohol for Power and industrial purposes. It is estimated that according to the proposed scheme, consumption under this head will reach 7 million gallons a year. Question of fuel oil though an important item on India's import list, has to be left over till the other Power Alcohol programme, as outlined in this scheme, is well on its way to completion.

10. *Five-year plan*—Subject-matter discussed above relates to an all India problem and calls forth for the progressive development of Power Alcohol Industry that will in its fifth year of growth, reach a figure of 60 million gallons to replace imported petrol and Kerosene as summarized below :

TABLE II

Type fuel	Per cent. alcohol	Power alcohol, 1943-44
Petrol replacement—		
Mix ure A	25	12,500,000
.. B	50	20,000,000
.. C	100	5,005,000
Kerosene replacement—		
· Illuminant	100	15,000,000
Motive power	100	7,000,000
Total (Power Alcohol) .. .. .	..	60,000,000

It is difficult to fix at this stage the rate of Alcohol production from year to year, but it may be taken as certain, that if the Provincial Councils pass the necessary legislation for the Alcohol Petrol Mixtures and there be no serious oppositions from the Government of India and the vested oil interests the contemplated five years plan for making available early 60 million gallons of Alcohol, would finish long before the scheduled period.

Our total Alcohol capacity of 60 millions gallons will be split up into six units each with a yearly capacity of about 10 million gallons and each consuming nearly 170,000 tons of Indian Molasses. Starting with one unit and as the scheme develops along, similar units at suitable centres will be installed throughout India.

11. *State control*—If the Power Alcohol Industry is to be developed in India, it is absolutely essential to do the same under strict State Control and protection. And the national significance of this problem can be better

judged from the letter quoted below, addressed by a French Senator to Clemenceau on 12th December, 1919 :

“ He who owns the Oil will own the World, for he will rule the sea by means of the heavy oils, the air by Petrol and the illuminating oils and in addition to this he will rule his fellow men in an economic sense by reason of the fantastic wealth he will derive from oil the wonderful substance which is more sought after and more precious today than Gold itself.”

To give an instance of an economic rate war, it may be stated that for considerable number of years, the Standard Oil Company of America used to regard India and China as its own preserve. The Company distributed at first gratis, and afterwards at half the cost price, lakhs of cheap Kerosene Oil lamps bearing the inscription “ Good Luck.” As British Dutch-Shell came on the scene she was able to sell the Chinese its oil at a price considerably below that which the Americans could afford to do, Sumatra being nearer than California. By 1911, however an agreement was made between the two Companies by which 50 per cent. of the East Asiatic market, was handed over to Royal Dutch. Recently Bombay City experienced a similar economic war in case of Petrol, Burma-Shell driving out the Russian Petrol.

Since 1911-12, oil economic fight has developed into a political fight and the struggle for oil is being fought out today, and will be carried on tomorrow, as fiercely as ever. Before the war, i.e. 1913, British Empire produced 2 per cent. of the World's total production of oil, while at present she controls at source over 20 per cent. of World's total production. This was made possible because of continued State help and protection to British oil trading interests. This business venture on the part of the British Government has proved very profitable. The original investment of £2.2 millions made by the British Parliament in 1914, has now become £60 millions. This British control over Anglo-Persian and Burma-Shell groups is no less valuable to Great Britain today than her control over the Suez Canal.

India's case is somewhat comparable to France and Germany, because the latter two countries do not possess any more natural oil resources than India. It is natural therefore that France's production of Power Alcohol should be the highest (88 million gallons) and Germany coming next with an annual production of 48 million gallons and the entire trade of Power Alcohol and Petroleum Imports in the two countries is regulated under State control and supervision.

Fortunately, circumstances at present are most favourable for India to develop the Power Alcohol Industry. There is nationwide demand for it, and the enormous quantity of waste Molasses will be put to use. Capital and Copper are available at cheap rates. The oil companies who are busy supplying the European Countries for storing enormous quantities of petrol, for defence purposes, would not mind a little shrinkage in their Indian business. And above all, Government of India, seems to be in a reasonable mood and most probably will not let down the Provinces, in trying out the economic efficiency of the new constitution. It is essential, therefore, that the bill for the compulsory mixing of Power Alcohol with Petrol be passed by the Provincial Legislators. The Honour and National responsibility however, for starting the Power Alcohol Industry will primarily rest with the United Provinces and Bihar Governments and in all respects the two Provinces are admirably suitable to shoulder the undertaking.

12. *State funds*—To make the enterprise of such a magnitude a success, an efficient organization and large funds would be necessary. Although the initial heavy capital investment and working capital would be entirely provided by the public, still the State must incur a heavy annual expenditure to fulfil her part of the obligation, which may take the form of subsidies, guarantee on the capital investment, establishing a Technical Institute and providing transport and other facilities in order to stabilize the Industry.

Considering the present state of provincial finances, it is doubtful if large funds would be available for establishing the Power Alcohol Industry. Therefore, it is proposed that in the interest of the Industry and the public at large, the State should raise the money in the following manner and earmark the same as an "All India Power Fund."

(a) *Molasses Cess*—It is proposed to levy a sale tax of one anna per maund on all factory molasses sold. The consumers and exporters, at present are paying very little for the molasses and they will certainly not grudge paying some cess so long the price of molasses does not exceed Re.1 per maund, which is the prevailing price in countries like England, America, etc. Molasses from Gur Refineries and Khandsars amounting to 144,000 tons a year should be exempted from the Cess, because on account of their better quality and taste are found excellent for tobacco curing and making Cattle Fodder. Factory Molasses amounting to 410,000 tons a year will yield an income of Rs.7 lakhs, of which the United Provinces will contribute Rs.4 lakhs, Bihar Rs.2.25 lakhs and the rest of India Rs.0.75 lakh only.

(b) *Petrol Cess*—It is proposed to levy a sale tax of annas two per gallon on all straight Petrol and Mixture sold throughout India, which according to our present rate of consumption and as stated in Section 8 above, comes to 50 million gallons, while Mixture B will carry no tax. Mixture C on the other hand shall receive State help of annas two per gallon and under the proposed scheme as outlined in Section 10 only 5.5 million gallons of Mixture C will be marketed. Similarly Power Alcohol replacing Kerosene when used as illuminant or motive power will receive a State aid of annas two per gallon. After adjusting the State subsidy on 27.5 million gallons of National Fuel (100 per cent.) Power Alcohol, the Petrol Cess will leave a favourable balance of Rs.28 lakhs a year. The State policy behind the above taxation measures shall be two-fold: first to make the new Power Alcohol Industry self-supporting from its very start and secondly to encourage the use of National Fuel at the expense of Foreign Petrol. How this large sum of Rs.35 lakhs a year be imbursement will largely depend upon the State Policy pursued and details in this connexion will have to be worked out by the proposed Alcohol Board of which a bare outline is given below.

13. *State Organization*—An Alcohol Board will be constituted on an all India basis, each province co-operating in the scheme will nominate one outstanding industrialist. These eleven members in turn will nominate four Technical Experts thus increasing the Board's strength to fifteen. The Board shall be vested with full and final authority on all matters concerning the development of Alcohol Industry and its progress and competency will be judged by its completing in time the five years plan as outlined in Section 10. The life of Board's member will be for five years but each Provincial Government will be free to recall its member and send in a substitute. All the 15 members of the Board shall be honorary but they will be paid first class travelling allowance plus Rs.100 for attending every meeting of the Board. The Secretary of the Board will be a permanent paid officer, assisted by several Under Secretaries representing various departments like,

Production, Alcohol Institute; Publicity; Excise; Power Farming, etc. It is estimated that the Board's establishment alone will cost Rs.6 lakhs a year.

Alcohol Institute will be established to carry on Industrial Research Work in co-operation with the Production Units and to introduce such Alcohol bearing products as described in Part II of this scheme. The Institute will be under the control of a Director, directly responsible to the Alcohol Board. It will have three co-ordinated Sections, viz. Chemical, Biological and Engineering. As to what Chemical research can do to establish an industry may well be illustrated by citing the case of American Alcohol Industry. With the advent of prohibition most of the distilleries were closed down thus effecting the agricultural interests very badly. To overcome this difficulty and to put back into service huge dead capital both the State and the Industry requisitioned the services of Research Chemists to find new outlets for Alcohol, with the result that in a few years' time the American Alcohol Industry was raised to a place of first importance and now the total United States Production of Industrial Alcohol, in the year 1937, reached 100,000,000 wine gallons, (100 per cent.) which was entirely absorbed by the various chemical industries like Chemicals, Drugs and Pharmaceuticals, Toilet preparations and Plastics, etc. Thus it was made possible to consume annually all the molasses available and in addition one lakh tons of Corn giving considerable relief to the American Agriculturists. Following the same policy of development we should find no difficulty in raising our annual consumption of Industrial Alcohol to 20 million gallons by the end of our five-year plan. The Chemical and Biological Sections will also be concerned in problems involving the recovery of fertilizers and other by-products like CO². Yeast and cheap denaturants. Till the Institute's own buildings are ready it will be accommodated in the Works Laboratories adjoining the first Central Distillery. The main Institute's buildings, staff quarters, laboratory equipment and fittings, various Pilot plants including steam and Power plant will cost nearly Rs.10 lakhs. And in order to finish the five-year plan in time and to build the Industry on strong chemical foundations and in order that the Institute's work be carried on the basis of International Co-operation involving exchange of research problems, Patents, etc., the annual recurring expenditure will amount to Rs.9 lakhs.

The Publicity and the State Aid departments working under the control of the Alcohol Board will by far play the most conspicuous rôle in shaping the success of the scheme. While it will be an easy matter to dispose off 38 million gallons of Power Alcohol as Motor Fuel with the help of Government Legislation, it would, on the other hand, require a well organized nationwide propaganda backed by a powerful sales and engineering service to market the balance of 22 million gallons of Tax-Free Power Alcohol which will be used in place of imported Kerosene for illuminating and motive power purposes. It shall be the primary duty of the Publicity Department to make the name of Power Alcohol or any other name given to this National Fuel like Qaumi 'Tail, a household word and make such arrangements that its availability is made as easy as that of wood, coal or kerosene. To replace 15 million gallons of imported Kerosene with Power Alcohol would mean putting into service 75,000 Alcohol Lamps a year for five years at about half the cost price and mainly manufactured in India. This is based on the assumption that a 30 candle power Alcohol lamp as supplied by the Publicity Department will burn on an average 8 hours during night time throughout the year. Same liberal policy will be adopted towards the supply of Alcohol Tractors and pumping sets run by Power Alcohol. All farm machinery ordered by the Co-operative Societies and Collective Farms throughout

India will be supplied at half the initial cost. The Engineering Section of the Institute will look after the demonstration and will render all possible service to the users of machinery run on Power Alcohol. State aided Automobile garages will render free service to trucks and buses using 100 per cent. Power Alcohol Motor Fuel. It is estimated that this department will cost approximately Rs.15 lakhs a year. The balance of Rs.5 lakhs will be taken up by the Excise Department and maintenance of other administrative machinery working under the control of the Alcohol Board.

14. *State Legislation*—The right thing would be that all the Provinces in a body approach the Government of India to pass the necessary legislation for compulsory mixing of Power Alcohol with imported or indigenous Petrol and take up the development of the Alcohol Industry on all India basis. If the concerted attempt fails in that event each Province should pass the necessary legislation and co-operate with other provinces in a manner that may set the organization going country-wide. Framing of the new Alcohol Act is a matter of details and can be drafted on uniform lines after the provinces have declared their attention of joining the scheme. As a matter of fact, the molasses problem, as well as the more important question of National Fuel will not be solved satisfactorily unless the problem is tackled on an All India basis.

As the proposed scheme will be developed in stages, it is recommended that there should be six central distilleries each with a daily capacity of 30,000 gallons of alcohol, thus bringing the annual production to 60 million gallons of Power Alcohol by the end of fifty year. Eventually each province will have one or more central distilleries most economically located to meet all their requirements of Power and Indian Alcohol. That the two Governments of the United Provinces and Bihar are seriously faced with the problems of disposing of large quantities of surplus molasses, makes it imperative on the part of the two Governments to start the first central distillery at a place conveniently located in respect of two Provinces and the most suitable place thought of from all economic considerations is "SONEPORE." What follows hereafter, therefore, shall relate to our first unit Central Distillery at Sonopore sponsored by the Governments of the United Provinces and Bihar and it is hoped that before placing order for the second unit, the All-India Organization and other State control measures will be perfected.

15. *Sonopore*—Chief factors discussed below in order of importance, that should determine the location of any Power Alcohol Central Distillery are :

- (a) Molasses supply;
- (b) Transport facilities.
- (c) Coal fuel.
- (d) Fresh Water Supply.

(a) *Molasses*—Sugar factories areas in which molasses is in most distressed state are: North Bihar and District of Gorakhpore, comprising nearly 56 sugar factories. It is from this area that the Indian Molasses Company of Great Britain purchases its supplies for export purposes. This Company has its storage installation at Sonopore and hauls the molasses in tank wagons from the neighbouring factories, situated on the B. & N. W. Railway line. The Company buys molasses at a ridiculously low price of annas 1-3 per maund and pays on the average anna 1 per maund as railway freight up to its storage installation at Sonopore. It costs another 1 anna

3 pies per maund to take the same by boat to Calcutta and the pumping charges at Calcutta come to 6 pies per maund thus bringing the cost up to 4 annas per maund before the Cargo Steamer leaves for Europe. If the ocean freight be taken at 4 annas per maund and following anna 1 per maund as Dock Charges on the other end, it costs the Indian Molasses Company a minimum of annas nine (-/9/-) per maund to land molasses in Great Britain. The overhead expenses are so high that the Company hardly makes anything by selling at 11 annas per maund. The Continental price is annas 12 per maund and the Cuban molasses today are fetching 14 annas a maund delivered in America, where the price prior to 1929 used to be Re.1-4 per maund. The Export Molasses scheme has proved a failure, as in the year 1936-37, the export amounted to 34,000 tons only, out of 350,000 tons of available surplus. Under the proposed scheme the entire molasses production will come under the control of the Excise and Prohibition Department and its marketing will be controlled by the Alcohol Board. The Alcohol Board shall fix the basic minimum price of 4 annas per maund at any Sugar Factory and after paying the Cess of 1 anna per maund and another 1 anna per maund at railway freight, it will cost the Central Distillery 6 annas per maund of molasses delivered.

As to the availability of molasses near Sonapore there are 17 factories in North Bihar that are within 200 miles of Sonapore, while 26 factories in the District of Gorakhpur, United Provinces, are situated within 200 miles of Sonapore. In all there are 60 sugar factories with a total annual production of 200,000 tons of molasses which lie within the economic distance (i.e. one anna per maund railway freight) of Sonapore. The proposed distillery, however, when working at full capacity will consume 170,000 tons of molasses a year producing 10 million gallons of Power Alcohol. Sonapore therefore occupies the best position in the whole of the United Provinces and Bihar as a molasses centre.

(b) *Transport Facilities*—We have already stated the railway facilities existing for the transport of molasses to Sonapore and the same service will be utilized for the distribution of Power Alcohol and other products in the markets of North Bihar and Eastern parts of United Provinces served by the B. & N. W. Railway and R. & K. Railway. Across the river, is the broad gauge State Railway—E. I. Railway, running from Calcutta to Delhi. The unique transport feature in favour of Sonapore is the existence of Gandak and Ganges transport service as far as Calcutta and it is no exaggeration to state that this feature alone should make Sonapore in the near future, a highly industrialized area. Water freight rate comes only to a fraction of what it costs to transport either by rail or road. For instance railway freight on Petrol from Calcutta to Patna is 1 anna 3 pies a gallon, when carried in tank wagons of 5,000 gallons. On the other hand to cover the same distance either way by a small steam boat and trailers it will cost at the most 3 pies a gallon and if there be no transshipment, another 3 pies a gallon will carry Power Alcohol from Calcutta to any Indian port like Madras, Bombay, Karachi, etc. There are enormous commercial possibilities if the Inland Indian Waterways be properly developed and the two Governments of the United Provinces and Bihar will do well to appoint a Joint Commission to investigate further development of river transport in the two Provinces. A Central Distillery at Sonapore will be ideally situated and may be compared well to a steam Power Plant installed at the mouth of a Coal Mine Pit, supplying current to large towns by a long distance transmission system.

(c) *Coal Fuel*—The proposed Distillery will consist of several units capable of producing annually 8 million gallons of Power Alcohol and 2 million gallons of Industrial Alcohol, the latter will be used in the manufacture of solvents and other Alcohol products as described in Part II of this scheme. Taking 333 working days in a year, it will come to 30,000 gallons of Alcohol a day of 24 hours. Steam consumption will be 35 lb. per gallon of Power Alcohol made, but taking into consideration other Power requirements, the powdered coal fired steam Power Plant will be designed at normal rating, on the basis of 40 lb. steam per gallon of Alcohol made. This means a daily consumption of 1,200,000 lb. of steam. Taking the average heat value of Bihar coals as 11,000 B. T. U. per lb. of coal and assuming an over all heat efficiency of 65 per cent., we will produce 6 lb. of steam per lb. of coal burnt or a consumption of about 90 tons of coal per day of 24 hours. Another 15 tons a day will be consumed by Railways and Steamships for the transport of molasses, Power Alcohol and other products. Sonopore is within easy reach of Bihar Coal Mines and by combining the Rail and River Transport Service and entering into long term coal supply contracts the fuel bill will be cut down considerably thus making appreciable contribution towards lowering the cost of Power Alcohol. Low pressure steam is used in the distillation and evaporation processes, therefore, two non-condensing extraction Turbine sets will be installed to generate current and supply processes steam at the desired low pressure. By this arrangement we shall have a large surplus of electric current available costing only one pie per unit.

(d) *Water Supply*—Distillation processes require large quantities of fresh cooling water for the condensation of vapours, therefore Central Distilleries, in general are located on sea-boards or large river heads. About 10 gallons of cooling water per gallon of Power Alcohol made is considered sufficient with a properly designed plant, but certain allowance must be made in case of tropical countries like India. In case of Sonopore, it would be safe to take 50 gallons of cooling water per gallon of Alcohol made. On this basis, the proposed unit will require 1,500,000 imperial gallons of cooling water a day. Fortunately the Gandak and the Ganges are big enough to meet requirements. With current costing one pie a unit, our pumping costs will be kept at minimum.

Not a single distillery out of existing ones now working in United Provinces, Bihar or in any other part of India can offer such decided advantages as described above pertaining to Sonopore. The existing distilleries are not only small but too obsolete units to deserve any economic consideration under the present scheme.

16. A careful survey, however, of the Sonopore area, shall have to be made before it could be decided to select a suitable site that may be free from any possibility of floods. The survey work by the prospecting company should start immediately and continue throughout the coming rainy months. The entire plant, however, will rest on a concrete pile foundation and entirely built on concrete and steel to withstand earthquake shocks and to be safe from minor sub-soil disturbances. Should any difficulty arise in finding a suitable site at Sonopore, the next best place would be across the Ganges lying between Digha-Ghat and Dinapur. The molasses, etc. could be ferried or piped across the river.

MANUFACTURE: In dehydrating Alcohol, i.e. producing a water-free Alcohol, known as Power Alcohol, such as is now required for motor

fuel, the azeotropic process which is the oldest and more economical than the salt process is generally used. For climatic conditions as prevailing at Sonopore, average Alcohol yield in an azeotropic process would be 98.5 per cent. and Benzol consumption of 0.004 gallon per gallon of Power Alcohol produced. Benzol solvent, which will be required for the manufacturing process, as well as for denaturing purposes, if not already available in India, will be recovered from the existing coke ovens, thus establishing another important industry from industrial waste.

It would cost 4 annas to manufacture a gallon of rectified spirit of 95 per cent. strength, and its summary analysis is given in Part II. We are now concerned to calculate the over all cost of a gallon of absolute alcohol of 99.97 per cent. strength, manufactured in a distillery five times the capacity, and employing azeotropic process. The molasses price is to be taken at annas 6 per maund at the distillery, yielding 2.1 imperial gallons of Power Alcohol of 57 gallons of Power Alcohol per ton of molasses. The molasses charge per gallon of Alcohol will come to 2 annas 9 pies. The total investment on the proposed distillery producing 30,000 gallons alcohol a day will amount to Rs.30 lakhs. Taking plant depreciation and insurance at 7 per cent. the annual amount comes to Rs.2.1 lakhs or a charge of 4 pies per gallon. Labour charges and staff salaries for the said Central Distillery will not exceed Rs.1 lakh annually or a charge of 2 pies per gallon. As to steam and power charges, we are taking a liberal estimate of 40 lb. steam consumed for every gallon of Power Alcohol produced, which when rendered in terms of coal means 4.5 lb. of coal, and assuming coal cost at Rs.10 per ton delivered at Sonopore, the Fuel cost per gallon of alcohol will not exceed 4 pies. Taking 0.004 gallon benzol per gallon of power alcohol produced, the daily benzol consumption will not exceed 100 gallons or Rs.100 a day. After making a liberal allowance for the consumption of other stores, chemicals and supplies, the total annual bill will not exceed Rs.1.5 lakhs a year or a charge of 3 pies per gallon of produce. Overhead and establishment charges will amount to Rs.1.5 lakhs a year or a charge of 3 pies per gallon. The excise supervision and direction will take another Rs.50,000 a year or 1 pie per gallon. Alcohol loss due to leakage and evaporation being transhipment to petrol bulk installations is taken at 1 per cent. by volume, and fire insurance at 2 per cent. on stock value of 1 million gallons, thus the combined charge per gallon will not exceed 1 pie which comes to over Rs.50,000 a year. The above items are summarised below :

TABLE III

Item	Per gallon		
	Rs.	s.	p.
Molasses cost at -/6/- per maund 0 2 9
Plant Depreciation and Insurance 0 0 4
Labour charges and staff salaries 0 0 2
Steam and Power Costs 0 0 4
Benzol, Chemicals and Stores 0 0 3
Overhead and establishment 0 0 3
Excise supervision and direction 0 0 1
Evaporation loss and fire insurance 0 0 1
Total <u>0 4 3</u>

Therefore, the actual cost of manufacturing Power Alcohol comes to 4 annas 3 pies per imperial gallon, including evaporation losses during transport up to mixing installations. Of this 2 annas 9 pies or 65 per cent. of total cost represents the cost of molasses and the balance 1 anna 6 pies or 35 per cent. as the manufacturing or conversion charge. In other words on one year's production, the Central Distillery shall pay Rs.11 lakhs for molasses; Rs.2.1 lakhs for coal and Rs.3.2 lakhs in the form of wages and salaries. By increasing the distillery capacity five fold, it has been made possible to reduce the manufacturing charge from 4 annas to 1 anna 6 pies per gallon. If the markets for the distillery products such as Dry Ice, Yeast, Fertilizers and surplus electric energy be properly developed, the extra profits from such sales would be more than sufficient to absorb the entire manufacturing charge of 1 anna 6 pies a gallon, thus bringing down the cost of Power Alcohol to 2 annas 9 pies a gallon barely to cover the cost of molasses only. The great strides made by the chemical and its economic success abroad is mainly due to the inter-department development of basic chemical industries in which a waste product of one industry, invariably forms a valuable raw material for another one, thus helping each other to reduce the over all manufacturing costs.

17. *Marketing*—The proposed unit at Sonapore will produce annually in the first instance, 8 million gallons of Power Alcohol; 2 million gallons of Industrial Alcohol in the form of Alcohol bearing chemical products and Potash and Ammonium Sulphate fertilizers to the extent of 16,000 tons and these products will have an annual market value of Rs.40 lakhs, Rs.50 lakhs and Rs.20 lakhs, respectively. With the completion of the five year plan the annual production will reach 60 million gallons of Power Alcohol, 5 million gallons of Industrial Alcohol and 32,000 tons of Fertilizer and at the present prices the annual production will amount to nearly Rs.5 crores. To distribute and market these products an efficient organization independent of Petrol distributing companies would be necessary. The said company will be one of the service units of the parent company and shall look after the transport, storage and supply of Power Alcohol from Central Distilleries like Sonapore to various Petrol bulk installations. If found necessary the company shall also provide facilities for the mixing of Power Alcohol with Petrol and shall establish service station, warehouses and sales offices for the mixture C and other Alcohol products described in Part II of this scheme.

To start with, the entire production of 8 million gallons of Power Alcohol will be marketed in the five provinces: Bengal, Bihar, Orissa, United Provinces and Central Provinces with an annual Petrol consumption of 34.5 million gallons. Should any difficulty arise in case of Bengal, in that event Madras or Bombay may be taken as substitute but it is very important to include one of the Port towns for marketing Power Alcohol. It is proposed to absorb 3 million gallons of Power Alcohol in the form of Mixture A containing 15 per cent. Alcohol only, another 4 million gallons of Power Alcohol in the form of Mixture B containing 30 per cent. Alcohol only and the balance of 1 million gallon of Power Alcohol will be consumed in the form of Mixture C or straight 100 per cent. Power Alcohol. No adjustment, whatsoever, either in the carburettor or in any other part of the Motor Engine would be necessary using above mixtures. With increased production of Power Alcohol either its percentage in the above mixture be increased or low Alcohol mixtures be introduced in new provinces,

In addition to the existing railway transport facilities and the proposed inter-provincial motor transport a national waterways transport company will be organized to cover the navigable portions of the rivers: Ganges, Sone, Gandak and later on extend traffic along Jumna and Gogra rivers, This will serve most of the commercial towns in United Provinces, Bihar, including Calcutta Port; further joining the Indian Coastal traffic, will serve the parts of Madras and Bombay. After working out the details and considering the economies effected by co-ordinating the three transport services, it has been possible to prepare the following table giving approximate average prices that the consumer will have to pay for a gallon of Power Alcohol at the service pump in the said five provinces:

TABLE IV

Item	Bengal	Bihar	Orissa	United Provinces	Central Provinces
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Power Alcohol cost	0 4 3	0 4 3	0 4 3	0 4 3	0 4 3
Denaturing charges	0 0 8	0 0 8	0 0 8	0 0 8	0 0 8
Profit 10 per cent.	0 0 9	0 0 6	0 0 6	0 0 6	0 0 6
Transport up to mixing department.	0 0 6	0 0 7	0 0 9	0 1 3	0 1 6
Mixing charges	0 0 2	0 0 3	0 0 4	0 0 5	0 0 6
Distribution	0 0 6	0 0 7	0 1 0	0 1 0	0 1 3
Retail commission	0 1 0	0 1 0	0 1 0	0 1 0	0 1 0
Transit loss 100 per cent. ..	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3
Excise	0 10 0	0 10 0	0 10 0	0 10 0	0 10 0
Total	1 1 10	1 2 1	1 2 9	1 3 4	1 3 11
Provincial tax	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0
Sale price	1 3 7	1 4 1	1 4 9	1 5 4	1 5 11
Petrol price, past 3 years' average	1 4 7	1 6 0	1 7 0	1 8 0	1 8 0

As the percentage of Power Alcohol in Mixture A is much smaller of the two, it would be necessary to leave the mixing and the subsequent distribution of the mixtures in the hands of the existing oil distributing companies. Therefore the price of Power Alcohol for all practical purposes of this scheme should be reckoned, delivered at the various mixing Depots located at Ports or in the interior. Table IV above shows that we are in a position to market Power Alcohol in the said five provinces at prices lower than Petrol, when averaged over last three years. Recently, however, due to rate war with "Caltex", Petrol prices at Calcutta has dropped to Re.1-2. a gallon and it may still go down to the level of Bombay where due to competition from Russian Petrol, its price stayed at 15 annas a gallon for about 4 years but recently it has again come up to Re.1-2 a gallon. Under the present scheme, however, we are in a position to market Power Alcohol in Madras and Bombay Presidencies at Re.1-2-6 and Re.1-3 a gallon respectively, delivered at their Port mixing depots.

Power Alcohol sold even at a little higher price for mixing purposes will not make appreciable difference in the ultimate price of mixture. This point is properly analysed in Table V below :

TABLE V

—	Petrol	Power Alcohol	10 per cent.	15 per cent.	20 per cent.	25 per cent.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	1 0 0	1 4 0	1 0 4.8	1 0 7.2	1 0 8.6	1 1 0
	1 0 0	1 8 0	1 0 9.6	1 1 2.4	1 1 7.2	1 2 0
	1 0 0	1 12 0	1 1 2.4	1 1 9.6	1 2 4.8	1 3 0
II	1 2 0	1 4 0	1 2 2.4	1 2 3.6	1 2 4.8	1 2 6
	1 2 0	1 8 0	1 2 7.2	1 2 9	1 3 2.4	1 3 6
	1 2 0	1 12 0	1 2 11.5	1 3 6	4 0	1 4 6
III	1 4 0	1 4 0	1 4 0	1 4 0	1 4 0	1 4 0
	1 4 0	1 8 0	1 4 4.8	1 4 7.2	1 4 9.6	1 5 0
	1 4 0	1 12 0	1 4 9.6	1 5 2.4	1 5 7.2	1 6 0
IV	1 6 0	1 4 0	1 5 9.6	1 5 8.4	1 5 7.2	1 5 6
	1 6 0	1 8 0	1 6 2.4	1 6 3.6	1 6 4.8	1 6 8
	1 6 0	1 12 0	1 6 6.5	1 6 10.8	1 7 2.4	1 7 6

Again the price of Power Alcohol should not be governed by the market price of Petrol which is largely controlled by the oil companies. Its price on the other hand should be regulated by the agricultural interests affected and be left to the authority of the Government Alcohol Board who will take into consideration various economic and national factors when fixing the price of Power Alcohol. The price however, may include a charge of 2 annas a gallon as Provincial excise duty, which at the completion of five-year plan will yield an annual revenue of Rs.75 lakhs distributed amongst different provinces in proportion to their Power Alcohol consumption. This excise duty, however, should not be mixed up with the molasses and Petrol cess stated in paragraph 12; while the former will contribute towards provincial finances, the latter on the other hand shall provide funds for the development and maintenance of the Power Alcohol Industry.

Figures contained in Table IV and Table V show that the manufacture and marketing of Power Alcohol is an economic feasibility. Given a fair chance the proposed scheme guarantees to supply to the consuming public, a national Fuel, at price, no higher than the Petrol price when averaged for the last three years. While affording substantial relief to the Sugar Industry, Power Alcohol will go a long way in stabilizing Petrol prices throughout India, thus restricting the monopolistic tendencies of the Oil Companies. All this will be made possible by a suitable legislation for compulsory mixing of Power Alcohol with Petrol and development of its trade as compatible with the national interests.

18. *Capital Investment*—The proposed central Distillery with a daily capacity of 24,000 imperial gallons of Power Alcohol, inclusive of all machinery, Power Plant, Buildings completely installed would cost

approximately Rs.30 lakhs. Taking 333 working days in a year, production will amount to 8 million gallons and allowing only half an anna a gallon as net profit the annual minimum return will amount, to Rs.2.5 lakhs or 8.3 per cent. on the capital investment. This, however, does not include any profit that will accrue from the recovery of fertilizers, dry ice, and from the disposal of yeast products. Recovery of by-products is treated separately in Part III and would yield higher returns on the investment. The business of manufacturing Power Alcohol will be organized as a Joint Stock Company and the Provincial Governments concerned shall guarantee for a period of 5 years a return of 4 per cent. on the total share capital invested.

For the marketing of Power Alcohol and other Alcohol products a separate organization to do the transport and selling would be necessary. This company will be a subsidiary concern but governed by the same Board of Directors and guided by All-India Power Alcohol Board. The company being assured of business shall not stand in need of any Government subsidy or guarantee on the capital lay-out. Most of its capital investment will be utilized in the purchase of steam boats, tankers, Alcohol trucks and in organizing the sale and distributing of straight Power Alcohol. This business would require a capital lay out of Rs.25 lakhs yielding a minimum return of 15 per cent.

19. *Summary*—My conclusions and recommendations are summarized below—

(1) In the year 1936-37 Indian production of molasses amounted to 550,000 tons of which 350,000 tons were available as surplus. Average price realized was 1 anna 6 pies a maund while the proposed scheme assures a minimum price of 4 annas a maund thus benefiting the sugar industry and the cane-grower to the extent of Rs.23 lakhs a year.

(2) In five years' time the scheme is capable of replacing 38 million gallons of Petrol and 22 million gallons of kerosene, with Power Alcohol. To start with, the Sonapore Unit will manufacture 8 million gallons of Power Alcohol consuming 140,000 tons molasses annually.

(3) A judicious mixture of Power Alcohol, up to 25 per cent. with Petrol makes a better fuel for automobiles, requiring no change in the adjustment of the Engine or Carburettor. A 50—50 mixture will burn satisfactorily in motor lorries and buses. Straight Power Alcohol can be used in certain type of engines, tractors and other agricultural and mining machinery.

(4) Power Alcohol, manufactured by this Azeotropic process, will cost 4 annas and 3 pies per Imperial Gallon. Of this 2 annas and 9 pies represents the cost of molasses at 6 annas a maund and the balance 1 anna and 6 pies as the manufacturing charge. Allowing on a gallon 6 pies as profit, 8 pies as denaturing charge and 10 annas as excise, Power Alcohol can be delivered to any mixing depot in India at an average price of Re.1-1-6 a gallon. The combined charge for mixing, distributing and transit loss will come to 2 annas 6 pies a gallon, thus bringing the average retail price, on all-India basis, to Re.1-4 against Re.1-7 of Petrol when averaged over the past three years.

(5) Power Alcohol can compete with Petrol and Kerosene without a subsidy from the Government. Necessary legislation, however, must be enacted for the compulsory mixture of Power Alcohol with Petrol. Besides paying its own establishment charges, the Industry can become a good

source for raising Provincial revenues as slight increase in Power Alcohol price will not affect appreciably the price of mixture.

(6) Alcohol Industry like many other agricultural industries such as sugar, textile, jute, vegetable oils, etc. is an important key industry especially in the chemical field and it must be developed on all India basis. The two Provinces most suitable for its establishment are United Provinces and Bihar. Sonopore locality satisfies most of the requirements of a Central Distillery.

(7) Sonopore Distillery with an annual capacity of 8 million gallons of Power Alcohol will cost Rs.30 lakhs, yielding a minimum return of 8.3 per cent. The investing public should be protected by the Provincial Government by exercising price control and guaranteeing 4 per cent. on the capital investment for five years.

(8) A subsidiary transport and distributing company shall be organized to carry Power Alcohol from the Distillery to all storage and mixing Depots which are owned by the existing Petroleum companies. A flat rate of 2 annas and 1 pie a gallon will be paid for this service. This company would require a capital layout of Rs.25 lakhs yielding a return of 15 per cent. Mixing and distributing of mixture to service pumps will be left to the existing Petrol distributing companies allowing them a fixed charge of 2 annas and 6 pies a gallon inclusive of 1 anna as retail commission.

(9) The denaturant used will be either 5 per cent. Benzol or $2\frac{1}{2}$ per cent. wood Naphtha by volume, thus the denaturing charge will come to 8 pies a gallon. The use of such denaturants will result in the establishment of Benzol Recovery and Wood Distillation Plants.

(10) On the completion of five years plan, we would be consuming 60 million gallons of Power Alcohol instead of imported Petrol or Kerosene Oil, thus saving annually Rs.250 lakhs from going abroad. This will also make possible the manufacture of Industrial Alcohol Chemicals and Fertilizers as outlined in Part II and III of this minority report. The Alcohol industry will primarily benefit the Indian Agriculture, partly solve the question of National Fuel and give substantial relief to the problem of unemployment.

PARTS II and III

UTILIZATION OF MOLASSES

1. With the fast development of Indian Sugar Industry, the disposal of molasses has become a problem, and with its increased production every year and no outlet for its consumption, it is having serious repercussions on the Industry. The most popular method, which at the same time is free from technical difficulties, is to ferment molasses into Alcohol, and use the same as Motor Fuel. Most of the countries that lack petroleum resources, use Power Alcohol as a substitute. This however, is only possible under Government protection and control and there is no reason why the Government of India should not pass such a legislation, providing compulsory mixing of Alcohol with the imported Petrol.

2. Besides the Power Alcohol question, various other proposals have been advanced from different quarters, in the past five years, suggesting the use of molasses as Fertilizer, Cattle-Food, Fuel, Road Surfacing, etc., but none of these has met with any appreciable measure of success in solving the molasses problem. The proposed scheme will be a new departure in India, as far as the treatment of molasses is concerned. It calls forth immediate establishment, either in United Provinces or Bihar, of a highly technical and specialized Alcohol-Chemical Industry, on lines as it is being practised today in many countries abroad. This scheme has nothing to do with the Power Alcohol, on the other hand, after fermenting molasses into Alcohol, it destroys Alcohol converting the same into commercial products that have a ready market in India.

3. In the Western Countries, Alcohol is looked upon as an Agricultural product, as it is chiefly manufactured from potatoes, cereals, molasses, etc. In the interest of Indian Agriculture, it is essential that new uses should be found for molasses, which is an important large scale by-product of the second biggest national industry. If such uses have an economic foundation and will thereby bring an extra return to the Industrialist it is only reasonable to expect that he will pass on a part of these returns to the cane grower. Industrial Alcohol will be produced from Molasses for use in various small scale industries and in the manufacture of other Alcohol products. The by-products of an Industrial Distillery such as Carbon Dioxide Gas, Cattle Food, Potash and Ammonia Fertilizers, etc. will also be of great benefit to the Indian Agriculture.

4. As Molasses form the basic raw material of this scheme consideration of its supply is of primary importance; it is estimated that factory sugar production for the year 1936-37 exceeded 1,000,000 tons, and molasses obtained amounted to nearly 450,000 tons. Of this figure, United Provinces, is responsible to the extent of 55 per cent. and Bihar 30 per cent. This figure does not include molasses from Khandsars. Allowing 100,000 Tons, of Molasses for consumption by other industries, we will have about 350,000 tons left over as surplus, which means a regular supply of 1,000 tons a day for a plant operating 350 days in a year. The proposed plant, however, will have a daily capacity of mashing 100 tons of Molasses only, as it is intended to prove that such an undertaking is commercially feasible.

5. *Scheme*—This Scheme calls for the controlled fermentation of Molasses into commercial Alcohols. These Alcohols in turn will be converted

into commercial Solvents and Plasticizers which will be used in the manufacture of such Alcohol Products that have a ready market in India. Table I below gives the annual import figures of commercial products, which either contain Alcohol or use Alcohol in some form or other in their process of manufacture, or they represent as by-products of the Alcohol Industry. Table I gives average import figures taken over the past five years from 1930 to 1935 :

TABLE I

No.	Product	Value
		Rs.
1	Acetic acid	1,40,000
2	Artificial leather	4,40,000
3	Artificial silk	3,40,00,000
4	Chemical manures	55,19,000
5	Denatured spirits	8,45,000
6	Nitrocellulose lacquers	14,64,000
7	Polishes of all kinds	21,07,000
8	Wines and liquors	1,80,00,000
	Total ..	6,25,00,000

All the products listed in Table I above show a steady increase in their early consumption. And if the Indian Alcohol and allied chemical industries be properly developed, most of these products can be profitably manufactured from Indian raw materials in India. The present Scheme makes a moderate start in this direction and proposes to manufacture.

(1) Commercial Alcohols, (2) Commercial Solvents, (3) Spirit Varnishes, (4) Nitro Cellulose Lacquers, (5) Artificial leather, (6) Recovery of by-products like Carbon Dioxide Gas and Fertilizers. These products of Alcohol are dealt with separately both from technical and economic viewpoint.

6. *Commercial Alcohol*—In most Western countries, Industrial Ethyl Alcohol ranks first in quantity and value of production of all organic chemicals. It is the basic raw material in the chemical and process industries and finds application in a multitude of products. For instance the total available capacity in the United States of America for producing industrial Alcohol is over 200 Million Gallons, manufactured mainly from imported Molasses and costing on average Re.1 per maund of Molasses. The methods of production and the controls exercised over mechanical, chemical and biological processes are highly perfected. By our mashing 100 tons of Molasses daily, Alcohol production of 95 per cent. strength will amount to 60,000 imperial gallons. As the Fusel-oil will have to be completely recovered for solvent purposes, about half of the entire Alcohol production can be made into Rectified Spirits of finest quality.

7. The over-all cost of converting Molasses into industrial Alcohol will be annas 4 per imperial gallon of 95 per cent. strength. This includes all manufacturing charges; such as: interest, depreciation, insurance, labour, power, chemicals and overhead. The cost of denaturing, when necessary, will come to 9 pies a gallon. The cost of Molasses, in addition to the conversion costs per gallon of Alcohol, will vary the market price of Molasses.

Table II, gives the conversion cost plus the Molasses cost for producing a gallon of Alcohol, with the price of Molasses ranging from 2 annas to Re.1 per maund of 82 lb.

TABLE III

Molasses price per maund	Alcohol cost per gallon
Rs. a. p.	Rs. a. p.
0 2 0	0 5 0
0 4 0	0 5 9
0 6 0	0 6 8
0 8 0	0 7 8
0 10 0	0 8 6
0 12 0	0 9 3
0 14 9	0 10 3
1 0 0	0 11 2

The present market price of Molasses is 1 anna per maund and allowing another anna per maund to cover the transport and storage charges, the cost per maund when delivered to the proposed Plant Site will not exceed 2 annas per maund. For our calculation purposes, however, we are taking the Molasses cost at 4 annas per maund. Figured on this bases, the overall cost of manufacturing a gallon of Alcohol of 95 per cent. strength, will come to 5 annas and 9 pies which would be the lowest price on record in the world. This is made possible, under the proposed scheme, because of cheap molasses, cheap fuel, and by installing the latest design large Distilling Apparatus, which will be most efficient in performance.

8. Reliable figures for the total consumption of Alcohol in India are not available. There are in operation five distilleries in the United Provinces, five in the Province of Bihar and two distilleries in the Central Provinces, and quite a number of small distilleries spread over other Provinces. The Excise Department, indicates a figure of 10,000 gallons of alcohol a day in the form of country liquors for British India alone. In view of the prohibition movement recently advocated by the Provincial Governments the present demand by the Excise Department must be ignored. The present scheme calls forth the diversion of Molasses-Alcohol into commercial products. It is estimated that over 15,000 gallons of industrial Alcohol a day is consumed by small industries throughout India. And this amount seems negligible when compared to 500,000 gallons consumed daily in the U. S. A. for industrial purposes alone. The imports of Methylated Spirits into India though on decline, still amount to over 100 gallons a day. In the face of these facts, our daily production of 600 gallons of industrial Alcohol could be comfortably absorbed by the Indian market, especially when our cost price amounts to 5 annas and 9 pies per gallon, against the present market price of Re.1-1 per gallon for Rectified Spirits and 10 annas per gallon for the methylated spirit. According to the present scheme, however, most of the Alcohol produced will be diverted into commercial products, which would give better returns per unit sale. And to meet trade requirements for the special quality rectified spirits or denatured spirits, it is intended to dispose of daily some 2,000 gallons of spirits at 9 annas per gallon, thus yielding a net profit of Rs.300 a day on this sale alone.

9. *Alcohol cost analysis*—Our basic raw material is Molasses, one maund of which will cost us 4 annas only and will produce 2.25 imperial gallons of 95 per cent. Alcohol. This means that every gallon of Alcohol made will consume Molasses worth 1 anna and 9 pies. The over-all conversion costs, as stated above, will not exceed 4 annas per gallon, thus bringing the total cost of Alcohol to 5 annas and 9 pies per gallon. The cost of denaturant and other denaturing charges will come to 9 pies per gallon, and this cost has to be incurred, in case the produce has to be sold in the market as denatured spirit, otherwise the net Alcohol cost when used in our own process industries for manufacturing various Alcohol products, will remain at 5 annas and 9 pies a gallon. There can be no question about the availability and cheapness of Molasses, but it may be asked, how the conversion cost of 4 annas per gallon was arrived at. A modern distillery, complete in every respect and capable of treating 100 tons of Molasses a day will cost nearly rupees ten lakhs. In figuring out the conversion costs we must take into account the charges like interest, depreciation and insurance on the capital invested, and to consider other items like labour, power, chemicals, stores and finally the overhead charges. Ordinarily no interest is charged on the paid up capital investment, plant depreciation in case of a distillery is rather small, while insurance rate is slightly higher. In our case we are allowing 6 per cent. 4 per cent. and 2 per cent. respectively on a total investment of rupees ten lakhs which amounts to Rs.1,20,000 a year on an annual production of 18 lakhs gallons of Alcohol. This charge comes to 1 anna per gallon. The daily wages bill consisting of 80 technical and skilled help, will amount to Rs.200 or Rs.75,000 a year. Thus labour charges comes to 6 pies per gallon of Alcohol made; while the overhead charge, which in other words means executive labour, will absorb another sum of Rs.200 a day, or 8 pies a gallon. Regarding power costs it may be mentioned that coal fired steam power plant will be installed, and our average steam consumption will be 25 lb. per gallon of Alcohol made. Our steam generation cost will come to Re.1, per 1,000 lb; thus making the power charge come to 5 pies per gallon of Alcohol made. Taking into consideration the power losses and consumption in other departments of the distillery, it will take another 3 pies of power for every gallon of Alcohol made, thus bringing the total power charge to 8 pies per gallon of Alcohol. Consumption of chemicals and general stores in a year's time will come to Rs.56,000, thus adding another charge of 6 pies to the gallon. Table III below summarizes the over-all cost of making a gallon of Alcohol of 95 per cent. strength, in a distillery having an annual capacity of turning out 18 lakhs gallons of such Alcohol. Molasses cost is taken at 4 annas per maund of 82 lb.

TABLE III

No.	Item	Annual charge	Charge gallon
		Rs.	Rs. s. p.
A	Cane molasses	1,88,008	0 1 9
B	Int., dep., and Insu.	1,20,000	0 1 0
C	Labour charges	75,000	0 0 8
D	Power costs	75,000	0 0 8
E	Chemicals and stores	56,000	0 0 6
F	Overhead charges	75,000	0 0 8
G	Alcohol losses, etc. .. .. .	..	0 0 6
	Total	5,89,000	0 5 9

10. *Commercial Solvents*—In the manufacture of Nitrocellulose Lacquers, Solvents play an important part. The question of rate of drying, flow and gloss and the fine characteristics are vital to Lacquers and these properties can be incorporated by the selective use of a proper blending of solvents which are classified by the trade according to their boiling points. To start with we will be manufacturing a few of the important Alcohol and Ester type of solvents such as: Ethyl Ether: Anhydrous Ethyl Alcohol; Amyl Alcohol; Amyl Acetate; Ethyl Acetate; Butyl Alcohol, Butyl Acetate, Ethyl Lactate, Ethyl Acetoacetate; Diethyl Oxalate; Diethyl Phthalate; Dibutyl Phthalate and Diamyl Phthalate. This list covers a wide range of boiling points from below 100°C to above 300°C, and will serve most of our requirements for the manufacture of high class Nitrocellulose Lacquers, varnishes and various collodion solutions. In addition to the above active solvents and plasticizers there are the so-called diluents. The hydrocarbons Benzol, Toluol and Xylol are the most important materials in this class. They are of great value in the blending and compounding of the resin solution with those of nitrocellulose. The presence of moisture is fatal to a Lacquer, therefore the Solvents manufactured under the proposed scheme will be Anhydrous. Absolute Alcohol will be produced by employing the Azeotropic process of distillation.

11. The proposed scheme converts Alcohol into such commercial products that will prove more remunerative than selling it as industrial Alcohol. Table IV illustrates the difference between the price of Alcohol and that of the price of Solvents made therefrom. Price quotations are for the American products f.o.b. New York, reduced to per lb. basis in Indian currency. The last column gives our cost prices for the same products under the proposed scheme :

TABLE IV

No.	Solvent	N. Y. price		Our cost price	
		Rs.	a. p.	Rs.	a. p.
1	Ethyl Alcohol, 95 per cent.	0	2 0	0	0 10
2	Absolute Alcohol	0	2 9	0	1 9
3	Amyl Alcohol	0	5 3	0	4 0
4	Fusel oil	0	7 0	0	6 0
5	Acetic acid	0	3 6	0	3 0
6	Ethyl Acetate	0	3 3	0	2 6

Foreign manufactures of Cellulose Lacquers buy their solvents and other raw materials from the outside markets, and they are paying more for their solvent requirements than it will cost us to manufacture under the present scheme, as is evident from Table IV above. On the other hand we will be paying a bit more for the important nitrocelluloses and plasticizers. Still our cost of producing a gallon of finished Lacquers will be less than the cost of any foreign manufacture. This is because Alcohol our basic raw material will cost us nearly half of what it does the foreign manufacturer. The Solvents produced will constitute our main raw materials for the manufacture of Lacquers, Varnishes, Artificial Leather, etc. which at present are entirely imported into India. Therefore, it is proposed to convert the balance of 4,000 gallons of 95 per cent. Alcohol into Commercial Solvents. As there exists good demand for the Commercial Solvents about 1,000 gallons will be sold as solvent which will be equivalent to 1,600 gallons of 95 per cent. Alcohol.

Making 4 annas on a gallon of solvent, our daily profit from the sale of solvents will amount to Rs.400. The balance of the solvents, nearly 1,500 gallons and equivalent to 2,400 gallons of 95 per cent. Alcohol, will be used in the manufacture of Lacquers, Varnishes, etc.

12. NITROCELLULOSE LACQUERS—The use of Cellulose Lacquers began about the middle of last century, but only limited progress was made because of the scarcity, price and nature of available solvents. The real progress of the Lacquers Industry came with the introduction of cheap and ample supply of high boiling Ester solvents, and at the same time development and improvement in the manufacture of low viscosity nitrocelluloses. The use of Lacquers is increasing rapidly and they are gradually replacing the old type of paints and varnishes. In U. S. A. alone the Lacquers sales in the year 1936 reached fifty million gallons. The entire automobile, aeroplane, shipping and railway industries of the world are being finished today with nitrocellulose lacquers because of their quick drying, wide adoptability, attractiveness and long life of their films. Some of the commercial articles on which Nitrocellulose Lacquers and Varnishes are used as finishes are: Artificial Flowers, Artificial Limbs, Automobiles, Baskets, Bathroom Fixtures, Bobbins for spinning, Book ends, Brass goods, Brush handles, Buttons, Cameras, Celluloid articles Clocks and dials, Dolls, Electric fans, Electric goods, Fibre articles, Fire extinguishers, Fishing lines; Fixtures, gas and electric, Floors, Furniture, Games, Gas mantles, Glass shades Hardware, all kinds, Jewellery, Lamps, Linoleum, Loud speakers, Machinery metal furniture, Metal work, all kinds, Musical instruments, Name plates, Novelties, Oil Cans, Optical instrument Pencils, Radio, Pen-holders, Pianos; Picture frames, Pumps, Radio goods and cabinets, Radio Panels, Scientific instruments, Sheo eyelets, Silverware, Steering wheels, Steam gauges, Switch plates, Thermo bottles, Toiler seats and tanks, Tools, Toys, Trunk Hardware; Type-writers, Umbrellas, Vacuum cleaners; Walls of rooms, Washing machines, Window shades, Wooden novelties, etc. etc. From the above list an idea can be formed, how the establishment of Nitrocellulose Lacquer industry in India would help development of so many other industries and to manufacture quality articles with finishes as attractive as seen on the imported articles. It would be the chief concern of the Research Department of the proposed undertaking to give all technical assistance and every facility, free of charge, to the users of our Lacquers, with a view to bring theirs products out in excellent finishes and at prices that will defy foreign competition.

13. In the manufacture of nitrocellulose lacquers, the low viscosity nitro-cotton plays the most important part, and this material has to be imported from firms that specialize in its manufacture on large scale. The finished lacquers contain on the average 11 per cent. by weight of nitrocellulose representing in value nearly 25 per cent. of the total value of the finished lacquer. In the handling and storage of nitrocellulose, the same precautions are required as are necessary for other inflammable products as Petrol, Alcohol, Celluloid and many other articles in common and daily use.

As shipped it contains 30 per cent. of denatured Alcohol and in such condition presents no greater hazard than Alcohol. Transportation by rail or steamer of wet nitrocellulose is allowed by all the foreign countries who classify the material as an "Inflammable Liquid."

14. The Consumption figures for the Paint and Varnish products in India are not available, but considering the large number of paint manufacturing establishments, it is taken that the consumption is fairly large and on

steady increase. Besides our home production, the annual imports of lacquers, varnishes and polishes amount to over Rs.35 lakhs. The imported lacquers like Duco, Valspar, etc., which will be our chief competitors, are being sold today at the Indian Ports at Rs.18 per gallon. Our cost price for the same quality Lacquer, inclusive of all charges and packing will not exceed Rs.10 per gallon and we propose to sell the same at Rs.11 per gallon ex-factory and leaving balance of Rs.7 per gallon to take care of the marketing charges. Provision is made to manufacture 800 gallons of finished lacquers to start with, thus yielding us an income of Rs.800 a day on this account.

15. **VARNISHES**: Spirit Varnishes like Copal and French type are in good demand in the Indian market, due to their comparative cheapness, easy applicability and quick drying, although the film is not lasting. The basic raw materials necessary for their manufacture are: Anhydrous Alcohol, Turpentine, Shellac, etc., which are available in India abundantly and cheaply. Therefore, quality varnishes will be manufactured both for the Indian market, as well as, for export purposes. Our cost of making a gallon of varnish will not exceed Rs.2 per gallon, against the present market price of Rs.3-8 a gallon at the Ports. On the varnish account we will be reserving annas 8 per gallon as our share of the profit, thus on the sale of 500 gallons of Varnish a day, we will have a net income of Rs.250 a day.

ARTIFICIAL LEATHER: Mixture of Anhydrous Alcohol, Ether and Ester Solvents are largely used in the manufacture of Artificial Leather. And the present scheme having full facilities of a complete lacquer manufacturing plant, it will be comparatively easier to prepare any specified collodion solution or Dopes for applying to a textile surface instead of a house wall or furniture. The required cloth will be purchased from one of the Indian Textile Mills, and by installing a suitable plant, the cloth impregnation, calendering, embossing, drying and finishing will be done simultaneously and by a continuous process. The import figures of Artificial Leather for the past two years are:

Year	Square yards	Value in Rs.
1934-35	726,265	5,39,418
1935-36	687,719	4,93,266

There are other articles like Book binding cloth and oil-cloth for which import figures are not available, and they are all manufactured by a similar process that imports a waterproof coating to the surface. The proposed leather plant will have a capacity of turning out finished cloth at the rate of 80 linear yards per working hour, and taking on the average 20 working hours day, our daily production will approximate 1,600 yards. The present market price of average quality leather cloth is Re.1-4 per yard, while our manufacturing cost will come to annas 14 a yard only. We propose to sell our leather cloth at Re.1-2 a yard leaving us a profit of annas 4 a yard, or Rs.400 per working day.

16. **CARBON DIOXIDE**: For every 180 parts of sugar present in Molasses, while being fermented into alcohol, some 80 parts of Carbon Dioxide Gas are produced or a theoretical yield of 48.8 per cent. Taking fermentable sugar as 50 per cent. on the weight of Molasses and assuming Gas recovery at 70 per cent. total daily production of commercial Gas either as Liquid or as Dry Ice will amount to 17 tons a day when the

Distillery is mashing 100 tons of Molasses daily. Allowing for stoppages in the Compressor Plant and other incidental shut downs our net daily production of Carbon Dioxide Gas mostly in the form of Dry Ice will average 15 tons, under the proposed scheme. This valuable Gas is by-product of this scheme and its total cost to us will be its purification and compression charges only.

17. Carbon Dioxide Gas is extensively used in Industry and Agriculture. Its main use lies in commercial refrigeration the artificial refrigeration (Dry Ice), now taking the place of old mechanical refrigeration (Ice from water). Carbon Dioxide Gas, when compressed to about 1,000 pounds per square inch at about 60°F, liquifies. In the commercial manufacture of Dry Ice, the liquified gas is allowed to expand through a patented nozzle into large tanks, and the snow produced therein is hydraulically compressed into hard blocks before being exposed to the air, thus forming the Dry Ice. It is snowy white, weighing about 80 pounds to the cubic foot, and has a temperature of 114°F below zero, i.e. 146 degrees colder than water ice. Dry ice contains roughly twice as much refrigeration pound for pound as ordinary ice, which absorbs only 144 B. T. U. per pound at 32°F. Dry ice, as a refrigerant possesses the following advantages to effect its higher cost as compared with water ice :—

(1) Insulating effect of gas evaporated, permitting slower rate of heat absorption.

(2) High heat absorptive value per unit of weight.

(3) Lower temperature as a factor of safety in shipping perishable goods like fruits, vegetable and dairy products.

(4) Evaporation to a dry gas which reduces maintenance of cars and containers, and prevents heat leakage.

(5) Carbon Dioxide itself has a slight preservative effect on food stuffs, thus the goods keep longer with its use.

(6) Light-weight packages of butter, cheese, eggs, ice-cream, confectionary, fruits and vegetables, etc. for shipment by mail or express to cover long distances.

(7) Ideal refrigerant for the ships, railways and cold storage warehouse, as it will avoid the high cost of mechanical installation and its inefficient operation.

(8) Dry Ice freezes quick, makes possible shipment and storage of frozen products, and used as local anaesthetic.

(9) Replacing the liquid gas in the carbonated beverage industry. This will obviate the use of heavy steel cylinders. The use of Dry ice will also eliminate the danger of bursting cylinders and save the capital investment.

(10) Dry Ice has a large field for use in various fire extinguishing apparatus.

18. It is not possible to over-emphasize the commercial importance of Dry Ice. India being a tropical and agricultural country, the development of Dry Ice Industry will play an important roll in the general economics of the country. For instance in the year 1925, when the writer took up this work, then U.S.A. produced only half a ton of Dry Ice per day, and the development was so fast that the average daily production for the year 1936 amounted to 350 tons. Nearly 80 per cent. of the former liquid gas has been changed over to Dry Ice. For the first time in India and in the course of last six months only four plants with an aggregate capacity of 15 ton a day are under construction. Prior to this liquid gas was manufactured in various

small plants in India employing the Coke Process and these plants will soon go out of business. Under the proposed scheme, total dry ice available for marketing will be 15 tons per working day. Two compressors of the three-stage intercooled type, each with a rated capacity of 1,000 lb. per hour will be installed. The gas being free and investment and other charges, per ton of Dry Ice, being the minimum, our manufacturing cost per ton of Dry Ice will come to Rs.60 per ton or 5 pies per pound, and we propose to sell the Dry Ice at Rs.85 per ton or 7 pies per pound, thus leaving us a net profit of Rs.25 per ton or Rs.375 a day. At present Dry Ice is being sold at annas 3 per pound or Rs.420 a ton. One new Dry Ice company registered in September, 1937, propose to sell at Rs.210 per ton while its manufacturing cost comes to Rs.85 per ton. It is interesting to note that our sale price per ton will be the same if not lower, than the cost price per ton of any Dry Ice establishment in India. This means that others have to wait till we are sold out. On the way industry holds goods future for the investor.

19. **BAKER'S YEAST** : The manufacture of Baker's Yeast and other yeast products constitute a major industry in most western countries, where yeast is employed in the making of daily bread. The Annual sales of one yeast company in the U. S. A. amounted to over Rs.20 crores, showing a net profit of 25 per cent. During the course of fermentation, there is considerable growth of Yeast most of which settles down at the bottom of the fermenters. Using 'A' yeast we will be producing daily some 2,000 gallons of fermenter settlings, each gallon weighing about $9\frac{1}{2}$ pounds, and having a moisture content of 75 per cent. Our daily production of dried Yeast will amount to nearly 5,000 pounds which is generally wasted by the distilleries. After secondary fermentation these yeast settlings can be filter-passed and moisture content reduced to 50 per cent. As such it is universally sold for bread baking, and also marketed in small tables wrapped in the foils for table use. It is very rich in proteins and contains on the average 4.5 per cent. Nitrogen. For the first year or so, we are not counting on any returns from this product, but we do expect that the proceeds realized from small sales made either as Baker's Yeast or Cattle Fodder, will more than compensate our recovery costs and at the same time provide funds for the experimental and publicity work for developing the yeast market in India.

20. **POTASH RECOVERY** : Another important feature of this scheme would be the recovery of Potassium Salts and Ammonium Sulphate fertilizers as by-products which in other words would mean putting back into soil, what has been taken out by the cane crop. Countries that lack natural potash resources develop their latent supplies of by-products Potash; and today the American by-product Potash amounting to 500,000 tons a year is largely supplied from the Cement, Alcohol and Iron industries. Some three industries are now well established in India and India if she chooses could become independent of her potash requirements. According to the proposed scheme the residual distillery waste, known as slop, is concentrated to 50 per cent. solids. The thick slop is sprayed into a specially designed combustion chamber, where it is allowed to burn. The ash known as vegetable potash is collected, ground and made ready for use. Potash thus recovered, is a dark material of fine texture, carrying approximately 35 per cent. of K_2O in the form of water soluble potassium salts. There is also present 1.5 per cent. of available P_2O_5 and 6.36 per cent N_2 . Again the field experiments have conclusively proved their beneficial effect on the crop growth. As stated in early part of this report, the surplus amount of molasses awaiting economic disposal, approximate 3,50,000 tons annually containing on the average

3.0 per cent. potash, as K_2O , and 0.2 per cent. Nitrogen as N_2 of which, 60 per cent. of each amounting to 6,000 tons of H_2O and 400 tons of N_2 can be recovered in commercial practice. When expressed in terms of fertilizer salts, these amount to 17,000 tons of potassium salts and 2,000 tons of ammonium sulphate, recoverable every year, representing an aggregate value of Rs.16 lakhs worth of fertilizers. The annual imports of chemical manures, even at this low stage of our Agricultural development, amount to over Rs.55 lakhs. The recovery of fertilizers as outlined above, under the proposed scheme will be taken up as soon as the capacity of the plant will be increased to 200 tons of molasses a day, as below this it will not be economical.

21. FINAL PRODUCTS—Table V below summarizes our list of products as described above and made from 100 tons of molasses per 24 hours. The allocation is only approximate, and the plant design allows flexibility in its various units to meet market requirements. Column 2 gives the unit cost price calculated on lines as detailed in case of alcohol in paragraph 9 :

TABLE V

No.	Product	Gallon/Day	Cost/Gal.	Sale/Gal.	Market price
			Rs. a. p.	Rs. a. p.	Rs. a. p.
1	Rectified spirits	2,000	0 6 6	0 9 0	1 0 0
2	Comm. solvents	1,000	0 13 0	1 2 0	2 0 0
3	Spt. varnishes	500	2 0 0	2 8 0	3 8 0
4	N. C. lacquers	800	10 0 0	11 0 0	18 0 0
5	Artificial leather, yards ..	1,600	0 14 0	1 2 0	1 8 0
6	Dry ice	1 ton	0 0 5	0 1 0	0 2 0

The total cost of making the above product amounts to Rs.11,000 a day and the same will be sold to trade, ex-our works, for Rs.13,500, thus leaving us a net profit of Rs.2,500 a day, and according to the current market prices, the above products are worth Rs.25,000—nearly 44 per cent. higher than our proposed sale prices. Such plants work three shifts of 8 hours each, and continue working throughout the year with occasional stops for repairs. Taking 300 as actual working days in a year, the annual profit would amount to Rs.7,50,000 on capital investment of Rs.25,00,000 only.

22. CAPITAL INVESTMENT—Capital distribution as given in Table VI, below is only approximate. There will be certain departmental adjustments, but the total investment in plant will not exceed Rs.20 lakhs : The amount allotted to each department covers everything like cost of machinery, plant, buildings, installation charges, etc. Besides capital investment of Rs.20 lakhs another sum of Rs.5 lakhs will be required as working capital :

TABLE VI

No.	Department					Amount
						Rs.
1	Power plant	..	..	..	..	3,50,000
2	Water service	..	..	..	..	50,000
3	Still-house	..	..	..	..	3,00,000

No.	Department	Amount
		Rs.
4	Anhydrous Alcohol Unit	1,00,000
5	Fermenter buildings.. .. .	1,00,000
6	Ester building	1,50,000
7	Ether plant	50,000
8	Vinegar plant	50,000
9	Dry ice plant	1,80,000
10	Lacquer manufacturing plant	1,25,000
11	Art leather plant	1,20,000
12	Molasses and product storage	1,25,000
13	Drums and packing department.. .. .	50,000
14	Research and control laboratory	50,000
15	Mechanical Workshop	50,000
16	Lands, building, railway siding.. .. .	1,50,000
	Total	20,00,000

23. FINANCE AND MANAGEMENT—Briefly, the essentials to be considered in launching a new enterprise are :

- A. The Undertaking itself.
- B. The Management.
- C. The Finance.

A. There is no question about the urgency of the undertaking for the disposal of Molasses. It has become an all-India question, and every sugar factory, especially those situated in Bihar and United Provinces, would welcome to an extreme degree any enterprise that will convert their waste Molasses into valuable commercial commodities. The present manufacturing scheme though new to India, has long been established abroad on most profitable basis and there is nothing experimental about the scheme. The proposed Plant will be employing the latest design machinery equipment and process technique and will be under the charge of an expert who has long experience of the Industry in all its aspects. The same Expert, has been manufacturing abroad similar products, in a Chemical-Distillery nearly ten times the size of the proposed Plant, and has in his possession numerous technical reports, formula, manufacturing data and drawings on which the proposed scheme is based. The expert is also in close touch with the recent development this industry is making abroad. Therefore, the enterprise, as far as, its technical side is concerned, is a sound one. Again there will not arise any question of infringement of Patent rights over any of the equipment, or process employed under the proposed scheme. Regarding its commercial side, the survey shows, that there exists a good profitable market for the products, and it will be a boon to the consumers who will be paying 44 per cent. less than the present market prices. Again the availability of cheap molasses, fuel and absence of internal or foreign competition ensure continued success and expansion of the enterprise.

B. The Management and executive authority will rest with a Board of Directors consisting of 5 to 7 Directors. These Directors need not necessarily be heavy investors, but they must be men of vision, possessing industrial experience and commanding public confidence. It is, therefore, advisable that the Directors be selected carefully, because a properly selected

Board, is one of the best important assets with which a firm can supply itself. It will not only attract the required capital, but induce men of proven merits to join the organization, thus ensuring its success. Subject to the strict control and supervision of the Board, the actual work of the organization in all its departments will be carried on by a wholtime Managing Director, who will be assisted by four departmental heads in charge of (1), Production (2). Sales, (3). Purchases and (4) Research.

C. Total capital investment will be Rs.20 lakhs. It is realized that before the desired capital will be forthcoming certain requirements in the minds of prospective investors must be satisfied and the three elements that generally influence their decisions would be : (1) Income (2) Control and (3) Risk. The Scheme on careful analysis promises a return of at least 30 per cent. on total capital investment of Rs.25 lakhs of which Rs.5 lakhs is the working capital. If out of Rs.25 lakhs total issue, Rs.10 lakhs, be issued as preference stock at 6 per cent. fixed dividend the returns on the common stock issue will come up to 46 per cent. The entire management and business policy will be controlled by the investing public through a duly elected Board of Directors. And the scheme, being assured of the necessary technical skill, raw material and ready market for the products, the risks involved are reduced to minimum.

24. EMPLOYMENT—The present scheme, even in its moderate form will be directly responsible for daily employment of nearly 200 hands as permanent staff throughout the year, and indirectly will help as many more hands who will be engaged in the transport, storage and supply of Molasses, and quite a number in the sale and distribution of our finished products. Of the permanent staff of 200, nearly 100 will be graduates recruited from Indian Science and Engineering Colleges, another 50 will be skilled workers, and the remaining 50 will consist of unskilled labour. This being a chemical and highly specialised industry, it holds out good future for the employment of technical graduates and those with aptitude for industrial research work. This scheme has a vast scope for development and will ultimately lead to the establishment of several small scale industries as discussed above under industrial Alcohol Lacquers, thus helping the employment question considerably.

25. PROSPECTUS—The proposed Scheme consuming only one-tenth of the available molasses supply is only a small beginning to satisfy part of country's requirements of Alcohol Products. With the fast development of small chemical and pharmaceutical industries, it is certain, that soon after the successful operation of the proposed Plant, not only its own capacity will be increased to enable us to recover the valuable fertilizers but another plant, in somewhat modified form will be set up to serve the distant markets of India. Another large and staple industry that could be developed in India on profitable basis, which at the same time will consume large volume of industrial Alcohol would be the establishment of an Artificial Silk Factory. In the Chardonnet process of Artificial Silk making, nitro-cotton is dissolved in Alcohol-Ether mixture, and the solution is squirted through jets; while the latest type of Cellulose Acetate Silk known in the trade as "Celenese," is prepared by heating cotton with Acetic Anhydride, Acetic Acid and a catalyst. The annual imports of Artificial Silk into British India alone amount to over Rs.3.5 crores. Considering the magnitude of Alcohol Industry abroad and the large imports into India of Alcohol-bearing products, it will be no exaggeration to state that within a few years, we will be able to solve our Molasses

problem. Instead of wasting over 350,000 tons of Molasses a year, we will be converting them into commercial products valued at Rs.5 crores, and this will be no small achievement in our national economy. Mention may be made, that the success of the prohibition movement will depend upon the successful solution of the molasses problem, because molasses will ferment despite the prohibition law, and one maund of molasses will give to the Bootlegger, 15 bottles of country liquor at practically no cost.

P. S. MAKER.

CAWNPORE :

The 1st June, 1938.

REPORT
OF THE
Cawnpore Labour Inquiry
Committee

APPOINTED BY THE
Government of the United Provinces.



ALLAHABAD:
SUPERINTENDENT, PRINTING AND STATIONERY, UNITED PROVINCES, INDIA
-1938

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*List of corrections to the Report of the Cawnpore Labour Enquiry Committee
appointed by the Government of the United Provinces (published with
Government Notification No. 2209/XVIII—735, dated 21st April, 1938).*

Paragraph	Line	Correction
Index ..	Appendix V ..	For the given heading substitute "Report of the Special Sub-committee of the Bombay Mill-owner's Association on introduction of efficiency schemes."
1	18	For ve read 'be.
	20	Delete 'comma' after 'also'.
3	6	For Babu read B.
6	38	Delete 'comma' after 107.
7	2	Insert 'comma' after Cawnpore.
11	14	For through read thorough.
13	13	For Lal read Lala.
15	2	Insert 'the' before Hon'ble occurring second line.
17	7	Insert 'comma' after Director.
19	6	For are read is.
	9	For worker' read worker's.
	10	Delete 'comma' after secured.
	12	Delete 'commas'.
20	1	Delete 'comma'.
	15	Delete 'commas' after as and rice.
	25	Delete 'commas' after life.
Foot note ..	2	Insert 'the' before United.
22	7	For workers' read worker's;
	10	Insert 'commas' before and after however.
26	5	For 'wages' read wage.
29	10	For weaver 2 looms (ring frame) read weaver, 2 looms.
	10 & 11	Insert between lines 10 and 11 "Ring Frame".
31	17	For 20-6-0 read 20-6-6.
33	5	Delete 'comma' after meagre.
		For goes read go.
35	6	For workers read workers'.
	7	For 'decreases' read decrease.
36	4	Delete 'comma' after as.
	6	For 'workers' read workers'.
38	1	For wages read wage.
39	3	For year 1929-37 read years 1929 and 1937.
Foot note ..	2	For 'detailed' figures read detailed figures.
40	1	Delete 'comma'.
	3	Delete 'a'.
41 Table VI ..	1	For Wages read Wage.
	7	Delete 'Narayan'.
Table VI(contd.) (1929)	1	For Wages read Wage.
	8 (Mill) (c)	For 32-9-0 read 22-9-0.
	9 (Mill) (D)	For 1-9-'35 substitute 1935.
	21(78")	Transpose P. 25-11-0 to the preceding lines against 67/72".
	23	For workers read weavers*
		Read (78" not included) as a footnote marked*.
Table VI (cont d.) (1937).	7 (Mill) (d)	For 22-9-9 read 22-9-0.
	9 (Mill) (d)	For 38-8-9 read 38-8-0.
Table VI (concl'd.)	12 (Mill) (k)	For 34-12-3 read 34-12-0.
	19	Insert *after weavers.
		Read (78" not included) as a footnote marked*.
Table VII	4	Insert + after designation.
	13 (7)	For B read P.
	28 (22)	For 1-37 read 1-376.
	30 (24)	For -957 read -959.
	last line ..	Insert as footnote + T indicates timeworkers, P piece-workers
43	8	For wages read wage.
45	6	Delete 'comma'.
	9	Delete 'comma'.
	11	For employer's read employers'.
46	12	For of read between.
		For between read in.
47	5	Insert 'comma' after is.
	13	For wages read wage.
51	7	Insert 'comma' after welcome.
52	11	Delete 'commas'.
	12	For wages read wage.
53	1	For wages read wage.
		For they read the employers.
	8	Insert 'Rs.' before 16-35 and 16-03.
	11	Insert 'Rs.' before 25-84 and 25-52.
54	3	For attendant's read attendants'
	4	Insert 'Rs.' before 15-90 and 16-15.
	6	For 78 read 40.
	10	Insert 'has risen from Rs. 12-53 to Rs.12-68, of a total of 617. in all the mills for whom' after average.
	19	Insert 'instances' after across.
	20	For statement read statements.
	22	Delete 'instances'.
55	1	Insert 'Rs.' before 15-69 and 12-15. For wages read wage.

Paragraph	Line	Correction
Table IXA ..	Column 4 ..	For ecrease in rupees read Decrease in rupees.
	No. 5	Insert 'tenters' after Roving.
Table IXB ..	Column 3 ..	For Men 1937 read Number of men in 1937.
	Column 4 ..	For rupees read rupees.
	No. 3 ..	For gres, readgrinders.
	No. 13 ..	For drawers' -in-read Drawers-in.
56	13	For Drawers'-in-wages read The wages of Drawers-in.
57	5	Insert 'commas' before and after however.
	8	For wages read wage.
	10	Insert 'comma' after, etc.
59	marginal note	Insert i after wages.
61	1	For agriculture read agricultural.
62	1	Insert 'commas' after situation and expected.
	6	For manufacture read manufactures.
63	3	Delete 'comma'.
	4	For to read and.
Table XII Head- ing	Column 3 ..	Delete 'comma'.
Table XIII (c)	6	For 76,456,492 read 76,456,493.
Table XIV (a)	Column 4 ..	For Jeans read Jeans.
		For Number read Average number.
		Delete Average.
	Column 7 ..	For 455,749 read 455,449.
Table XIV (a)	Column 8 ..	For 192,714 read 192,874.
Table XIV (b)	Column 6 ..	For 18,795, read 18,495.
	Column 3 ..	For numbe read number.
		For 968,775 read 9,685,175.
		For 9,685,658 read 9,856,658.
64	Column 5 ..	For 1174,922 read 174,922.
66	5	For 3,419 read 2,419.
	1	For numbers read number.
	2	For were read was.
67	6	Insert 'comma' after Cawnpore.
69	6	Delete 'comma'.
71	38	For the above percentages mean, therefor, read The above percentages mean.
	sub. para. after 1st Table.	
Tables entitled and " Block Accounts".	"Paid up Capital"	Include the two 'percentage' columns under Bombay and Cawn- pore, respectively.
Table entitled " Block Account", last line	Block Account",	Insert Average percentage.
	Column 1	
	Column 4 ..	Insert 3·10.
	Column 7 ..	Insert 3·70.
Table XV ..		Insert as heading "Consolidated Balanced Sheet of Cawnpore Cotton Mills".
72	Column 8 ..	Delete 'comma' after Total.
75	5	For on read of.
76	16	For likely read unlikely.
	2	Insert 'commas' after places.
Table XVI	11	For wages read wage.
	No. 7 ..	For 26·0 read 26·8.
		For -7 read -4.
	No. 11 ..	For 17·3 read 16·8.
		For +54 read +47.
	No. 23 ..	For 42·5 read 42·7.
	No. 24 ..	For 38·7 read 40.
		For 68·0 read 63.
	No. 25 ..	For 35·6 read 35·9.
		For 37·07 read 37·06.
		For -7 read -3.
	No. 27 ..	For 2·13 read 21·7.
		For +29 read +31.
78	marginal note	For Rise read Increase.
82	15	Delete 'level'.
	16	For worker read workers.
83	3	For considerable periods read 'a considerable period'.
85	4	Insert 'a' after have.
86	8	Insert 'commas' after minimum and stated.
89	4	For states read states'.
		Delete 'comma'.
90	7	Insert 'is' after this.
91	7	Delete 'wages given to'.
94	19	Insert 'comma' after bear.
96	4	For their read his.
	5	For workers' read worker's.
	14	For analyze read analyze.
	15	Insert 'comma' after However.
98	7	For England, or Japan read England and Japan.
	9	Insert 'in' after employed.
	marginal note	For living wages figure read living wage figures.
101	Table	Against 'Between 15 to 17' and under 'Ring Siders' read 1.
105	35	For rates read rate.
106	3	For earning read earnings.
	5	For is read are.
107	31	Insert 'comma' after order.
109	3	Insert 'comma' after is.
110	17	For suitable read suitable.
	18	For department's read departments.
	27	For go-head read go-ahead.

Paragraph	Line	Correction
	28	<i>For those read these.</i>
111	10	<i>For other read other.</i>
	13	<i>Insert " before The</i>
112	7	<i>For is read are.</i>
113	8	<i>For textiles read the textile.</i>
	11	<i>Delete ' comma ' after key-note.</i>
114	3	<i>Delete ' comma '.</i>
115	15	<i>Delete ' comma ' after per.</i>
116	Marginal note . .	<i>For relationalisation read rationalisation.</i>
118	17	<i>For therefore read therefor.</i>
	30	<i>Delete ' the '.</i>
119	9	<i>Delete ' comma ' after own.</i>
	18	<i>For fortnight read fortnight's.</i>
	23	<i>For recruiting read recruiting.</i>
120	1	<i>For Textile Mills read textile mills.</i>
125	3	<i>For system read systems.</i>
128	2	<i>For system read systems.</i>
	10	<i>For system read systems.</i>
133	3	<i>For Indian's read Indian.</i>
136	10	<i>For department read departmental.</i>
137	2	<i>For recommending read recommended.</i>
		<i>Insert ' comma ' after Labour.</i>
		<i>Delete " after integrity.</i>
140	2	<i>For and read an.</i>
140	14	<i>For liaison read liaison.</i>
142	6	<i>For doctors read doctors.</i>
	7	<i>For dispensary read dispensers.</i>
	Marginal note . .	<i>For fitness read fitness.</i>
143	2	<i>Delete ' the '.</i>
	6	<i>For welcome read exertion.</i>
	13	<i>Insert ' comma ' after denied.</i>
144	3	<i>For themselves read themselves.</i>
145	13	<i>For Japanese read Japanese.</i>
	14	<i>For these read those.</i>
	19	<i>For workmen read workman.</i>
151	2	<i>For of read off.</i>
157	18	<i>Insert ' such ' after take.</i>
158	9	<i>For of read to.</i>
	17	<i>Delete ' comma '.</i>
	19	<i>Delete ' comma '.</i>
160	1	<i>For date read data.</i>
163	9	<i>Delete ' comma '.</i>
164	5	<i>For months' read months.</i>
168	Marginal note . .	<i>For latrine read latrines.</i>
175	6	<i>For enable read enables.</i>
	8	<i>For holidays read holiday.</i>
178	Marginal note . .	<i>For desirability read desirability.</i>
181	1	<i>Insert ' comma ' after however.</i>
185	7	<i>For inflict injury not only read not only inflict injury.</i>
186	5	<i>For over read instead of.</i>
191	3	<i>For Trades Union read Trade Unions.</i>
194	8	<i>For conncted read connected.</i>
		<i>Insert ' and ' after housing.</i>
	14	<i>For if read of.</i>
195	2	<i>Delete ' that of '.</i>
197	2	<i>For Employees' read Employers'.</i>
	8	<i>Insert ' phrase ' before ' C. I. D. '.</i>
		<i>Delete " after C. I. D.</i>
		<i>Insert " after employers.</i>
	9	<i>Insert ' respectively ' after Mills.</i>
201	11	<i>For for read of.</i>
	15	<i>Insert ' more ' before ' important '.</i>
	27	<i>For quartr read quarters.</i>
III	Kakomiganj 14	<i>Delete ' comma '.</i>
IV	Elgin	<i>Insert ' a ' before courtyard.</i>
	Settlement 6.	<i>Delete ' his '.</i>
V	4	<i>Insert ' with ' after but.</i>
	6	<i>For then read the.</i>
VII	Heading	<i>For Nishartganj read Wishartganj.</i>
	6	<i>Insert ' comma ' after room.</i>
203	1	<i>For know read known.</i>
	10	<i>For owner read occupant.</i>
204	3	<i>For far read for.</i>
205	4	<i>For ventilations read ventilation.</i>
206	5	<i>For not read set.</i>
207	5	<i>Insert ' comma ' after problem.</i>
	10	<i>For de-vice read devise.</i>
208	2	<i>For dwelling read dwellings.</i>
209	8	<i>For persued read pursued.</i>
210	14	<i>For workers read workers'.</i>
214	2	<i>For workmen read workmen's.</i>
216	5	<i>Insert ' comma ' after necessary.</i>
218	10	<i>For bounds read bonds.</i>
	20	<i>Insert ' comma ' after contented.</i>
220	10	<i>Insert ' comma ' after sanitary.</i>
	48	<i>For held read hold.</i>
222	10	<i>For the read free.</i>
	11	<i>For the read free.</i>

Paragraph	Line	Correction
225	5	<i>For assistants read assistance.</i>
229	3	<i>Insert ' comma ' after dietetica.</i>
233	2	<i>For exists read exist.</i>
237	2	<i>For had read have.</i>
	9	<i>For intimation read intimidation.</i>
241	8	<i>For Debtors' read Debtors.</i>
244	6	<i>Delete ' comma ' after information.</i>
	7	<i>Insert ' comma ' after tobacco.</i>
	9	<i>Insert ' comma ' after machinery.</i>
	11	<i>Deletes ' of '.</i>
IX	Heading	<i>Insert ' comma ' after sugar.</i>
XI(4)	1	<i>For compensations read compensation.</i>
XIV(2)	1	<i>For crashee read creches.</i>
249	4	<i>For production number of quality read production, number or quality.</i>
251	5	<i>Delete ' level '.</i>
253	9	<i>For either be read be either.</i>
254	10	<i>For workmen read workman.</i>
256	2	<i>Delete ' comma ' after workers.</i>
		<i>For rigorous read rigors.</i>
257	8	<i>For if possible the adoption read the adoption, if possible.</i>
259	4	<i>Delete ' comma ' after should.</i>
262	3	<i>Insert ' comma ' after "good quality ".</i>
263	1	<i>For humidifications read humidification.</i>
	2	<i>For employers' read employers.</i>
	10	<i>For workers read workers'.</i>
264	2	<i>For not be read be not.</i>
267	2	<i>For Debtors' read Debtors.</i>
269	Marginal note..	<i>For Labours read Labour.</i>
271	Marginal note..	<i>For increments read increment.</i>
273	1	<i>For date on read data from.</i>
274	Marginal note..	<i>Insert ' cost of leave proposal '.</i>
275	Marginal note..	<i>Insert ' cost of Provident Fund proposal.'</i>
276	Marginal note..	<i>Insert ' Total addition to labour costs.'</i>
Appendix I Item (16).		<i>Insert ' be ' after shall.</i>
Appendix III Item (17).		<i>Deletes ' comma ' after employed.</i>

APPENDIX IV

[The figures of (1) earnings per person reported, (2) earnings per hour (annas) and (3) percentage increase or decrease in 1937, given as foot notes to each statement, are wrongly placed in all the statements except no. 16, and are to be read as given in statement no. 16].

Statement number	Row	Year and column	Correction
1	D Footnote	1931/7 1937	For 70·000 read 270·000. For 1·96 read 1·096. For 8·94 read 8·94 per cent. Insert '6'.
2	C	1933/3	For 1-0-0 read 16-0-0.
3	B	1937/4	Deletes 96·000 (3, 4 and 5 work in a team.)
5	A	1937/7	For 35·938 read 96·000 (3, 4 and 5 work in a team.)
	B	1937/7	For 135·187 read 35·938.
	C	1937/7	For 177·750 read 135·187.
	D	1937/4	For 23-3-6 read 22-3-6
	E	1937/7	For 22·750 read 177·750.
	F	1937/7	For 125·000 read 22·750.
	G	1937/7	For .. read 125·000.
	H	1937/7	For 84·468 read ...
	I	1937/7	For 29·250 read 84·468.
	J	1937/7	For 33·000 read 29·250.
	K	1937/7	For 801·030 read 33·000.
	Total	1937/7	For .. read 801·030.
6	E	1929/6	For 84·3 read 94·3.
	Total	1937/7	For 2·156·155 read 2,156·155.
7	Correction	1929	Delete 'Elgin.'
	Footnote	1937	Delete 'Elgin.'
		1937	For 234 ÷ annas read 234=annas. For earnings read earnings. For .. read 1930.
8	A	2	For 1930 read ...
	B	2	For 1930 read ...
	D	1937/3 to 7	Read the second set of figures against the Mill 'E.'
	Total	1929/7	For 3,771·18 read 3,771·185.
	Correction	1929	Delete 'Elgin.'
		1937	Delete 'Elgin.'
	Correction	1929	Delete 'Elgin.'
		1937	Delete 'Elgin' and 'and Textiles to 9 hours.'
	Footnote	1929	For 25·52 read 25·84.
10	B	1937/7	For 37·666 read 371·666.
	Correction	1929	Delete 'Elgin.'
		1937	Delete 'Textiles' and 'and Elgin to 9 hours.'
	Footnote	1929	For Result read Result.
11	K	1934/5	For 4 read 74.
12	K	1937/7	For 7,20·000 read 720·000.
	Footnote	1937	For 12·67 read 12·68.
13	F	1937/5	For 2·85 read 85.
	G	1929/7	Delete 'weft.'
		1937/7	For 4,125·000 read 4,125·000 weft. Delete 'weft.'
			For 4,758·750 read 4,758·750 weft.
14	H	1937/4	Insert '(L).'
15	G	1937/7	For 370·012 read 370·812.
	C	1937/3	Insert 'very few.'
		1937/4	For very few read ...
	G	1929/4	For 12 read 12·8·0.
16	I	1929/7	For 2,363·500 read 2,362·500.
	K	1937/4	For 15·12·2 read 15·12·9.
	Correction	1929	Delete 'Textiles.'
	Net total	1937/2	Delete 1937.
	Footnote	1929	For anna read annas.
17	D	1935/4	For 2·13·9 read 20·13·9.
	J	1929/2	For .. read 1930.
	Correction	1929	Delete 'Textiles.'
18	C	1933/3	For 28 read 20.
	E	1937/7	For 521·750 read 529·750.
	H	1929/4	For 51·7·0 read 59·7·0.
	I	1937/7	For 933·958 read 933·968.
	K	1934/3	For 1 read 18.
	Total	1937/3	For 75 read 124.
	Correction	1929	Delete 'Textiles.'
	Footnote	1937	For 2·620 read 2·602.
19	A	1937/7	For 842·114 read 142·114.
	C	1929/2	For 1935 read 1933.
	H	1937/3	For G read N. G.
	Correction	1929	Delete 'Textiles.'
20	E	1929/7	For 19·109 read 119·109.
	K	1937/5	For 11·3 read 1·13.
	Correction	1929	Delete 'Textiles.'
21	E	1929/4	For 37·12·3 read 27·12·3.
	G	1929/3	For 18 read 12.
		1937/7	For 329·250 read 329·500.
	Total	1937/7	For 1,749·483 read 2,639·998.
	Correction	1929	Delete 'Textiles.'
	Footnote	1937	For 3·180 read 31·80.

Statement number	Row	Year and column	Correction
22	Correction	1929	Delete 'Textile.'
	Footnote	1937	For 1' 40 read 1' 409.
23	Correction	1929	Delete 'Textile.'
	Footnote	1937	For 2' 084 read 2' 064.
24	B	1937	For 159' 437 read 153' 437.
	D	1937/6	For 92, read 90.
25	Correction	1929	Delete 'Textiles.'
	Footnote	1937	For 13' 56 read 13' 65.
25	Total	1937/3	For 3,447 read 4,895.
	Correction	1929	Delete 'Textiles.'
25	Correction	1937	Delete 'Textiles.'
	Nett total	1937/7	For 1,28' 200 read 1,276' 200.
26	Footnote	1929/7	For 57,016' 630 read 157,076' 630.
	D	1937	For 37' 07 read 37' 06.
	I	1937/7	For 90' 089 read 90' 000.
	K	1937/3	For 18 read 13.
27	Correction	1937/5	For 3 read 8.
		1934/7	For 152' 030 read 152' 000.
	G	1929	Delete 'Textiles.'
		1929/4	For 14' 6' 0 read (10) 14' 6' 0.
28	Correction	1937/4	Delete 'to.'
		1937/4	For 14' 6' 0 read (15) 14' 6' 0.
	A	1929	Delete 'to.'
		1930/7	Delete 'Cawnpore Textiles.'
	D	1937/2	For categories read category.
		1931/5	For 245 read 255.
	E	1931/7	For 1' 17 read 1' 16.
		1937/7	For categories read category.
	G	1937/3	For categories read category.
		1929/4	For 503 read 303.
29	Footnote	1929/5	For 13' 12' 0 read (10) 13' 12' 0.
		1937/5	Delete 'to.'
	I	1929/5	Delete 'to.'
		1937/5	Delete 'to.'
	J	1929/5	For '89 read 1' 89.
		1937/7	For 1718' 84 read 1,718' 843.
Footnote	1930/7	For categories read category.	
	1937/7	For categories read category.	
30	Footnote	1929 and 1937.	Delete the entire footnote except the first line.
		1937/6	For 23 read 93.
	G	1937/7	For 278' 537 read 278' 437.
		1929/5	Delete 'to.'
Footnote	1937/4	For 16' 0' 0 read 15' 0' 0.	
	1929	For 7+3 read 7+3.	
31	D	1931/7	For 40' 875 read 46' 875.
31	K	1934/3	For 32 read 22.
		1937/2	For 193 read 1937.

Appendix V—

Insert as heading 'Report of the Special Sub-committee of the Bombay Mill-owners' Association on introduction of efficiency schemes.'

Blow Room—

Under para. *Card room*, line 7, delete 'and' after stripper. Under para. *Drawing Frames*, line 2, insert 'comma' after Drawing.

Roving Department—

Under para. *efficiency scheme recommended*, line 6, for 'we' read 'be.'

Ring Spinning—

Under para. *efficiency Scheme recommended*, line 19, delete 'comma.'

Weaving—

Under para. *Wages*, line 3, for should read should.

• No. 2209/XVIII—735

INDUSTRIES DEPARTMENT

Dated Lucknow, 21st April, 1938

MISCELLANEOUS

THE report of the Committee of Enquiry appointed by the United Provinces Government in notification no. 3275/XVIII, dated the 11th November, 1937, to examine and report on the conditions of life and work of the labourers employed in factories at Cawnpore, attached herewith, is hereby published for general information.

Government wish to express their warm appreciation to the Committee for their devoted and arduous labours and the great pains which they have brought to bear upon their investigation of an admittedly difficult and intricate problem and for their extremely able and exhaustive report. Copies of the report have already been forwarded to the Employers' Association of Northern India and the Mazdoor Sabha, Cawnpore, for their information and consideration. Government hope that the suggestions and recommendations of the Committee on the points referred to them for their consideration may lead to an amicable settlement of pending differences between employers and their workmen in Cawnpore and to a satisfactory solution of all outstanding questions. It is the earnest desire of the Government that there should be an end to all industrial controversies in Cawnpore so that with the joint endeavour of capital and labour industry may flourish with resultant prosperity not only to the city of Cawnpore but to the province generally. In bringing about such a happy result the good offices of the Government are always at the disposal of both employers and workmen. Government would be ready to assist the parties in arriving at a settlement by mutual agreement and ensure lasting peace in the industry. Failing an amicable settlement Government would proceed to take the report into consideration and reach their own decisions. Any representations received up to 10th May, 1938, both from the employers and labour or any other person interested, will be duly considered.

By order,
P. M. KHAREGAT,
*Secretary to Government,
United Provinces.*

Report of the Cawnpore Labour Inquiry Committee appointed by the Government of the United Provinces

CHAPTER I

INTRODUCTORY

1. The Labour Enquiry Committee was appointed by the United Provinces Government notification no. 3275/XVIII, dated the 11th November, 1937, which is reproduced below :

"The Governor has been pleased to appoint with effect from 30th August, 1937, a Committee of Enquiry to examine and report on the conditions of life and work of the labourers employed in factories at Cawnpore.

2. The Committee consists of—

- (1) Sriyut Rajendra Prasad Saheb, Chairman;
- (2) Sir Tracy Gavin Jones,
- (3) Mr. Harihar Nath Shastri,
- (4) Sriyut Gulzari Lal Nanda, and
- (5) Professor S. K. Rudra, M.A. (CANTAB).

3. The terms of reference to the Committee are as follows :

(1) Whether wage cuts have taken place direct or indirect, and if so, where and to what extent?

(2) In case any such wage cut is established, whether there should be any increase in wages, and if so, what?

(3) How do the present rates of wages in Cawnpore compare with those prevailing elsewhere in India and whether, taking also, into consideration the profits made by the mills and the cost of living in Cawnpore they should be increased and if so, to what extent?

(4) Is it desirable to prescribe any minimum rate of wages for any class of labour at Cawnpore and if so, what should such rate be?

(5) What is the most suitable arrangement for shifts to enable a factory to continue working as long as it desires to do so without unduly inconveniencing the labourers?

(6) Whether schemes of rationalization and intensification of labour have been, are being or are intended to be introduced, and if so, on what lines? What are the effects of such schemes on the labourers as regards their earnings, health, efficiency, etc.?

(7) What abuses, if any, are associated with the present system of supervision, recruiting, suspending and dismissing labourers and what steps should be taken to remove the same?

(8) What days, if any, should be observed as holidays in factories in addition to or in lieu of Sundays?

(9) On what terms should emergency leave be granted in the case of (a) piece workers and (b) time-workers?

(10) Are the general conditions of labour in factories satisfactory and what, if any, improvements are needed?

The Committee will also adjudicate on questions of interpretation of the terms of settlement arrived at on the 9th August, 1937, as well as on other matters referred to it by either party during the pendency of the inquiry.

4. The Director of Industries, United Provinces, is the Secretary to the Committee.

5. The Committee is empowered to co-opt technical advisers who will not have the power to vote.

6. The Committee will please submit its report before the end of January, 1938.

7. The Government hopes that the parties concerned will render all possible assistance to the Committee."

2. The terms of reference were supplemented by G. O. no. 3275(3)/XVIII, dated the 11th November, 1937, which ran as follows :

"I am directed to say that it has been suggested to Government that steps may be taken to introduce welfare work and to effect improvements in the housing conditions, etc. of the labourers at Cawnpore with a view to ameliorate their condition and promote their happiness and well-being.

2. I am therefore to request that the marginally-noted three points may kindly be placed before the Labour Enquiry Committee, so that it may consider them and make such recommendations to the Government on the subject as it thinks necessary."
- (1) What improvements are required in the conditions in which the labourers live in Cawnpore especially as regards housing, sanitation, etc., and what steps should be taken to effect the same ?
 - (2) What welfare activities are desirable and through what agencies should they be carried out ?
 - (3) What statistical data should be maintained in regard to labour conditions and welfare and by what agency ?

3. Sriyut Gulzari Lal Nanda could not be spared by the Government of Bombay to serve on the Committee. By notification no. 4543/XVIII, dated the 13th January, 1938, the Government therefore appointed Mr. B. Shiva Rao, Press Correspondent, New Delhi, to take his place. Sriyut Gulzari Lal Nanda, however, took a lively interest in our proceedings. He visited Cawnpore once and helped us with advice. Mr. Babu Shiva Rao actually took charge of his duties on 6th January, 1938.

4. The constitution of the Committee underwent a further change when Sir Tracy Gavin Jones and Mr. Harihar Nath Shastri offered to retire on certain conditions. It was felt that it would be more conducive to the work of the Committee if the representatives of the parties to the dispute, which had given rise to the Committee, did not function as its members. The Government accordingly issued notification no. 143/XVIII—735, dated the 16th January, 1938, which is reproduced below :

"The Governor is pleased to direct that with effect from 12th January, 1938, the Committee of Enquiry appointed in notification no. 3275/XVIII, dated the 11th November, 1937, as amended by notification no. 4543/XVIII, dated the 13th January, 1938, to examine and report on the conditions of life and work of the labourers employed in factories at Cawnpore shall consist of—

- (1) Sriyut Rajendra Prasad Saheb, Chairman,
- (2) Professor S. K. Rudra, and
- (3) Mr. B. Shiva Rao, Press Correspondent."

5. On the retirement of Sir Tracy Gavin Jones and Mr. Harihar Nath Shastri the Committee co-opted Mr. B. K. Murthy, B.E. (MECH.), M.Sc., TECH., A.M.C.T., Textile Expert to the United Provinces Government, as a Technical Adviser.

6. The events leading to the appointment of the Committee may be briefly summarized.

Immediately after the assumption of office by the Congress in July, 1937, a number of strikes took place in several textile mills in Cawnpore with a view

to securing an increase in wages and general improvement in the conditions of employment. It was stated at a number of meetings of workers that the employers had reduced their wages from time to time during the last few years, either directly by a revision of wage rates, or indirectly by the abolition or curtailment of bonuses and allowances. It was also alleged that the policy of the employers in introducing rationalization and other methods of intensification was responsible for increasing unemployment among factory labourers at Cawnpore. Allegations were also made that the members and office-bearers of the Mazdur Sabha, the only organization of textile workers in Cawnpore, were harassed and victimized by the employers with a view to crush Trade Union activities. The Hon'ble the Premier, Pandit Govind Ballabh Pant, explained the attitude of his Government on the subject and promised to take all legitimate steps to secure to factory workers in Cawnpore reasonable standards of work and living. He also announced the decision of the Government to appoint a special Labour Officer to deal with labour disputes arising from day to day. This Officer, Dr. Raj Bahadur Gupta, M.A., Ph.D., was appointed in the beginning of August, 1937. On the 5th August, the Hon'ble the Minister for Industries, Dr. Kailash Nath Katju, visited Cawnpore and discussed the demands of the workers with the representatives of Labour and the Employers' Association of Northern India which had been brought into existence on the 3rd August, 1937. Unfortunately, however, the negotiations fell through because the employers would not agree to recognize the Mazdur Sabha as the mouthpiece of labour. The radical section of the Mazdur Sabha thereupon organized a systematic campaign of agitation which resulted in a general strike in almost all the textile mills. The Employers' Association reviewed the situation on the 6th August, and agreed to grant recognition to the Mazdur Sabha provided all the mills in Cawnpore resumed normal work by 9th August. The workers, however, refused to go back to work until all the demands of the workers, including the restoration of cuts in wages, had been agreed to by the employers. The district authorities considered it necessary, in the interests of peace, to promulgate orders under section 144, prohibiting meetings and the assembly of more than five persons. Action was also taken against certain individuals, including the General Secretary of the Mazdur Sabha, Mr. S. S. Yusuf, under section 107, of the Criminal Procedure Code. On the 8th August, the Hon'ble the Premier decided personally to intervene in the matter and came down to Cawnpore to discuss the situation. His efforts were successful in bringing about an agreement between the representatives of the Employers' Association and the Mazdur Sabha in the afternoon of 9th August. That agreement provided for the appointment of an Enquiry Committee to go into the demands of labour. A full copy of the agreement will be found in Appendix I to this report.

7. Although the terms of reference were general the Committee confined itself to consideration of the conditions in the textile industry at Cawnpore. more particularly cotton. The jute mills were not looked into at all. This was necessitated by the circumstances under which the enquiry was held. The dispute had occurred in the textile industry which is also the most prominent industry in Cawnpore. There was no statistical material available to formulate any opinion about other industries and the time-limit imposed by Government circumscribed the sphere of our investigations. According to its terms of reference the Committee was also called upon to adjudicate on all interim disputes. At the very commencement of its career, it was faced with a deadlock that had arisen on account of strikes or lockouts in three mills. We requested the Government to refer this matter to a separate body and they

Scope of the inquiry.

accordingly appointed a Court of Inquiry under section 3 of the Trade Disputes Act, 1929. With regard to other interim disputes that arose from time to time, the Committee expressed its inability to take them up on the ground that their consideration would prejudice the general enquiry and delay the findings on the main issues. The Government then directed that "questions of interpretation and other matters which are referred to it during the pendency of the enquiry can be taken up later after the main enquiry is completed and the report thereon prepared."

Procedure.

8. At our sittings both the Employers' Association and the Mazdur Sabha were fully represented by their members or nominees. The Government appointed Mr. Shitla Prasad Saksena, M.A., Lecturer in Economics, Lucknow University, as a technical adviser to assist the Mazdur Sabha in presenting their case to the Committee and he was present throughout. The procedure for examining the witnesses was that after they had been examined by the Chairman and other members of the Committee, both sides were allowed to examine or cross-examine them, as the case may be.

Press.

9. The Press was admitted to all public sittings of the Committee, except in the early stages of the enquiry when the Secretary issued *communiqués* briefly summarizing the proceedings of the day. In view of the tension prevalent in the city, appeals were made on more than one occasion to the Press to co-operate with the work of the Committee. We are grateful for the response made to these appeals.

Questionnaire.

10. A comprehensive questionnaire was issued which is reproduced as Appendix II to this report. We received only two written replies, one from the Employers' Association which gave general answers on behalf of the cotton textile industry as a whole and the other from the Executive Committee of the Mazdur Sabha. At a later stage the Employers' Association supplemented its reply by supplying copies of the replies of the individual mill members. Nineteen out of 29 textile mills in Cawnpore are members of the Employers' Association. The non-member mills did not care to reply to the questionnaire and took no part in the proceedings.

Our handicaps.

11. The work of the Committee was greatly hampered in more ways than one. Apart from the complications and the delays caused by lightning strikes, frequent allegations from the workers' side of victimization and the generally disturbed conditions in Cawnpore, which culminated in the murder of an employee of the Elgin Mills, we felt that the lack of precise information, of the kind which was available to a similar Committee in Bombay, was a very serious handicap. The Bombay Labour Office is a unique institution in India with a well-equipped staff and through its experience of over 17 years has accumulated a wide and intimate knowledge of all aspects of the labour problem especially in relation to the cotton textile industry. It has a wealth of well ascertained and well assimilated facts and figures at its disposal. Such an institution is a powerful factor in the elucidation of complex and intricate problems, such as we have been called upon to determine. It has carried out, on at least four occasions, a through wage census, such as has not been attempted even once in these Provinces. Unlike Bombay, Ahmedabad and Sholapur, Cawnpore has not even had the advantage of the service of an accurately constructed and regularly maintained cost of living index number, so valuable in any investigation of the wage problem. We are glad to note, however, that a useful beginning in this direction has been made by the Bureau of Statistics and Economic Research, United Provinces, Cawnpore. Moreover, there have been, during the last 12 years, three detailed investigations by Tariff Boards into the conditions of the textile industry, but none of these visited Cawnpore.

12. Though the enquiry started in November, our Committee did not receive detailed material from the Employers' Association until a very late stage of our investigations. It was, in fact only after several reminders that the documents, to which reference was made in the written memorandum of the Employers' Association, were made available to the members of the Committee, on the strict understanding that these would not be disclosed to the representatives of the Mazdur Sabha, except at the time of cross-examination. Protests were made to us by the latter that this placed the Mazdur Sabha's representatives at a great disadvantage in cross-examining witnesses appearing on behalf of either individual mills or of the Employers' Association. Greatly as we sympathized with this point of view, we felt bound by the restriction imposed on us by the employers. This procedure prolonged the stage of oral evidence, with results which could not in any way be regarded as satisfactory.

13. We orally examined altogether 23 witnesses, of whom 7 were drawn from amongst the management of the various mills and 9 were workers, 3 having been produced on behalf of the employers and the rest on behalf of the Mazdur Sabha. The other witnesses were—

Witnesses
examined.

(1) Sir Tracy Gavin Jones, President and representative of the Employers' Association, assisted by Messrs. A. L. Carnegie and C. W. Tosh;

(2) Mr. A. L. Carnegie, President of the British India Corporation;

(3) Mr. Harihar Nath Shastri, President of the Mazdur Sabha;

(4) Mr. Shitla Prasad Saksena, representing the Mazdur Sabha;

(5) Mr. B. P. Srivastava, Chairman, Municipal Board, Cawnpore, assisted by Dr. S. N. Tiwary, Executive Officer.

(6) Rai Bahadur Lal Srinarain, Executive Officer, Improvement Trust; and

(7) Mr. A. Hai, Chief Inspector of Factories and Boilers, United Provinces.

A complete list of the witnesses will be found in Appendix III.

14. Members of the Committee visited from time to time various mills and the localities where the workers live. Mill Directors and Managers gave every possible assistance and freedom to see their mills and to interrogate their workers. Opportunity was also given to see the mills at work during the night shift. The Chairman of the Improvement Trust, Mr. E. M. Souter, C.I.E., M.L.A., with the Executive Officer showed us some *ahatas* and the new area reserved for factory workers. The Mazdur Sabha officers, particularly Mr Suraj Prasad Avasthi, M.L.A., enabled us to visit their premises and see the Reading Room and Dispensary facilities they provide for the workers. Mr. Carnegie of the British India Corporation conducted us over the MacRobertganj and Allenganj Settlements. Mr. H. A. Wilkinson gave us the opportunity of acquainting ourselves with the welfare work carried on for several years through the agency of well-trained Y.M.C.A. Secretaries.

Places visited.

15. There was a preliminary meeting at Lucknow on the 10th September, 1937, attended by the Hon'ble the Premier and Hon'ble the Minister for Industries, at which the programme of the Committee was decided. The formal sittings of the Committee commenced at Cawnpore on the 15th September. After the meeting of the 16th September, there was a long adjournment to enable those interested to prepare their answers to the questionnaire. The Committee reassembled on the 15th November, and except for a few short breaks and two long breaks, one of a week in November and the

Sittings.

other of about a fortnight in December, it met almost from day to day until the 31st January, 1938, when the evidence was closed. In all we had 38 sittings.

16. We have to record with regret that our President, Sriyut Rajendra Prasad, was prevented by serious illness from attending the sittings except in September, 1937, and from 7th to 14th January, 1938. It is, however, a matter of profound satisfaction that he was able to take part in the final discussions relating to our recommendations. In his absence Professor S. K. Rudra presided over our deliberations. He was present throughout from the 15th November, 1937. Mr. Shiva Rao was present at our sittings from the 7th to 24th January, 1938.

Acknowledgements.

17. We must express our gratitude to Sir Tracy Gavin Joines who, even after his retirement from the Committee, continued to take a keen and active interest in our deliberations. We are indebted to Pandit Harihar Nath Shastri for presenting the case on behalf of the workers, in spite of serious handicaps, with marked ability. We would also like to place on record our high appreciation of the very valuable help that we have received from Mr. B. K. Murthy, our technical adviser and Mr. J. Tinker, Managing Director. Cawnpore Cotton Mills, on technical matters. They have given us their time ungrudgingly and assisted us in all possible ways. The work done by Mr. Shitla Prasad Saksena, ably assisted by Mr. R. D. Bharadwaj, has been of immense value and contributed greatly to the unravelling of the problems before us.

Our thanks are also due to the various gentlemen who came to give evidence before us. The lucid and unreserved manner in which they answered our questions evoked our admiration on several occasions.

The small staff of the Industries Department placed at our disposal did their work with commendable expedition and efficiency. They worked unsparingly under great difficulties. Our special thanks are due to them and particularly to Messrs. Debi Prasad and Faiyaz Ali.

We would like to make special mention of the help we received from Dr. Raj Bahadur Gupta, the Government Statistician and his able assistant, Mr. Jugal Kishore Pande, M.A., in supplying us with needful statistical statements.

We would also like to mention with appreciation the name of Mr. D. M. Arrindell, the Employers' Labour Officer, for helping to elucidate the employers' point of view.

18. Lastly, our Secretary, Mr. J. Nigam, I.C.S., Director of Industries and Commerce, United Provinces, has been our efficient and tireless collaborator both on the Committee and in the office. The work of assembling material, the production of witnesses, the arrangements for meetings and all other matters connected with our work, was carefully thought out and planned by him. This has been a matter of peculiar difficulty. For after the end of the public sittings of the Committee on the 31st January, the members dispersed to their respective stations. He acted as the liaison officer, and co-ordinated our work. His ability and particularly his judicial training and experience were of invaluable help to us in our task. To him we owe our sincerest thanks.

CHAPTER II

THE WAGE PROBLEM

19. Wages have usually formed the main cause of trouble in most labour disputes the world over. Cawnpore has been no exception. The reason for this is obvious. In most countries, and it is daily becoming truer of India also, wages form the major, if not the sole source of the worker's income. His livelihood and that of his entire family depend upon the wages he receives. Income from other sources, if they exist at all, are strictly limited. Amounts so gained are meagre. Supplementary sources of income, in terms of money or real wages, are therefore not an appreciable part of a workers' total income. Hence the matter of the wage-rate and the total amount of wages secured, per unit of time, month or fortnight, is of the supremest importance to him. His welfare and the welfare of all those who depend upon him, are based upon the amount of earnings received. And since the majority of the community consists of wage-earners and their dependants the well-being of society is intimately connected with the wages received, individually as well as in the aggregate. The wage question is therefore of vital importance. Importance of the wage question.

20. In India it was often said that the wage-rate or the wage itself, was not of such significance, because the so-called industrial worker was really an agriculturist. He came into industry as a matter merely of tiding over pecuniary difficulty for a period in his village home. He had his secondary source of income, and as soon as there was general improvement in agricultural conditions, he resorted back to his traditional means of gaining his livelihood. This undoubtedly was in large measure true. Parenthetically this accounted, amongst other reasons, for the migratory habits of our industrial population. It also formed one of the important causes of the slow development of trade unions, for collective bargaining purposes, even in our main industries. But the present day facts reveal a situation in the countryside where these old conditions are changing very rapidly. With increasing pressure upon the soil*, with greater and greater fragmentation, holdings are becoming uneconomic. Even our staple crops, for instance wheat, are not so secure in our own markets and *mandis*. Crops, such as, wheat, cotton, rice, and sugarcane, are elsewhere in the world being more and more scientifically raised and economically handled and marketed. The result is that the position of our food and commercial crops—and incidentally our cattle-raising and dairy-product industries also—has been thoroughly jeopardized. Our village arts and crafts too are being annihilated by the more attractive and cheap machine-made products. For instance, Japanese celluloid dolls are replacing the traditional "Guriya" made of cloth, and the crude toys of the potter are giving way to the more enticing mechanical toys of the West. The extension of the means of transportation is rapidly transforming our tastes and habits in these and other matters. Thus the economic security of life, has, for the present, been cut from beneath. The villager is becoming, in ever-increasing numbers, a landless agricultural labourer. He is drifting slowly but surely,

*The population of the Province has been increasing rapidly. The mean density per square mile in United Provinces increased from 413 in 1881 and 427 in 1921 to 456 in 1931.

city-ward. He is coming now to stay and not to run away back to his village home. Statistics can be cited to substantiate this trend of the movement of population. City populations are now in increasing proportions being composed of "native-born" people. Hence we must regard the industrial wage of the worker as the mainstay, both of himself and his family. Every large industrial centre including Cawnpore, has now built up a stable industrial population which regards industry as its life occupation. Indian economy must necessarily shift in this direction, unless disaster is to overtake its vast and rapidly expanding population. The industrial wage is therefore of national significance.

Interests to be considered in determining an equitable wage.

21. This wage has, however, to be equitable. The theory of marginal productivity is not a mere pastime problem for the intellectual gymnastics of the economist. It is a stern reality of the market place. It is in the opinion of many economists definitely and decidedly the ultimate factor which determines the distribution of the national dividend. Other agents or factors of production have also to be taken into due regard. Under existing conditions the industrial worker is not the only consideration. The industrialist, the businessman, the technician, the supervisory and administrative functionaries have also to be taken into account. The *entrepreneur* and the financier play an important part in the economic organization of the country. The modernization of the industrial structure of this land depends very greatly upon their initiative, capacity and energy. Much that has been achieved in India is largely due to their efforts often against heavy odds. Cawnpore itself is manifestly a monument to the courage and the enterprise of the employers, firstly British, and now British and Indian both. If it is desired that India should be rapidly industrialized, the confidence of the captain of industry and of the financier in the conduct of affairs should not be impaired. The profit motive has to be kept in mind, unless indeed it is contemplated to transform the very basis of the economic structure of the country.

22. While we accept the importance of the profit motive as a stimulus to economic enterprise, we at the same time wish to emphasize that the position of the worker must equally be safeguarded and secured. This factor has often not been considered as of much significance. In fact, there has been great exploitation. Wages have been the first to suffer for any decline in industry and the last to benefit from any increase in prosperity. The workers' standard of living appears to have been the last consideration. The various ways and means that have been adopted in other countries to safeguard the worker's position, are here, on the whole, conspicuous by their absence. Profit motive should not however be interpreted to mean indiscriminate profits, particularly in the case of a protected industry.

23. Besides the worker and the employer, there is yet a third party to be considered. He is no less important. Though be it that he is silent. He is the consumer. He is the ultimate person who pays for the final commodity sold. He, usually, has to bear the higher costs of production, no matter how they may have been incurred. Rising prices and deteriorating quality are very often the dual evils he has quietly to endure. The consumers represent the vast masses of the country. They are unorganized and like most consumers, unless they are in the co-operatives, they are non-vocal. The State therefore must keep the interest of the ultimate consumer and his welfare constantly in mind. The endeavour should be to organize economic life in such a fashion as to promote productivity with a tendency to declining prices and improving quality. It is thus alone that material satisfaction and increased content can be secured for the good of the country.

24. It is chiefly to investigate this wage question that the present Committee came into existence. According to our terms of reference we are to discover— Problems before us.

“(1) Whether wage cuts have taken place direct or indirect, and if so where and to what extent?

(2) In case any such wage cut is established, whether there should be any increase in wages and if so what?

(3) How the present rates of wages in Cawnpore compare with those prevailing elsewhere in India, and whether, taking also into consideration the profits made by the mills and the cost of living in Cawnpore, they should be increased and if so to what extent?

(4) Is it desirable to prescribe any minimum rate of wages for any class of labour at Cawnpore and if so what should such rates be?”

25. In this connection we have regretfully to record that we were poorly served with the aid of statistics, indispensable in an inquiry of such a nature. Neither with regard to wages nor with regard to cost of living index series, had we much to go by. Unlike Bombay, with its well-equipped, well-staffed and well-organized Labour Office, which has made several wage census investigations and has records, facts and figures relating to industrial conditions of workers, we had next to nothing to guide and direct us in our inquiry. Such figures as we did obtain cannot be regarded as wholly reliable. The source, the method, and the time of collection somewhat vitiated their value. We desire to state it at once that this lack of accurately collected data is an outstanding defect in the industrial equipment of the Province in general and of Cawnpore in particular. This state of affairs must be rapidly repaired. We make suggestions elsewhere in this connection. We regard these as an essential part of our recommendations. Scantiness of available material.

26. The Employers' Association did not give us much information. Such information as they did eventually supply us, was given piece-meal and after much persuasion. One of the main causes which held up the work of the Committee was this unwillingness and delay on the part of the employers to provide us with the necessary figures. The completed wages statement, which we call the third millwise wage statement, we actually received on the eve of our final consideration of the report. We feel bound to express surprise that the employers have neglected the statistical study of their major industry in Cawnpore. We suggest that they should “rationalize” their system of keeping records of their data. It is vital to their individual as well as to their collective interests to do so. Committees like ourselves would, incidentally, be grateful for such information properly collected and recorded.

27. The contention of the workers, as represented by the Mazdur Sabha is that there has been both a direct as well as an indirect wage cut as between 1929 and 1937. They also maintain that, apart from the Madras Presidency, the wages in Cawnpore are lower than in Bombay, Ahmedabad and even Sholapur. They say quoting from the Royal Commission on Indian Labour (the figures given are for 1929): The case of the Mazdoor Sabha.

“In the United Provinces where Cawnpore is the most important centre the Chief Inspector of Factories gives the rates of wages for male weavers as Rs.33 and for male spinners as Rs.25 per month. In the Punjab, Delhi and Bengal rates stand to rule substantially higher than in the United Provinces” (Royal Commission on Labour Report, page 198). In Bombay the average earnings of the two loom weavers in 19 selected mills varied between Re.1-9-1 to Rs.2-1-6 per day. This works out a monthly average on the basis of 26 working days in a month from Rs.40-12-2 to Rs.45-7 which shows that even the minimum wage at Bombay was higher by 23.5 per cent. than Cawnpore wages.”

28. They also refer to the Report of the Indian Tariff Board on the Textile Industry, 1927, and give the comparative wages for various categories of workers for different textile centres in the country as follows :

TABLE I
The comparative wages for various categories of workers for the different textile centres in India

Standard muster, 1st April, 1926	Bombay	Ahmedabad	Cawnpore	Delhi	Nagpur	Madras
	Rs. s	Rs. s. p.	Rs. s. p.	Rs.	Rs. s.	Rs. s. p.
Blow room tenters ..	29 0	23 10 0	16 14 6	19	24 0	25 14 6
Card room tenters ..	27 4	24 7 6	23 12 0	14	24 0	23 3 8
Frame tenters ..	37 12	27 6 0	27 3 0	25	30 12	25 2 0
Ring frame side boys ..	29 12	26 7 6	15 10 0	20	24 0	(a) 14 10 8 (b) 17 15 0
Winders ..	21 4	23 1 0	27 13 0	25	16 8	21 8 0
Weavers ..	47 12	47 15 9	32 7 0	35	41 0	34 7 0
Folders ..	29 0	25 11 3	14 6 0	20	24 0	26 3 5

29. They also give the comparative table furnished by the Upper India Chamber of Commerce at Cawnpore.

TABLE II
The comparative wages furnished by the Upper India Chamber of Commerce, Cawnpore

	Bombay		Ahmedabad		Cawnpore
	Per day	Monthly	Per day	Monthly	Monthly
	25 days working				Rs. s. p.
Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.		
Weaver 2 looms (ring frame) ..	1 13 4	47 10 8	1 13 5	47 12 10	39 1 4
Siders (minders) ..	1 3 0	30 14 0	0 15 2	24 10 4	18 10 6
Tarwalas (piccers) ..	0 15 5	25 0 10	Not given		17 6 1
Doffers ..	0 12 1	18 10 2	0 10 7	17 3 2	12 8 9

30. They proceed to quote from the Tariff Board, 1932, and give the following percentages for the labour costs of production at various textile centres.

TABLE III
The comparative labour costs of various textile centres

	Per cent.	Excess or deficiency as compared with Cawnpore
(1) Ahmedabad	53·8	13·05
(2) Baroda	52·65	11·90
(3) Delhi	51·60	10·83
(4) Bombay	49·40	8·65
(5) Calcutta	42·40	1·65
(6) Cawnpore	40·75	..
(7) Nagpur	38·60	-2·15

31. Some comparative figures compiled from the above sources are given in Table no. IV.

TABLE IV

The comparative wages for some categories of workers which comprise a high percentage of the total workers in the industry

	Cawnpore	Bombay	Ahmedabad
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Inter frame tenter	14 0 0	28 15 8	35 8 4
Roving frame tenter	14 0 0	27 10 8	30 14 0
Doffers	12 0 0	14 12 1	18 4 6
Mule (minders)	34 0 0	39 9 9	44 11 6
Side piecers (mule)	22 0 0	25 11 1	35 1 2
Coloured winders	25 9 0	20 9 0	21 10 8
Sizing (mixers)	20 0 0	23 10 0	24 11 1
Weavers (2 looms)	17 8 0 to 20 6 0	33 9 5	49 13 4
Bleaching (bleach croft minder)	14 0 0	21 7 5	23 1 2
Coolies	14 8 0	18 18 5	20 15 10
Sweepers	12 0 0	16 15 4	17 5 0
Fitters	22 8 0	38 14 7	37 7 0

32. And they say—

“Thus wages at Cawnpore have throughout been comparatively low. At least the facts do not bear out the assertion that wages at Cawnpore compared favourably with other parts of the country. Though Cawnpore is the next important cotton textile centre in the country after Bombay and Ahmedabad, at times, wages of Cawnpore workers have actually been lower than the wages in smaller textile centres like Sholapur, Delhi, Baroda and Calcutta. It is rather paradoxical that the employers at Bombay and Ahmedabad have always demanded wage reductions and protection on the ground that the upcountry wage rates are comparatively low which has every time been accepted by the Tariff Boards on the Textile Industry, while the employers at Cawnpore are contending that the wages at Cawnpore compared favourably with those paid in other parts of the country.”

33. They proceed to argue that the economic depression began in the year 1929, and went on deepening until 1934. In keeping with other textile centres, Cawnpore also experienced wage cuts. They state—

“Although no authentic or official wage statistics are available for this period, meagre, data which we have in our possession goes conclusively to prove that wages at Cawnpore have substantially been reduced during this period.”

34. They indicate that the reduction has taken place in various ways classified as follows :

A—DIRECT CUTS—

(i) Reduction in the rates.

(ii) Reduction through the abolition of bonuses on production and attendance and reduction of dearness allowance, *khoraki* (midday meal) allowance and the like.

B—INDIRECT CUTS—

(iii) Introduction of new varieties of cloth at rates which do not bring the wages to the level of those earned on old varieties.

(iv) Reduction of piece-rates to meet unprecedented high production by individual operatives.

(v) No adjustments are made consequent upon a substitution of finer for coarser counts.

(vi) Introduction of inferior raw material which affects output considerably.

(vii) Short work and consequently loss of time and wages.

(viii) Introduction of new methods of work involving a reduction in the number of operatives employed and the consequent extra work that has to be looked to by the workers.

(ix) Changes in the speed of the machine which affect wages in various ways.

(x) (a) The introduction of the system of giving forced leave instead of the old system of fines which have been limited under the Payment of Wages Act.

(b) The introduction of different rates for damaged cloth on the same machine. This is another substitute for the old system of imposing fines.

(xi) Reduction in the hours of work since January, 1935, and the consequent fall in the wages of piece-workers and alterations in the system of the payment of wages to time-workers.

(xii) Deduction of a fixed percentage from wages for the substitution of old machines by new.

(xiii) Changes in the cost of living resulting in the reduction of real wages.

35. The memorandum states—

“With regard to the direct cut in the wages and bonus it is not possible for us to give exact and detailed information.”

But under the reduction or withdrawal of bonuses they estimate the loss to 12½ per cent. in the workers' income. They calculate that the shortening of the hours has meant a 7 per cent. cut in workers wages. They reckon that due to cut in the rates, the decreases in wages averages about 20 per cent. They proceed therefore to say—

“The wages on the whole therefore have been reduced by about 40 per cent. since the beginning of the economic crisis due to these three factors alone. It is not possible to assign the proper share of other factors in the reduction of wages. But there is no doubt that it is quite so important as to make itself felt and make the workers complain against it very bitterly.”

36. On the other hand, the employers in their memorandum state—

“Answer to question no. 1—There was a difference in the rates of time wages paid by the various mills; this difference being due to unavoidable factors, such as, age and design of machinery, lay-out of the factory and quality of the material being worked, etc. Statements have been prepared showing the workers average earnings of each of the mill members, and, so far as the Association could ascertain, there had been no reduction in the rates of wages paid since 1929.”

37. Further they proceed to say—

“Answer to question no. 4—See Association’s remarks to question no. 3 (Piece-rates for different operations were calculated and based on traditional practical experience, and on such factors as speed of machinery, type of material being made, etc.) There has been no reduction in the piece-rates which have adversely affected the earnings of the workers and, in fact, the reverse has obtained, particularly on the weaving side. In this connection, consideration must be given to the reduction in the working hours, as now laid down in the Factories Act.”

“Answer to question no. 5—When changes are made in piece-rates due to variations in quality of material, etc., careful consideration is always given by mill managements to ensure that earnings of the workers should not be reduced below the basic figures as shown in the answers submitted by the various mill members to questions relating to rates of wages paid.”

38. The Employers’ Association supplied us three mill-wise wages statements. They refer to eleven principal cotton mills which employ all but a small fraction of the workers in the industry at Cawnpore. Wage statements supplied by the Employers’ Association.

39. The statement which accompanied their memorandum was the following :

Average monthly wages earned by mill-workers at Cawnpore for the year 1929-37 based on 9 hours per day*

	Cawnpore, 1929			Cawnpore, 1937		
	Rs.	a.	p.	Rs.	a.	p.
Mixing room	15	15	8	17	4	8
Blow room	15	2	8	18	10	5
Cards	15	6	9	17	4	1
Drawings	26	10	0	28	9	2
Slubbers	28	7	3	30	2	2
Inters	25	10	8	28	6	9
Rovers	28	1	9	25	1	11
Rings (twist)	16	11	9	20	4	9
Rings (weft)	16	14	0	20	18	5
Mules (spinners)	33	9	9	34	18	2
Mules (piecers)	21	6	0	28	0	10
Winding (old)	19	8	6	23	12	6
Winding (H. S.)	21	6	0	22	11	9
Warping (old)	38	8	6	42	14	7
Warping (H. S.)	Nil			58	6	2
Sizing (back)	17	7	9	20	9	1
Sizing (front)	27	9	9	32	10	8
Drawers	26	13	9	31	18	2
Weaving	35	9	3	40	0	6

*As explained in a later paragraph in this chapter only three mills out of eleven supplied detailed figures for 1929.

This statement gives the wages for the entire department or for the whole of a particular occupation for the entire industry in Cawnpore. The figures for 1929 as given in this statement were obtained by reducing the actual averages by 10 per cent. in order to base them on a 9-hour working day. Wages of mistries and fitters and others were included. It did not show the number of persons employed. Very little could be learnt of the actual situation from such a statement as this. And yet this was all that the Association would let us have. The statement could not be briefer and balder.

40. It was only in the middle of January, that we obtained the first mill-wise statement as contained in Table no. VI. Had even this kind of a statement been supplied to us early in our inquiry, or at least in the beginning of January, after the Christmas recess, we could have proceeded more swiftly and satisfactorily with our work.

41. The second mill-wise statement reached our hands as late as the middle of February. A summary of that statement is contained in Table no. VII.

TABLE VI

Wages Statement—1929 or nearest year

(P.=Piece work. T.=Fixed wage)

Departments	1930	1936	1932-33	1931	1929					1930	1934	1935
	Mill (A)	Mill (B)	Mill (C)	Mill (D)	Mill (E)	Mill (F)	Mill (G)	Mill (H)	Mill (I)	Mill (J)	Mill (K)	Mill (L)
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Mixing Room ..	15 8 0	16 0 0	T.17 1 0	23 8 4	(1) 21 5 8	Narayan .	Contract ..	T.18 8 0	14 8 3	15 8 0	18 0 0	17 0 0
2. Blow Room ..	15 8 0	17 0 0	T.17 14 0	18 0 0	(2) 16 14 0	..	T.15 10 0	T.19 8 0	14 2 9	15 8 0	18 0 0	17 0 0
3. Cards.. ..	15 8 0	16 0 0	T.17 1 9	18 9 2	(3) 23 18 6	..	T.15 10 0	T.18 8 0	14 1 9	15 8 0	18 0 0	16 0 0
4. Drawings ..	33 9 0	25 6 3	P.33 13 0	22 4 7	(4) 25 18 8	..	P.34 4 0	P.27 2 0	29 6 3	32 8 0	43 8 6	22 6 1
5. Slubbers ..	32 1 0	25 3 11	P.48 8 0	32 5 10	(5) 35 5 0	..	P.25 6 0	P.27 7 0	28 12 9	31 10 0	43 10 0	22 5 4
6. Inters ..	28 11 0	27 6 1	P.37 18 0	29 14 4	(6) 32 0 0	..	P.23 12 0	P.22 15 0	27 4 9	28 7 0	34 12 9	22 4 8
7. Rovers ..	25 18 0	24 11 1	P.36 0 0	27 8 2	(7) 25 5 0	..	P.19 9 9	P.19 0 0	24 0 0	25 4 0	31 12 9	23 7 3
8. Rings (Twist) ..	24.15 0	18 0 0	P.21 2 0	19 7 0	(8) 15 10 0	..	T.16 4 0	T.19 0 0	15 1 6	..	18 8 0	18 0 0
9. „ (Welt) ..	..	19 8 0	P.21 2 0	..	(9) 15 10 0	..	T.14 14 0	T.19 0 0	..	..	20 8 0	..
10. Mule (Spnrs) ..	37 12 0	..	..	..	(10) 37 6 8	..	P.32 18 0	..	41 0 0	37 5 0	..	..
11. „ (Piecers) ..	24 4 0	..	..	..	(11) 25 12 0	..	T.20 15 0	..	21 0 1	26 0 0	..	..
12. Winding (Old) ..	19 13 0	19 8 0	P.20 0 0	20 8 10	(12) 28 3 6	..	P.24 11 0	P.17 13 0	27 13 0	..	17 10 6	..
13. „ (H. S.) ..	..	..	..	23 11 9	(13) ..	..	..	..	..	..	..	..
14. Warping (Old) ..	34 11 0	43 14 5	44 4 0	25 9 11	(14) 49 1 6	..	P.42 0 0	P.58 7 0	43 14 0	..	43 9 3	..
15. „ (H. S.) ..	..	..	..	29 15 7	(15) ..	..	..	..	..	..	..	..
16. Sizing (Back) ..	20 5 0	20 0 0	T.22 12 0	18 4 6	(16) 20 7 0	..	T.16 4 0	T.18 8 0	18 8 0	..	20 0 0	..

TABLE VI—(contd.)

Wages Statement—1929 or nearest year

(P.= Piece work, T.-Fixed wage)

Departments	1920	1926	1922-23	1931	1929					1930	1934	1935
	Mill (A)	Mill (B)	Mill (C)	Mill (D)	Mill (E)	Mill (F)	Mill (G)	Mill (H)	Mill (I)	Mill (J)	Mill (K)	Mill (L)
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
17. Sizing (Front) ..	29 4 0	37 0 0	T.35 12 0	28 0 6	(A7) 29 3 0	..	T.22 8 0	T.30 0 0	26 8 6	..	33 0 0	..
16. Drawers ..	28 9 0	30 15 8	P.02 9 0	34 8 8 (1-9-'35)	(18) 28 13 3	..	T.22 12 0	P.30 6 0	37 8 0	..	25 1 9	..
<i>Weaving</i>												
26/28" .. ..	..	..	..	..	..	..	..	..	..	..	..	..
29/32" .. ..	..	..	..	..	..	..	P.36 12 0	P.31 4 0	31 4 4	..	40 10 6	..
33/36"	35 0 0	49 0 0	..	29 11 0	40 14 0	..	P.37 8 0	P.40 2 0	..	..	42 6 9	..
37/40"	37 5 0	50 11 10	..	..	..	..	P.30 1 0	P.29 8 0	38 12 0	..	41 2 9	..
41/46"	37 14 0	54 15 1	..	35 7 8	42 0 0	..	..	P.36 12 0	42 8 7	..	38 13 9	..
47/50"	38 15 0	51 2 9	..	32 3 8	38 5 0	..	..	P.38 13 0	..	..	42 8 8	..
51/54" .. ..	..	..	..	..	..	..	..	..	47 14 9	..	..	..
55/60"	37 11 0	..	..	..	43 8 0	..	P.30 8 0	..	..	..	39 9 6	..
61/66"	35 12 0	43 2 1	..	..	45 0 0	..	P.38 6 0	..	..	..	36 1 9	..
67/72" .. ..	..	..	..	..	..	..	..	..	..	..	..	..
78" .. ..	..	..	..	..	..	..	..	P.25 11 ..	..	..	..	..
Average for all the above workers.	37 1 6	49 12 9	40 3 0 (78" not included).	32 7 5	41 15 0	..	34 10 2	35 11 ..	40 0 10	..	39 15 8	..

TABLE VI—(contd.)

Wage Statement—1937.

(P=Piece work, T=Fixed wage)

Departments	Mill (A)	Mill (B)	Mill (C)	Mill (D)	Mill (E)	Mill (F)	Mill (G)	Mill (H)	Mill (I)	Mill (J)	Mill (K)	Mill (L)
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Mixing Room ..	14 14 0	16 0 0	17 1 0	20 0 6	(1) 29 1 6	10 0 0	Contract	T. 18 8 0	18 13 6	15 8 0	18 0 0	17 0 0
Blow Room ..	15 5 0	17 0 0	17 14 0	17 14 0	(2) 17 1 0	14 10 0	T. 15 10 0	T. 19 6 0	14 11 0	15 4 0	18 0 0	17 0 0
Cards ..	15 5 0	16 0 0	17 14 0	22 9 9	(3) 21 12 9	14 10 0	T. 15 10 0	T. 18 8 0	14 8 0	15 4 0	18 0 0	16 0 0
Drawings ..	25 9 0	27 6 7	40 14 0	27 11 4	(4) 23 13 8	29 6 0	25 5 0	P. 29 8 0	23 4 3	26 5 0	31 8 0	22 8 6
Slubbers ..	25 3 0	26 4 2	42 3 0	33 8 9	(5) 31 2 3	30 14 0	24 14 9	P. 27 13 0	34 7 9	26 5 0	38 5 3	20 9 10
Inters ..	26 6 0	30 3 0	26 15 0	29 14 8	(6) 28 7 9	23 10 0	24 0 9	P. 24 9 0	28 2 3	22 13 0	26 3 0	20 12 2
Rovers ..	21 6 0	40 4 2	26 3 0	27 5 2	(7) 26 14 9	24 2 0	21 0 9	P. 20 9 0	26 14 2	22 4 0	21 0 0	24 7 11
Rings (Twist) ..	28 9 0	26 0 0	21 2 0	20 6 1	(8) 22 4 0	..	T. 16 4 0	T. 19 0 0	17 14 0	..	18 8 0	18 0 0
.. (Welt) ..	28 15 0	27 0 0	..	19 6 8	(9) 21 1 3	21 10 0	T. 16 14 0	T. 19 0 0	18 1 9	..	20 8 0	..
Mules (Spnrs) ..	34 6 0	..	..	..	(10) 31 13 3	..	30 0 0	..	42 1 6	35 13 0	..	..
.. (Piecers) ..	23 5 0	..	..	..	(11) 23 4 9	..	T. 20 15 0	..	21 1 3	25 11 0	..	..
Winding (old) ..	16 7 0	22 13 7	22 8 0	27 11 6	(12) 24 0 3	27 8 0	27 6 0	P. 17 15 0	34 2 0	..	17 6 0	..
.. (H. S.) ..	18 9 0	..	25 1 0	28 12 9	(13) ..	..	..	P. 19 12 0	..	..	21 8 0	..
Warping (Old) ..	52 7 0	42 0 10	34 8 0	48 15 9	(14) 38 4 3	..	44 12 0	P. 47 1 0	41 8 0	..	42 4 3	..
.. (H. S.) ..	71 1 0	..	63 7 0	50 4 9	(15) ..	..	..	P. 48 12 0	..	..	..	..
Sising (Back) ..	21 2 0	20 0 0	22 12 0	18 4 6	(16) 20 7 9	..	T. 16 4 0	T. 21 0 0	23 3 9	..	22 0 0	..

TABLE VI—(concl.)

Wage Statement—1937

(P=Piece work, T=Fixed wage)

Departments	Mill (A)	Mill (B)	Mill (C)	Mill (D)	Mill (E)	Mill (F)	Mill (G)	Mill (H)	Mill (I)	Mill (J)	Mill (K)	Mill (L)
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Sizing (Front) ..	35 12 0	37 0 0	35 12 0	28 7 0	(17) 29 4 0	..	T. 22 8 0	T. 33 0 0	34 1 6	..	38 0 0	..
Drawers ..	32 9 0	31 13 1	46 15 0	32 13 5	(18) 30 1 9	..	28 10 0	P. 27 3 0	37 2 0	..	26 3 9	..
<i>Weaving</i>												
26/28" ..	..	..	..	..	..	..	..	P. 35 11 0	..	..	..	..
29/32" ..	..	..	..	..	..	..	..	P. 34 5 0	32 5 6	..	35 12 11	..
33/36" ..	38 1 0	49 0 4	..	39 0 8	35 0 0	..	34 3 0	P. 31 9 0	..	..	37 10 0	..
37/40" ..	37 9 0	50 5 8	..	..	..	..	34 1 0	..	44 11 5	..	37 11 9	..
41/46" ..	36 9 8	..	..	41 4 6	36 1 0	..	32 5 0	P. 37 5 0	44 15 7	..	34 12 8	..
47/50" ..	39 14 0	53 2 3	..	41 13 4	40 13 9	..	..	P. 36 18 0	45 13 6	..	34 12 8	..
51/54" ..	..	..	..	..	..	..	..	..	..	..	..	..
55/60" ..	43 2 0	53 13 7	..	..	37 12 0	..	35 14 0	..	..	..	41 8 6	..
61/66" ..	41 8 0	..	..	..	35 10 3	..	38 8 0	..	..	..	..	..
67/72" ..	..	..	..	..	..	..	..	..	..	..	..	..
78" ..	..	..	..	..	..	..	..	38 5 0	..	..	..	..
Average for all the above weavers.	39 13 0	52 0 8 (78" not included)	40 5 0	40 11 6	37 1 0	..	35 0 0	35 18 6	41 15 6	..	37 7 0	..

(18)

TABLE VII

Summary

Num- ber	Category Designation	Earnings per month		Earnings per hour		Earnings per hour	
		1929*	1937	1929*	1937	Decrease	Increase
		Rs.	Rs.	As.	As.	Per cent.	Per cent.
1	T. opener attendants ..	16'94	16'51	1'042	1'129	..	8'95
2	T. scutcher	16'82	16'08	1'035	1'098	..	6'08
3	P. lap carriers ..	17'84	17'57	1'098	1'196	..	8'92
4	T. card machine attendants	16'28	16'86	1'000	1'139	..	13'90
5	T. fly gatherers ..	18'25	18'49	1'128	1'264	..	13'55
6	T. strippers and grds ..	17'13	17'48	1'054	1'195	..	13'40
7	B. drawing tenters ..	27'85	27'81	1'714	1'867	..	8'94
8	P. slubbing	31'87	30'61	1'931	2'098	..	6'73
9	P. inter	29'08	26'44	1'790	1'808	..	1'005
10	P. roving	26'26	22'28	1'616	1'520	5'96	..
11	T. doffers carding ..	12'20	12'01	'751	'821	..	9'32
12	T. " spinning ..	12'98	13'34	'799	'912	..	14'16
13	T. P. siders	17'57	19'68	1'081	1'346	..	24'51
14	T. doubling tenters ..	16'70	15'75	1'028	1'077	..	4'75
15	P. reelers	18'98	14'89	1'165	1'014	12'95	..
16	P. grey winders (O. T.) ..	18'26	18'57	1'124	1'269	..	12'90
17	P. " winders (H. S.) ..	23'18	22'76	1'426	1'556	..	9'12
18	P. warpers (O. T.) ..	41'44	36'79	2'550	2'515	1'37	..
19	P. " (H. T.)	38'40	59'68	2'368	4'081	..	72'72
20	T. warping creelers ..	14'05	14'75	'865	1'008	..	16'58
21	T. front sizer	31'80	32'40	1'957	2'216	..	12'24
22	T. back	20'25	20'12	1'246	1'377	..	10'42
23	P. drawers-in	28'28	31'30	1'740	2'140	..	22'98
24	P. reachers	13'25	14'03	'815	'957	..	17'67
25	P. weavers	37'88	37'03	2'381	2'532	..	8'61
26	P. T. folders machine ..	16'27	15'30	1'001	1'046	..	4'50
27	P. folders hand	15'78	16'45	'971	1'125	..	15'87
28	T. coolies .. ..	..	..	..	..	..	..
29	T. oil men	17'02	16'07	1'047	1'099	..	4'96
30	T. sweepers (D)	12'80	13'50	'785	'928	..	17'13
31	T. " (compound) ..	12'40	13'44	'783	'851	..	11'54

* Or nearest year

42. The third mill-wise statement reached us literally at the eleventh hour, or the night of 10th of March, 1938. We had already formulated our chapter on wages, and were to assemble for our final deliberations on the 11th March when we received the completed mill-wise statement.

A summary of this statement is given in Table VIII. Detailed statements on which the summary is based will be found in Appendix IV. These statements are merely the statements supplied with the summary in Table VII in a completed form. In the earlier statements information regarding two mills which became available subsequently had been omitted.

TABLE VIII

No.	Category Designation	Earnings per month		Earnings per hour		Earnings per hour	
		1929*	1937	1929*	1937	Decrease Per cent.	Increase Per cent.
1	Opener attendants	16'35	16'03	1'006	1'096	..	8'94
2	Scutcher	16'12	15'70	'992	1'074	..	8'26
3	Lap carriers	17'15	16'92	1'055	1'157	..	9'67
4	Card machine attendants ..	15'20	16'15	'978	1'104	..	12'88
5	Fly gatherers	17'31	17'41	1'035	1'190	..	11'73
6	Stripers and grds.	16'46	16'59	1'018	1'134	..	11'94
7	Drawing tenters	25'23	28'00	1'553	1'914	..	23'25
8	Slabbing	27'75	29'07	1'707	1'988	..	16'46
9	Inter	25'84	25'52	1'590	1'745	..	9'76
10	Roving	23'80	21'69	1'465	1'458	1'22	..
11	Doffers carding	11'03	11'45	'742	'789	..	5'52
12	" spinning	12'58	12'68	'771	'867	..	12'45
13	Siders	17'83	18'84	1'083	1'288	..	18'71
14	Doubling tenters	16'74	17'10	1'030	1'160	..	13'50
15	Reelers	15'69	12'15	'964	'83	19'26	..
16	Grey winders (O. T.)	20'05	19'92	1'233	1'362	..	10'46
17	" " (H. S.)	23'18	22'76	1'426	1'556	..	9'12
18	Warpers (O. T.)	40'17	38'05	2'472	2'632	..	5'26
19	" (H. S.)	38'40	50'18	2'363	4'081	..	72'72
20	Warping creelers	14'14	14'88	'870	1'014	..	16'55
21	Front sizers	29'21	31'80	1'797	2'175	..	21'03
22	Back sizers	19'61	20'61	1'206	1'409	..	16'83
23	Drawers-in	26'57	30'47	1'685	2'084	..	27'46
24	Reachers	12'65	13'65	'778	'938	..	19'92
25	Weavers	36'67	37'07	2'256	2'535	..	12'36
26	Folders machine	16'01	15'15	'985	1'086	..	5'18
27	" Hand	15'86	16'58	'976	1'184	..	15'19
28	Coolies .. ..	..	..	..	..	..	..
29	Oil men	17'02	16'07	1'047	1'099	..	4'96
30	Sweepers (D)	12'64	13'83	'778	'912	..	17'22
31	" (compound)	12'40	12'44	'763	'851	..	11'54

* O: nearest year

43. A comment is necessary at this stage on the figures supplied by the employers. Though the statements are supposed to refer to 1929, it will be clear from a reference to these statements that of the eleven mills only four supplied the figures for 1929, two for 1930, one for 1931, two for 1933, one for 1934 and one for 1935. And even as regards the figures for 1929, one important mill did not supply the numbers employed in the different

departments in 1929 and in 1937. We could therefore make no use of the wages statement of this mill without this essential item of information. In other words, only three of the eleven mills were able to supply data on which a comparison could be made on the basis of the figures of 1929. It may be stated that two mills were not in existence in that year and therefore could supply their figures only for the years in which they started working. In view, therefore, of the paucity of information we consider that it would be unsafe to draw any definite and general conclusions with regard to the variations in wages between 1929 and 1937. With this caution, we proceed to analyze to the extent we can, the statements given by the employers.

44. The first mill-wise statement was compiled on the basis of only those workers, though their number was not disclosed, who had put in a complete 26 days' attendance in the mills. This statement gave only a few categories of occupations and in some cases gave the wages of the department only. The information thus given was not deemed satisfactory. This statement referred to the month of January for 1929 (or a later year as explained in the previous paragraph) and 1937. Analysis of the various mill-wise statements.

45. With regard to the second and the third mill-wise statements, it must be indicated at once that these refer to the month of March in the two respective years, and not to January, as in the first statement. The change was made at the request of the members of the Mazdur Sabha. They contended that January was the best month in the year and the wages for January, would not really be a correct representation of the wages position. They thought March to be a more typical month of the year. This month was accordingly selected. Some of the discrepancies therefore that appear between the first and the subsequent statements, must partly be explained on the basis of the change of month. We were informed that actually March proved an even better month than January from the employer's point of view.

46. Both the subsequent statements refer to the same eleven mills. They give the earnings of 31 categories of occupations. These include all the major processes, and can, therefore, be regarded as representative. These 31 categories represent 13,567 workers out of a total of 23,218. The occupations which have not been included are those which comprise only a few men in each category. They are in the majority of cases on monthly or daily rates. In these statements only a general average for the weavers has been given, while the first statement gave averages separately for wages earned on different widths of looms. The number of workers in each occupation has been given except of one large mill. The percentage of attendance is also recorded. It should also be added that in these statements a comparison has been made of the actual earnings between 1929 (when there was a 10-hour day) and 1937 (when the limit of working hours had been reduced to nine).

47. The second and the third statements are an improvement on the first. We shall, for our purpose, confine our attention to the third statement. We do so for two reasons. One is that, as we have stated above, the Mazdur Sabha representatives desired a comparison for the month of March. And secondly this statement is in comparison with the two previous ones, more informative, as it gives the weighted averages. At the same time we must add that owing to the very belated submission of the statement we were not in a position to cross-examine the representatives of

the Employers' Association with regard to the methods adopted in its preparation. There are several doubtful points. We are not clear, for instance, how the different mills have calculated the average earnings per month. Our work would have been simplified to a certain extent if the statements had disclosed the actual wages bill for each category. These items of information which would have been of considerable value were not furnished to us by the Employers' Association. Further, information is not available as to the extent to which rationalization has proceeded in different departments and in the various mills from year to year, and to what extent the figures of earnings given represent the effect of this factor.

48. In the absence of specific information on these relevant points, a proper comparison of the present wages with those prevailing in the previous years so as to ascertain the variations that have taken place becomes practically impossible. Moreover, we find that if the figures given by the Employers' Association for the earlier years are compared with those that are quoted by the Mazdur Sabha from the report of the Royal Commission and the Report of the Tariff Board, there is considerable divergence between the two; and we have no means to ascertain which accurately represent the position. We, therefore, feel that unless we have well shifted data on all these essential points, it is not possible to draw any general conclusions of a positive character.

49. The Mazdur Sabha's contention that wages have been cut down by 40 per cent. was based on the evidence presumably of a certain number of workers from some of the mills. In arriving at this conclusion the Mazdur Sabha did not, we believe, take into account certain important factors. We mean to cast no reflection by this remark on those responsible for the Mazdur Sabha's memorandum and in particular Mr. Shitla Prasad Saxena. In fact, against great odds, and with limited resources at their disposal, they were able to collect much data which have proved helpful. But it is of course likely that only those who had lost a portion of their earnings brought their grievances to the notice of the Sabha, while those who had either not had any cut in their wage or even had an increase did not bring this fact to their notice.

50. At the same time, it is not possible to accept the employers' statement that there has hardly been any drop in the wages between 1929 and 1937 in any category. It may be noted that while they attributed the apparent drop in wages to a reduction in working hours from 10 to 9 between these two years, in evidence most their representatives admitted before the Committee that the workers have been able to make good by approximately 5 per cent. in a large number of cases, due to increased efficiency whether of man or machine, or possibly both. It is clear that a fall of 5 to 6 per cent. must have taken place in the earnings of the piece-workers owing to the reduction of hours from 10 to 9 from 1935. We understand that in Bombay a proportionate compensation was given by the mill-owners in the wages of the piece-workers to make up for the fall in earnings; but so far as our information goes, no such increase seems to have taken place in Cawnpore.

51. A second point to be borne in mind is that the annual bonuses have not been included in the employers' figures. It is true that only a few mills pay these, and of course the employers contest the point that they are part of earnings. For that reason, while monthly bonuses have been taken into

account, annual bonuses have not. We have dealt with the question of annual bonus elsewhere. But for the worker a bonus is an addition to his earnings and for that reason welcome however the employer may regard it.

52. There is yet another point. It is admitted that with the coming into operation of the Payment of Wages Act, there has been a cut in the workers' earnings through increasing resort to suspension or forced leave of a fairly drastic character in some mills; also the payment of differential rates for so-called good, bad or indifferent work. We have condemned this practice in another chapter. Here it is sufficient to say that it has had the effect of lowering wages by an appreciable amount in the mills in which the practice has obtained. The employers' figures are all based on 26 days' full work in a month, making no allowance for leave, whether voluntary or forced, playing off, differential rates of payment, etc., all of which must reduce the actual figure considerably. Precisely by how much, we are unable to determine, without the total wages bill before us.

53. In the summary attached to their detailed wages statements they have shown the earnings per month in 31 different categories in 1929 and 1937 respectively. They have also worked out the earnings per hour in these two years and come to the conclusion that there has been a decrease in earnings (per hour) only in two categories and an increase in 28. But from the summary itself it is obvious that there has been a diminution in earnings on a monthly basis in 12 categories. To take a few instances, the average earnings per month of opener attendants dropped from 16.35 to 16.03; but according to the employers there was an increase of 8.94 per cent. in the earnings per hour. Again, in the case of Inter tenters, though there was a drop from 25.84 to 25.52, on the employers' calculation there was an increase by 9.75 per cent. Quite clearly, therefore, the millowners' contention cannot be accepted.

54. The difficulty of arriving at any conclusions on the general question whether there has been a rise or drop in wages may be illustrated from another point of view. Carding machine attendant's earnings have risen from 15.90 to 16.15, representing, on the employers' statement, an increase of 12.88 per cent. Actually, however, of a total number of 126 workers for whom comparative average earnings are given only 78 had an increase in wages while 46 had a decrease. It cannot be a source of satisfaction to these 46 that because of an increase in wages in some other mills for workers in the same department the general average wage-rate has risen. Again in the case of the spinning doffers, though the average details are given 256 had an increase and 209 a decrease in their earnings. Conversely, where there has been a decline in the average earnings it does not follow that every worker included in that category has suffered a decrease. There must be some who have earned an increase. For instance, the average earnings of Roving tenters, 487 in number, decreased from Rs.23.80 to Rs.21.69 but of these 239 got an increase and the rest a decrease. Again, the earnings of Grey winders (old type machines) declined from Rs.20.05 to Rs.19.92 but 206 out of 605 got an increase in their average earnings. It is seldom that one comes across in the statement instances of either a general rise or a general drop in wages in all the mills. Mention, however, may be made of Reelers whose average has dropped from 15.69 to 12.15 owing to a decrease of wages in practically all the mills, though even this has not been on a uniform basis.

55. An analysis of the wages statements is given as Table IX in regard to the 31 main categories.

TABLE IX
Earnings per month as between 1929 and 1937
A.—Decrease

Number	Designation	Number of men in 1937	Decrease in rupee	Percentage decrease
1	Opener attendants	71	0.33	2.0
2	Scutcher tenters	124	0.42	2.6
3	Lap carriers	94	0.28	1.8
4	Inter tenters	254	0.82	1.2
5	Roving	546	2.11	8.9
6	Doffers carding	591	0.61	5.1
7	Reelers	1,161	3.54	22.6
8	Grey winders (old type machine)	627	0.18	0.6
9	Grey winders (H. S.)	142	0.42	1.8
10	Warpers (O. T.)	124	2.12	5.8
11	Folders machine	118	0.88	5.4
12	Oil men	87	0.95	5.6

B.—Increase

Number	Designation	Men 1937	Increase in rupee	Percentage increase
1	Card machine attendants	190	0.25	1.6
2	Fly gatherers	46	0.10	0.6
3	Stippers and gros.	180	0.13	0.8
4	Drawing tenters	401	2.77	11.0
5	Slabbing tenters	152	1.82	4.8
6	Doffers spinning	790	0.15	1.2
7	Siders spinning	1,953	1.21	6.9
8	Doubling tenters	89	0.26	2.2
9	Warpers (H. S.)	8	21.28	55.4
10	Warping creelers	77	0.69	4.9
11	Front sizers	88	2.60	8.9
12	Back sizers	87	0.79	4.0
13	drawers-in	161	8.90	4.7
14	Reachers	172	1.00	7.9
15	Weavers	4,895	0.89	1.1
16	Folders hand	207	0.72	4.5
17	Sweepers (D)	128	0.69	5.5
18	Sweepers (compound)	112	0.04	0.3

56. These figures illustrate vividly the point to which we refer again in the chapter on standardization that there has never been any

attempt made in the past to bring about any standardization in wage-rates. They vary consequently in the most chaotic fashion. Lap carriers in some mills get over Rs.22, while in others they drop down to Rs.14 and even Rs.11-6. Similarly the wages of Carding machine attendants range from Rs.10-11 to Rs.22-8-6. Drawing tenters' wages range between Rs.14-12-3 and Rs.40-15-5. Slubbing tenters' wages vary between Rs.15-10-11 and Rs.43-6-8.* Those for Inter tenters range between Rs.12-15-8 and Rs.38-1-4. Roving tenters' wages range between Rs.13-15 and Rs.37-2-8. Grey winders' wages range between Rs.10-5 and Rs.27-0-6. The minimum and maximum for Warpners (old type machine) are Rs.21-6-7 and Rs.47-1 respectively. Drawers'-in-wages range between Rs.23-9-6 and Rs.43-14-5.

57. In regard to the wage rates prevalent for the same category of workers in the different mills, it is clear that some mills have carried out rationalization in certain departments. While the wages have remained stationary or even dropped in some mills, they have risen substantially in one or two with however an appreciable decrease in the number of workers employed. For instance, a mill which engaged 12 lap carriers on Rs.17-14 a month in 1931 had only 8 in 1937 on Rs.22-8-6 a month, the total wages bill being Rs.214-5 and Rs.180-25 respectively. The same results are perceptible in some other categories such as fly gatherers, strippers and grinders, roving tenters, etc. namely throwing a number of workers out of employment, increasing the wages of the rest, with obvious material advantage to the mill concerned.

58. To sum up therefore; it is impossible to answer with precision the question what wage cuts have taken place during the years 1929 to 1937 because the figures relate, as we have already said, only in the case of three mills to the earlier year and the statements of the employers, such as they are, have not been tested by cross-examination.

59. Having thus dealt with the question of wage cuts, we have now to consider whether according to our third term of reference there should be any increase in wages. But before we give our award in this connection, it is necessary that we should examine whether it is possible for the industry now to bear an additional burden. We have also to take into account the disparity in the wage levels between Cawnpore and other centres and its relation to the cost of living.

60. It is admitted that 1929 was a prosperous year. Since then the world has been in the throes of a depression. India too has suffered, though with a time lag. It is certain that its agriculture has had a severe set-back. The prices of most of the agricultural commodities declined as shown in the following table :

TABLE X
Index numbers of agricultural wholesale prices in the United Provinces
(1913=100)

Year							General Index number
1929	..	..	..	..	..	..	160
1930	..	..	..	..	..	..	114
1931	..	..	..	..	..	..	78
1932	..	..	..	..	..	..	85
1933	..	..	..	..	..	..	80
1934	..	..	..	..	..	..	77
1935	..	..	..	..	..	..	87
1936	..	..	..	..	..	..	82
1937	..	..	..	..	..	..	92

Can the industry bear an increase in wages.

Decline in the prices of agricultural commodities.

61. Due to this cataclysmic decline of agriculture prices the agriculturist's debt burden, and other fixed payment obligations, impoverished him considerably, and very greatly diminished his purchasing power. The Indian peasant after all is the most important buyer of the Indian cotton mills' products in the aggregate. For, as is well known, the great bulk, if not the whole amount of our mill production is consumed in the home market. Only about 2 to 3 per cent. of the total production finds foreign markets.

Its effect on textile industry counterbalanced by other factors.

62. This situation one might naturally have expected would have led to a deterioration of the Indian mills' position. Actually, however, for various reasons the Indian cotton mill industry made considerable progress. One important reason is the increasing efficiency in the methods of production. There has been a steady, almost rapid, decline of imports of cotton manufacture particularly from England. This decline of supply of yarn and piece-goods from abroad was made good by the Indian Cotton Mills manufacturers as would appear from the following table :

TABLE XI

Table showing the imports of piece-goods excluding Fents into India from the United Kingdom, Japan and other countries

(Quantity in millions of yards)

Year	United Kingdom	Japan	Total from all countries	Mill production in India
1929-30	1,236	563	1,802	2,419
1930-31	520	321	882	2,561
1931-32	376	340	753	2,990
1932-33	583	579	1,193	3,170
1933-34	415	341	761	2,945
1934-35	552	374	944	3,397
1935-36	440	496	947	3,571
1936-37	334	417	764	3,572

Expansion of the textile industry in Cawnpore.

63. It has to be stated that in this increased supply of cotton goods to the Indian market Cawnpore is rapidly increasing its share. The figures in the following tables XII to XIV, show without mistake that between the years 1929 to 1937 Cawnpore has gained much ground.

TABLE XII

Abstract statement of the quantity (in lb.) of yarn, spun and woven goods manufactured in India and the United Provinces

Description	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	Percentage increase in 1936-37 over 1928-29
1	2	3	4	5	6	7	8	9	10	11
Yarn (British India) ..	557,675,108	780,819,223	758,665,250	848,126,658	885,772,179	798,711,480	853,240,814	904,298,959	890,584,020	59·7
Do. United Provinces ..	60,328,887	76,456,492	85,049,826	89,781,242	98,129,775	98,865,084	99,701,805	108,020,179	115,002,739	90·6
Cloth (British India) ..	376,512,960	484,820,782	507,870,845	585,295,636	597,951,966	551,398,085	621,419,141	687,819,884	650,755,442	72·8
Do. United Provinces ..	25,698,080	30,339,280	38,954,485	36,369,851	41,466,090	47,410,399	54,385,840	53,789,915	62,922,007	144·9

TABLE XIII(a)
United Provinces Mill Industry

Year ending 31st August	Number of mills	Number of spindles installed	Average number of spindles at work daily	Number of looms installed	Average number of looms at work daily	Approximate quantity of cotton consumed in bales during the year	Average number of workers employed daily	Total number of days worked
1	2	3	4	5	6	7	8	9
1929	24	661,824	679,510	8,594	7,623	167,164	23,908	(a)
1930	24	668,788	614,308	8,961	8,151	199,768	25,133	281
1931	23	658,850	623,792	8,688	8,282	235,522	26,514	297
1932	22	654,504	626,919	8,811	8,278	251,820	26,687	270
1933	22	664,476	638,048	8,908	8,505	279,006	27,476	268
1934	22	689,614	615,741	9,172	8,491	280,520	27,286	272
1935	25	709,653	621,999	10,163	8,824	297,282	28,105	261
1936	25	734,664	664,769	10,784	9,914	319,740	30,113	273
1937	25	741,051	680,198	11,245	10,459	312,484	30,148	(a)
Percentage increase in 1937 over 1929..	4.2	12.0	17.4	30.8	37.2	86.9	25.6	..

(a) Not available.

(28)

TABLE XIII(b)

Detailed statement of the quantity (in million lb.) and the Counts of yarn spun in the United Provinces

Counts	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	Percentage increase in 1936-37 over 1928-29
1	2	3	4	5	6	7	8	9	10	11
18 to 10S	8,292,618	10,368,753	14,877,286	16,221,014	16,053,257	15,744,759	17,371,807	19,495,485	19,711,515	137.7
11S to 20S	37,884,652	50,110,855	52,588,036	53,858,366	54,686,534	53,018,393	53,154,692	53,180,155	53,186,756	56.2
21S to 30S	12,254,372	12,838,392	13,910,434	16,483,344	19,100,422	22,962,571	26,578,765	27,942,904	30,826,564	152.1
31S to 40S	1,843,700	1,819,189	1,998,270	1,805,079	1,971,395	861,848	724,561	1,347,893	2,210,293	116.0
Above 40S	426,282	1,124,824	1,042,908	1,199,335	1,045,924	983,748	956,459	224,793	42,195	-30.1
Waste etc.	126,718	145,649	182,447	159,104	272,381	348,720	415,001	329,608	2,255,411	1679.9
Grand Total ..	60,328,337	76,356,492	85,049,326	89,731,242	93,129,775	93,865,034	99,701,306	103,030,179	115,002,789	90.6

68)

TABLE XIII(c)

Statement of the quantity and description of woven goods manufactured in the United Provinces

Description	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	Percentage increase in 1936-37 over 1928-29
Ohaddars (yards)	2·6	2·4	3·2	4·2	2·8	5·6	3·6	3·08	4·0	48·1
Dhoties (yards)	52·06	64·05	69·5	86·7	102·2	112·7	127·3	119·85	133·8	107·0
Drills and Jeans (yards)	3·6	4·2	3·6	2·9	3·5	4·8	3·5	3·7	4·8	33·8
Gambrie and Lawns (yards)	·9	·2	2·0	1·7	·6	·39	·2	·1	·4	93·3
Printers (yards)	1·7	1·1	1·0	1·3	1·1	·7	3·1	2·47	4·3	152·9
Shistings and long cloth (yards)	9·7	12·4	13·9	9·2	9·3	12·9	14·3	16·8	27·4	182·5
T. cloth and sheetings (yards)	17·2	21·1	25·1	28·8	31·0	30·7	44·7	42·9	44·5	158·7
Tent cloth (yards)	1·8	1·4	·9	·6	1·1	1·5	1·2	1·4	2·8	55·6
Khaddar (yards)	·9	·8	1·5	·6	·6	1·5	1·1	1·6	1·8	100·0
Other sorts (yards)	2·1	1·9	1·7	2·1	2·5	2·5	1·6	3·2	3·2	52·4
Total (yards)	91·9	109·0	122·5	138·1	154·7	172·4	200·6	194·7	227·0	145·0
Coloured piece goods (yards)	6·9	8·9	7·5	6·08	8·2	8·4	9·2	9·7	10·0	44·9
Grey and coloured other than piece goods (lb.)	·6	·8	·8	·8	1·0	·8	·7	·9	1·0	66·7
Hosiery (lb.)	·06	·1	·1	·1	·1	·1	·2	·5	·6	900·0
Miscellaneous goods (lb.)	·07	·04	·2	·06	·04	·09	·07	·02	·05	-28·6
Mixed with wool and silk (lb.)	·002	·01	·03	·02	·00003	..	..	·000004	·000002	-99·9
GRAND TOTAL (YARDS)	98·8	117·9	130·0	144·2	162·9	180·8	209·8	204·4	237·0	139·9

N.B.—All figures are in millions.

TABLE XIV(a)

Abstract statement of progress of Cotton Mills in Cawnpore, United Provinces

Year ending 31st August	Number of mills	Number of spindles installed	Number of spindles working daily average	Number of looms installed	Average number of looms at work daily	Approximate quantity of cotton consumed in bales	Average number of workers employed	Average total number of days worked
1	2	3	4	5	6	7	8	9
1929	10	470,916	440,861	7,774	7,223	185,524	18,014	Not available.
1930	10	476,242	464,246	7,919	7,568	162,376	18,795	299
1931	10	478,946	446,968	7,882	7,525	155,676	19,568	298
1932	10	468,252	450,179	7,911	7,480	170,940	19,688	299
1933	10	475,828	465,749	7,980	7,646	192,714	20,285	274
1934	10	449,408	482,580	8,327	7,635	199,106	20,810	299
1935	13	529,087	465,188	9,286	8,019	218,602	21,152	304
1936	13	647,834	498,661	9,786	9,102	248,910	23,218	303
1937	13	554,225	513,719	10,257	9,746	244,840	23,627	298
Percentage increase in 1937 over 1929..	30·0	17·7	16·5	31·9	34·9	80·0	31·2	..

TABLE XIV (b)
Mill statement for India

Year ending 31st August	Number of mills	Number of spindles installed	Number of spindles at work daily	Number of looms installed	Number of looms at work daily	Average number of hands employed daily	Approximate no. of bales (3½ cwt.) of cotton consumed
1	2	3	4	5	6	7	8
1929	844	8,807,084	6,957,889	1174,922	133,882	946,925	2,161,166
1930	848	9,124,768	7,979,454	179,250	156,622	384,022	2,398,714
1931	889	9,811,953	8,098,714	182,429	157,609	395,475	2,638,176
1932	899	9,506,088	8,328,082	186,841	161,840	403,226	2,911,264
1933	844	9,571,668	8,202,149	189,040	162,818	400,003	2,837,158
1934	852	9,618,174	7,845,077	194,986	158,802	384,988	2,703,990
1935	865	9,68 ,775	8,441,464	198,567	174,114	414,884	3,128,414
1936	879	9,685,658	8,504,408	200,062	177,925	417,803	3,109,618
1937	870	9,742,798	8,458,001	197,810	177,111	418,386	3,156,380
Percentage increase in 1937 over 1929 ..	7.6*	10.6	21.5	18.1	32.8	20.6	48.0

*Excluding Burma.

64. It would appear that the quantity of woven goods in the United Provinces (millions of yards) rose from 98·8 in 1929 to 237·0 in 1937 (vide Table XIII). In other words, there was an increase of about 140 per cent. This compares very favourably indeed with the all-India increase between these years, from 3,419 to 3,572, or of about 47 per cent. The figures for Cawnpore alone are not available. But we have reasons to believe that it is responsible for the vast bulk of the woven goods produced in the United Provinces.

65. A study of the variations in the number of spindles and looms installed at Cawnpore shows that although there was a fall in the number of spindles between 1930 and 1934 by an average of 4·6 per cent. the deficiency was more than made up by 1937, when it rose by 17·7 per cent. as compared with the year 1929. The rise in the number of looms was 31·9 per cent. The corresponding rises for the rest of India in 1937 were 8·9 and 12·2 per cent. respectively.

66. The average numbers of working days in all the textile mills at Cawnpore between 1930 and 1937 were as follows :

Years							Average number of working days per year
1930	..	..	..	..	..	..	299
1931	..	..	..	..	..	..	293
1932	..	..	..	..	..	..	299
1933	..	..	..	..	..	..	274
1934	..	..	..	..	..	..	299
1935	..	..	..	..	..	..	304
1936	..	..	..	..	..	..	303·5
1937	..	..	..	..	..	..	298

The all-India average, excluding Cawnpore, for the year 1936 was 297. Thus there has been an increase in the number of working days by slightly more than 1 per cent. over 1930 and about 2 per cent. over the average of the rest of the country. The figure for 1937 has been affected by the strikes in that year and is, to that extent, uncomparable with the other figures.

67. Another clue to the expansion of the industry is provided by the figures of cotton consumption per year given in Table XIV. In this case an important consideration will be the counts of yarn spun. The spinning of finer counts might show a lower cotton consumption, even though the production actually goes up. From the evidence led before us we conclude that in the case of Cawnpore taking all the mills together, the tendency in recent years has on the whole been to go finer. One mill during the course of its evidence said that it had gone 17 counts finer. An increase of 80 per cent. in the quantity of cotton consumed may, therefore, mean a still higher percentage of increased production, due to the tendency of going in for finer counts.

68. The question now arises whether this expansion is an index of the prosperity of the industry. We are satisfied that the expansion is due to the industry attracting more capital on account of its prosperity; but we have to refute the likely contention that the position of the industry was so precarious that it was necessary to expand the existing plant or to work a longer number of hours per day in order to reduce the overhead charges per piece of cloth woven and thus to re-capture the market at depressed prices, or in other words, to recoup the losses by savings in the total cost of production. It would have been easy to find out the true position if detailed information regarding the profits and losses of the various mills had been available, but even in the absence of this information the position can be ascertained on the basis of circumstantial evidence and the implications of certain tendencies and facts which have struck us during the course of our inquiry.

Prosperity of the
cotton textile
industry in
Cawnpore.

69. The expansion of the industry began in 1935 when the process of economic recovery had begun and the price level was rising. If the industry had been expanded for meeting losses, expansion would have taken place during the period of acute depression. On the other hand, between 1930 and 1934 when the depression was deepening, the mills at Cawnpore acted in just the reverse way by following a policy of reducing the number of spindles, and looms in order to restrict production. This means that the mills tried to push up the prices by controlling the supply even at the cost of higher overhead charges per piece of cloth woven.

70. Then again, the expansion which began in 1935 did not mean an extension of the old plant only. As a matter of fact, some of the important mills, e.g. the Cawnpore Cotton Mills Co. Ltd. (Kakomi) and the Juggi Lal Kamlapat Cotton Spinning and Weaving Mills did not increase their spindles and looms at all; rather they reduced them to some extent. The Cawnpore Textiles Ltd. curtailed the number of their working spindles rather heavily. Further the expansion in the industry was not confined only to working double shifts instead of a single shift. If this was the only method of expansion it could be taken as a process of doubling the number of looms and the spindles. During the depression only a few mills worked double shifts. The fact is that as many as three new mills with a total spindlage of 49,600 and a total loomage of 803 were started during the period. The starting of new mills necessarily indicates attraction of new capital to the industry—most likely due to comparative advantage in investment. Coupled with this, the extension of the old plant and the additions to spindles and looms may also be taken to be further signs of prosperity in the industry which were visible at the beginning of the process of recovery.

71. In further support of our conclusion regarding the strength of the industry in Cawnpore, we now turn to such figures relating to profits as are available to us. A consolidated balance sheet covering eleven mills has been supplied to us by the Employers' Association. This is reproduced as Table XV. The figures have been certified by Messrs. Billimoria and Company, a firm of chartered accountants in Bombay and we have no hesitation in accepting them as correct. But the statement regarding the working results of the industry from the year 1929 to 1937 is not quite satisfactory, inasmuch as it does not give any information on the following points :

- (1) Depreciation Fund ;
- (2) Amounts borrowed to finance the block and the interest paid thereon ;
- (3) Remuneration paid to the agents as commission ;
- (4) Depreciation deducted.

Even so it is clear that the block accounts show a sliding rise, as also the Reserve Fund. This steady increase is, we consider, the result of greater prosperity.

Though the statement does not give information on all necessary points, it shows beyond doubt that the mills have all along been making decent profits.

The following figures show what return the trading profit and the dividend amounts distributed work out on the paid-up capital :

Name of year							Percentage of trading profit on paid up capital	Percentage of dividend on paid up capital
1929	..	..	..	..	..	..	7.59	4.85
1930	..	..	..	..	..	..	6.19	6.94
1931	..	..	..	..	..	..	8.06	6.51
1932	..	..	..	..	..	..	8.70	6.46
1933	..	..	..	..	..	..	4.92	5.79
1934	..	..	..	..	..	..	13.50	8.48
1935	..	..	..	..	..	..	8.11	6.78
1936	..	..	..	..	..	..	8.79	5.70
Average	..	..	..	..	..	..	8.2	6.43
Average of total trading profit on total of block and paid up capital for 8 years..							8.15	6.33

The above percentages mean, therefore, a fair return, considering the present money conditions and the general rate of interest now available to investors in sound and satisfactory concerns. It may not be irrelevant in this connection to compare the working results of the Cawnpore industry with the Bombay mills. The following figures show what return the trading surplus works out on paid-up capital and the block account in the two centres :

Paid up capital

Year	Bombay		Percentage	Cawnpore		Percentage
	Paid up capital (crores)	Trading surplus (lakhs)		Paid up capital	Trading surplus	
				Rs.	Rs.	
1931	19.16	148	11.22	2,25,25,980	18,16,261	8.06
1932	13.64	90	6.59	2,25,25,980	19,60,040	8.70
1933	11.60	50	4.31	2,25,25,480	11,09,851	4.92
1934	11.32	130	11.39	2,11,54,620	28,56,768	13.50
1935	11.78	85	7.21	2,11,79,620	17,19,526	8.11
1936	11.76	111	9.43	2,27,54,620	20,01,587	8.79
Totals	73.28	614	..	13,26,65,050	1,14,64,028	..
Average percentage	..	..	8.37	..	..	8.64

Even if the block account be taken into consideration the following table will show the comparative advantage of Cawnpore over Bombay :

Block account

Year	Bombay		Percentage	Cawnpore		Percentage
	Block account (crores)	Trading surplus (lakhs)		Block account	Trading surplus	
				Rs.	Rs.	
1931	36.25	148	4.08	4,77,41,580	18,16,261	3.80
1932	37.40	90	2.40	4,86,09,891	19,60,040	4.03
1933	30.71	50	1.62	4,96,00,488	11,09,851	2.26
1934	31.56	130	4.11	5,12,42,809	28,56,768	5.57
1935	31.28	85	2.71	5,39,79,181	17,19,526	3.18
1936	30.92	111	3.53	5,97,86,860	20,01,587	3.33
Totals	198.13	614	..	30,99,54,259	1,14,64,028	..

TABLE XV

Number of returns	Year	Paid up capital	Total, Block Account A	Reserve Fund	Trading Profit	Percentage of Trading Profit on Block	Total amount of dividend declared	Percentage of dividend paid on Block
1	2	3	4	5	6	7	8	9
		Rs.	Rs.	Rs.	Rs.		Rs.	
8	1929	3,25,26,215	4,60,73,998	75,86,000	24,70,189	5.36	15,78,500	8.42
8	1930	2,25,40,515	4,71,66,914	87,58,532	18,82,707	2.98	15,66,000	8.32
8B.	1931	2,25,25,380	4,77,41,580	96,78,592	18,16,261	3.80	14,66,690	8.07
8	1932	2,25,25,380	4,68,03,891	89,92,532	C 19,60,040	4.03	14,56,583	8.00
8	1933	2,25,25,430	4,66,00,488	92,30,014	11,09,851	2.26	13,05,500	2.68
8	1934	2,25,64,620	5,12,42,309	95,46,222	C 28,56,763	5.57	17,83,856	8.48
8	1935	2,11,79,620	5,39,79,161	98,69,887	C 17,19,526	3.18	14,37,733	2.66
11	1936	2,27,54,620	5,97,86,860	1,01,83,940	20,01,587	3.38	12,98,565	2.18

NOTE—A. Total Block Account does not include amounts written off under Capital Reduction Schemes.

B. Further Reduction in Capital due to surrender of shares.

C. Profit on Investments is included in the amount of Trading Profits, as these amounts were used for paying dividend.

1932	1934	1935
Rs. 2,05,908	Rs. 60,316	Rs. 1,38,108

72. We have worked out the figure of trading profits and dividends on the paid up capital rather than on the undepreciated block, because allowances must in fairness be made for the interest or the remuneration earned on the use of the depreciation, reserve and other funds and also for provision in the normal profit and loss account on borrowed loans, if any. These factors have been accorded due weight, we observe, also by the Bombay Labour Enquiry Committee, (vide para. 83, interim report). Money conditions, as pointed out by that Committee, are much easier today than they were two or three years ago when the Special Tariff Board considered a 6 per cent. return on the total fixed capital as a fair one; the bank rate is lower today and there is greater willingness on the part of the investor to come forward in support of industrial enterprise.

73. While the working results of the mills in Cawnpore show a fairly satisfactory position over a series of years, we may now examine the improvement that has taken place particularly during the course of the last six months. As we have no statement regarding the working results of the mills during the year 1937, we can only fall back on the general conditions prevalent in the trade to form an idea of the improvement that has taken place. Generally speaking the prices of cloth, on the one hand, and of cotton, on the other, give a fair indication of the measure of profits in the textile industry, as the other conditions ordinarily remain more or less stationary. If we follow the trend of prices of these in 1937, it will be found that there has been a very heavy fall in the prices of cotton during the year, synchronizing with a slight rise in cloth prices in Cawnpore; and this has helped to widen the margin of profit to a very considerable extent. It is not possible to make any exact calculation regarding the extent to which the margin has increased; but some estimate may be formed of the consequence of this fall in the price of cotton.

74. The Cawnpore mills consume largely "Bengal" and "Punjab American" cottons. The prices of this variety of cotton together with the prices of cloth during the year 1937 and the beginning of the current year are given below :

Month	Prices of cotton (per maund)	Price of cloth	
		*Sheetings per yard	*Dhotis per pair
1937			
	Rs. a.	a. p.	Rs. a p.
January	20 0	5 8	1 9 6
February	17 12	5 8	1 8 6
March	17 8	5 8	1 8 6
April	16 4	5 8	1 9 3
May	15 12	5 8	1 9 0
June	15 12	5 8	1 9 0
July	15 12	5 8	1 9 0
August	16 0	5 8	1 9 0
September	15 12	From 8th " 23th	5 10 6 0
October	18 8	6 0	1 9 0
November	18 2	6 0	1 9 0
December	18 2	6 0	1 9 6
1938			
January	18 0	6 0	1 9 9
February	18 0	6 0	..
March	11 8	6 0	..

*These figures relate to standard Muir Mill sheetings and Dhoties and have been obtained through the Upper India Chamber of Commerce.

The above figures show that cotton prices came down from Rs.20 per maund in January, 1937 to Rs.13-2 in December, 1937. This latter price which remained practically stationary until February this year, has dropped to Rs.11-3 in March. If we compare the average of cotton prices for the first quarter with that of the last quarter of 1937, we find that the fall works out at 28 per cent. The effect of this variation on the profit margin will be better understood if we compare the cost of the total cotton consumed in a year by the Cawnpore mills at prices ruling in the first quarter of 1937 with those at prices prevailing during the last quarter. The total cotton consumed by the Cawnpore mills during 1937 comes to 244,340 bales. It is safe to say therefore that the profits made on this score must be substantial.

75. In this connection, it was argued before us that the price of cotton must be a variable factor and that the present rates cannot last indefinitely; conversely, it was pointed out that if they should continue to rule low, prices of cloth must come down in sympathy with those of raw cotton and a substantial part of the advantage passed on to the consumer. Moreover, low prices for cotton must sooner or later affect the purchasing power of the agriculturist and thus lead to a slackened demand for cloth. We do not deny the force of these arguments. At the same time, the facts of the present situation are incontrovertible. Despite the low prices of cotton which have been prevalent for several months, the prices of cloth have shown no tendency to drop; nor is there evidence to show that the demand for cloth is slackening. So far at any rate the mill-owners have had practically the full benefit of this favourable factor. The question is whether it is likely to undergo any sudden or considerable change in the near future. The difficulties of our exporters of cotton to Japan have been accentuated in recent weeks, and it is considered most likely that Japan, our biggest buyer, will absorb the normal quantity. So far as Lancashire, our next most important customer, is concerned, it is equally doubtful whether she will increase her quota so long as she can obtain American cotton at more favourable prices. We note that the Bombay Labour Enquiry Committee, after a study of all the relevant factors, has come to the conclusion that the average price level for Indian cottons during the current year will continue to be lower than it has been for some time. We are satisfied having regard to all aspects of this question that the industry can well afford to meet the extra cost involved in giving effect to our recommendations.

Cawnpore and
Bombay wage
levels compared.

76. As regards the disparities in the wages prevailing in Cawnpore and other places particularly Bombay and Ahmedabad which are the leading industrial centres, a pointed reference has been made in the memorandum of the Mazdur Sabha which we have already noticed in paras. 27 to 35. Even allowing for the fact that the figures given in Tables I, II, and IV are not the latest and in several cases also liable to error, the broad fact remains that the Cawnpore wage level is far lower than that of Bombay and Ahmedabad. In the following Table no. XVI, an attempt has been made to compare the latest available Bombay figures with the Cawnpore figures of 1937 in respect of 31 categories to which we have confined our detailed examination. The Bombay figures have been taken from the General Wages Census Report of 1934, and are weighted averages, as in the case of Cawnpore. Figures of a later period are not available for all categories. Daily wages have been converted into monthly by multiplying by 26 for the sake of comparison. It should, however, be pointed out that in 1934 the Bombay mill industry was working 10 hours a day and this factor should be allowed for in making the comparison.

TABLE XVI

Comparative statement of wages of selected categories in Bombay and Cawnpore Cotton Mills

No.	Name of occupation	Average earning per month of 26 working days in Rs.		Percentage increase or decrease of Bombay wages over Cawnpore wages
		Bombay, 1934	Cawnpore, 1937	
1	Opener attendants	21.2	16.03	+32
2	Scutcher „	21.0	15.7	+34
3	Lap Carriers	20.8	16.92	+22
4	Card Machine Tenters	19.6	16.15	+22
5	Fly Gatherers	19.8	17.41	+14
6	Strippers and Grinders	23.8	16.59	+43
7	Drawing Tenters	26.0	28.0	-7
8	Slubbing „	29.2	29.07	+0.5
9	Outer „	27.7	25.52	+8
10	Roving	26.2	21.69	+22
11	Dollers Carding	17.8	11.45	+54
12	„ Spinning .. .. .	..	12.68	..
13	Siders	22.0	18.84	+17
14	Doubling Tenters .. .. .	..	17.10	..
15	Reelers	16.6	12.15	+36
16	Grey Winders (O. T.)	18.2	19.92	-19
17	„ „ (H. S.) .. .. .	..	22.76	..
18	Warpers (O. T.)	44.6	39.05	+18
19	„ (H. S.) .. .. .	..	59.68	..
20	Warping Creelers	17.85	14.83	+20
21	Front Sizers	68.0	31.8	+115
22	Back „	84.4	20.61	+66
23	Drawers-in	42.5	30.47	+38.7
24	Reachers	22.3	13.65	+68.0
25	Weavers	35.8	37.07	-7
26	Folders Machine .. .. .	..	15.15	..
27	„ Hand	21.3	16.58	+29
28	Coolies .. .. .	..	..	..
29	Oilmen	25.5	16.07	+58
30	Sweeper (inside)	17.4	13.33	+32
31	Sweeper (outside) .. .. .	..	12.44	..

77. The differences thus disclosed are too glaring to escape attention. It is not possible for us to say what part of the difference should be attributed to factors such as greater efficiency, higher cost of living and finer counts in Bombay. Generally speaking, however, it appears to us that these causes cannot explain or justify the whole of the difference. These disparities will be further accentuated as a result of the recommendations contained in the interim report of the Bombay Textile Enquiry Committee which we gather have been accepted by the Bombay millowners. They will push up the general wage level in Bombay by about 12 per cent.

Rise in wages
justifiable.

78. Relying on such data as we have and which we have indicated we are of the opinion that the industry in Cawnpore is in a strong and healthy position, and it is possible to attempt a reduction in the difference between the Bombay and Cawnpore wage levels. It would, therefore, be justifiable to suggest that a rise in wages should be given to all the workers engaged in the industry. If our analysis of the situation is at all correct, the comparative position of the industry as between 1929 and 1937, we believe, justifies us in making this call upon the industry.

Our proposals.

79. Our proposal is that for the purpose of giving increments in wages the workers should be divided into the following five wage groups and given increases as indicated against each.

Wage groups	Increases
I—Between Rs.13 and Rs.19 ..	2½ annas in the rupee, subject to the condition that no one gets more than Rs.21-8.
II—Between Rs.19 and Rs.25 ..	2 annas in the rupee subject to the condition that no one gets more than Rs.27-8.
III—Between Rs.25 and Rs.32-8 ..	1½ annas in the rupee subject to the condition that no one gets more than Rs.35.
IV—Between Rs.32-8 and 40 ..	1 anna in the rupee subject to the condition that no one gets more than Rs.41-8.
V—Between Rs.40 and Rs.50 ..	½ anna in the rupee subject to the condition that no one gets more than Rs.60-8.

We would add that the cases of those workers who are receiving less than Rs.13 are dealt with separately in the next chapter.

80. Further we recommend that all time-workers wherever they are on a daily basis should be put on a monthly basis. In 1929 the monthly basis was the usual rule and we do not see why that salutary practice should not be reverted to. The conversion of a monthly rate into a daily one on the basis of a 26 day month not only deprives the workers of the wages during the holidays, but in effect reduces their earnings because it is not often that a mill works for full 26 days.

Effect of our
proposals.

81. On a rough calculation we believe that these proposals will raise the general wage level in Cawnpore by between 10 and 12 per cent. and their effect therefore will be to prevent the disparity between Bombay and Ahmedabad on the one hand and Cawnpore on the other being further widened in consequence of the interim recommendations of the Bombay Enquiry Committee (1938). They will leave unimpaired the comparative advantages which Cawnpore enjoys over Bombay and Ahmedabad.

Relation of cost of
living to our wage
proposal.

82. We have to recognize the fact that both the employers as well as the Mazdur Sabha agree that there has been a reduction in the cost of living as between 1929 and 1937. In the subsequent statements made in the course of evidence there was considerable agreement between the employers and the Mazdur Sabha on this point. There are, however, certain considerations which we would urge in applying the principle of lower cost of living to the determination of wages. We deal in the succeeding chapter with the question of the minimum wage which cannot properly be fixed without relation to the cost of living. But no one will dispute the point that the lower paid workers who form such a large proportion of the total number do not get a living wage. To the extent, therefore, that the cost of living dropped during the years of the depression they were able to approximate towards standards compatible with a living wage. The cost of living theory cannot have in reality valid application to those classes of workers whose wages are below a living wage

level. Our wage increment proposal will mean a definite betterment in the standard of living of the worker over the 1929 level. Present prices have not caught up to the 1929 point though they show a distinct trend towards a rise.

We have no desire to see the men wedded for all time to a given standard of the past, even if it be that of 1929. A progressively rising standard is desirable. For eventually this must lead to a general promotion in their efficiency. We could suggest a rise in wages, adjustable to the difference between the cost of living between the two years. We, however, refrain from taking this course. The one reason is given above, namely, we do not desire to see the workers fixed to a given level permanently. The other reason is that we cannot depend too surely on the reliability of the cost of living index supplied.

83. Regarding bonuses the employers contended that these are *ex gratia* Bonuses. payments and the workers cannot make any claim to them. However, if bonuses have been paid for considerable periods, they increase earnings to that extent, and thereby help workers to reach a particular standard of living. Workers soon become accustomed to such a standard, so that when employers, however justifiably from their point of view, withdraw these bonuses, or effect reduction in the rates, the workers feel it immediately. Obviously, they dislike the idea of a lowering of their standard of living. Our idea is that wherever the bonuses are of a monthly character, they should be incorporated with the wages. Wherever the bonuses have been of an annual nature, they should be converted into profit sharing schemes.

84. We have, however, one exception to our general rule in this connection. This is in regard to the bonus given to compensate for the high cost of living, whenever prices tend to go up as compared with some basic year. There should be a sliding scale arrangement in this connection, agreed upon between the employers and the representative of the Mazdur Sabha. Given a reliable cost of living index series, which we propose should be maintained by the Labour Office, the adjustment of wages should become almost automatic for a given rise or fall in the index number.

85. In order that this arrangement should function smoothly we propose a Wage Fixation Board. This should be constituted and function somewhat on the lines of the British Trade Boards. It may consist merely of employers' and workers' representatives, with their own chairman. Or they may have neutral chairman, the Commissioner of Labour for instance. Such machinery would prove, we believe, highly useful. Wage troubles are likely to crop up. The cotton industry is not a static industry. We are anxious to provide all means possible to adjust factors liable to lead to industrial strife. We consider none of greater importance than machinery for the adjustment of the wages.

CHAPTER III

MINIMUM WAGE

The principle of the minimum wage.

86. The principle of the minimum wage has now been accepted as being reasonable, fair and necessary in almost all advanced modern nations. Starting from the British colonies, it spread to England, the Continent and now is found to be on the Statute books of both the old and the new world countries. It is not necessary to elaborate either its history or its significance, fascinating though such a task would be in itself. Abundant literature is available on the subject and students may refer to that for further knowledge. The principle of the minimum simply stated is to guarantee to the worker a living wage.

The principle accepted by the Employers' Association, but certain conditions demanded.

87. We are happy to acknowledge that the employers have accepted the principle of the minimum wage. In their answer to question no. 12, they say—

“The Association see no objection to minimum rate of wages being fixed for factory adult labour, provided that under no circumstances should the standard of minimum rate of wage be so fixed that the textile industry of the United Provinces would be unduly handicapped in competition with the textile industry in other centres. It is not feasible to deal with a minimum wage for one industry without considering the possibilities of a minimum wage for all industries. Moreover, the establishment of a minimum wage would involve taking evidence about whole of India's economic activity and the Central Government's fiscal policy.”

It is therefore in its practical application rather than in its intrinsic principle that the employers apprehend several difficulties.

Danger of selecting a single industry.

88. For instance, it is not without justification that the employers state that it would be unfair to single out any one industry for the imposing of this piece of legislation. It would impose a burden upon it, not borne by other industries. It would be an act of discrimination against it. It would, therefore, lead to the flow of resources away from it, into other industries presumably not so worth while in themselves. This deflection would be artificial and to that extent may injure the national dividend. Theoretically speaking, this objection against the introduction of the minimum wage principle is correct. Marginal productivity is a guiding principle which cannot safely be abandoned in the gainful employment of the agents of production. Yet a judicious interference may, from the long period point of view, be actually more beneficial than it appears to be from the short period standpoint. It is practically due to such consideration, that either protection or subsidy or some aid is given by the State to particular industries. Such deliberate interference with the economic laws of supply and demand is regarded as necessary and worthwhile from the long range point of view. People in the cotton industry should not find it difficult to grasp the implications of such action.

Desirability of all-India action.

89. We appreciate, however, the force of the contention of the employers that it should be promulgated as an all-India piece of legislation. This is sound in principle. Otherwise, fear of inter-provincial and Indian States competition, would emerge as a stern reality in the disposal of Cawnpore products. Already industry is migrating into Indian States in consequence of the progressive labour legislation which is being adopted in the British

Provinces in the country. The injury of such a geographically localized legislation has to be taken into due consideration. Also, the factor of foreign competition cannot be overlooked. The labour costs of production in the Indian cotton industry are phenomenally high per 1,000 spindles or per 100 looms. We, therefore, have to be careful in adding to the burden of this, our leading industry in the country. We are, however, confident that our suggestion in this regard will not be burdensome. If anything it will tone up the industry in Cawnpore.

90. In fixing a minimum wage, we have necessarily to take the cost of living into consideration. We have to determine the standard. This is not an easy matter. Physiological, social and environmental elements of the problem have all to be carefully examined. Data have to be collected. Family budgets have to be obtained, studied and analysed. The requisite items have to be selected with care, and accurately weighted, quantitatively and qualitatively. All this work of a high order, requiring patience, precision and understanding of the classes on whose behalf the cost of living is being determined. The family unit itself has to be defined and fixed. In the Indian social system this is not a matter of easy achievement. Traditions and social usages of the peoples have to be respected and duly appraised.

The standard of living-difficulty of determination.

91. Another important factor that has to be considered is the prevailing rates of wages in similar occupations, or the general wage rate in the neighbourhood. In this connection the background of rural conditions and the prevalent wage-rate for the agricultural labourer cannot be kept out of mind, especially when it is recognized that the bulk of the textile mill workers come from the agricultural classes. Then, the many trades and occupations in the city, including, for instance, wages given to municipal and domestic servants, cannot be overlooked. The manual worker toiling in the street, pushing a hand-cart, or lifting heavy burdens in the bazaar, has to be kept in mind. All these are considerations that are relevant to the question.

Wages in other occupations.

92. There is one consideration, however, of a different nature which has caused us much uncertainty. It is this. We cannot overlook the fact that in most countries, where minimum wage legislation has been introduced, it has been in regard to minor trades and occupations. Major industries, except under special circumstances and considerations, for instance, the coal trade in Great Britain—have not been brought under the action of such legislative measures. Big industries have evolved their own guarantees. Labour, through its own organized strength, has secured for itself terms which protect it adequately, including a basic minimum wage. They have not resorted to State assistance in this connection. By their inherent strength, with admirable perseverance, through the process of collective bargaining, they have carved out for themselves this protection, with the full recognition and agreement of their employers.

Minimum wage legislation usually applied to minor trades.

93. If conditions were not abnormal and other factors were equally helpful, as for instance public policy regarding the provision of education, health and other matters, we would be very greatly inclined to leave the large industries, the cotton industry in particular, to settle the question for itself. We cannot help feeling that in the long run, this would be the very best procedure to adopt in the interest of textile labour itself. But, reviewing affairs as a whole we feel that our proposal for a minimum wage for the cotton industry is desirable. We are impressed with the thought that our proposal will benefit particularly those categories of workers in the cotton industry who are the lowest paid and the least vocal in Union activities. Hence we feel

Our view.

justified in recommending a minimum which we know will help these low paid categories of workers.

Need of a minimum wage to other trades and occupations in Cawnpore.

94. There is another aspect of the proposition which weighs with us. While we have confined ourselves exclusively to the cotton mill workers, we were nevertheless styled the Labour Enquiry Committee. We actually received requests from other grades of labour, for instance the depressed class workers, to take up the inquiry of their conditions of work and wages. The scavengers too desired that their wages and conditions of work should be investigated. It is probably true that the cotton operatives, comparatively speaking, are well off. Certain categories amongst the cotton workers, particularly the weavers, are definitely better off, in every way, than low-paid clerks, *muneems*, shop-assistants, and ill-paid municipal or district board school-masters and school-mistresses. It is well to recognize these facts. Other categories of workers, and probably no one more than the general labourer, man and woman, need far greater consideration and protection. But it was impossible, under the circumstances in which we were placed, to undertake such an inquiry, however desirable it may have been in itself. We are glad to note that the labour leaders in Cawnpore are alive to this aspect of the labour question. They are increasingly bending their energies in this direction. We feel that in accepting the minimum wage principle and in prescribing a figure, we shall be able to bear indirectly at any rate, on the wages rate in other ill-organized and low-paid trades and occupations. We are not very hopeful about the wage rate for the class of the general labourer. His wage is related to the wage rate of the landless agricultural worker in the country-side. It is only when general economic conditions improve, will his wage also increase. The population factor looms large in this consideration. It is inescapable.

Decent standard essential for children—the future generation.

95. We must state it frankly that we desire to see our workers living a decent and self-respecting life. We wish them to be adequately housed, cleanly clad, and sufficiently fed. We desire their children to be well-nourished, well-cared for, and sufficiently educated, to grow up to be efficient workmen and workwomen, and enlightened and responsible citizens. We realize how stunted, cribbed and confined is their present existence. For instance, even the budget estimate that has been prepared by the Mazdur Sabha does not include the item of milk. How essential milk is for little children and nursing mothers, and the sick and suffering, is too obvious to require emphasis. For a people who are mostly vegetarian, the need for milk is even greater. Yet this item is not included in the budget estimates either by the workers or by the employers.

Indebtedness.

96. There is another aspect of the worker's economic situation which has been neglected. It is the fact of his indebtedness. The indebtedness of the workers is proverbial. It is one of the largest single causes of their depressed economic condition. But no item towards interest payment as a cost in the items of expenditure in the workers' budget has been included. For several reasons this exclusion is correct. Yet it is an expenditure that weighs heavily upon the worker. It is not possible for him to escape it, especially if he has had the misfortune to contract that debt from that sturdy fellow the Kabuli. For he is a moneylender and liquidator combined, thanks to his invincible *lathi*! But be it recorded to the honour of the worker that he has no intentions of defaulting. Debt repudiation is not in his line. This faithful repayment of debt, interest and compound interest, was a fact which amazed and elicited the admiration of the foreign experts on the Central Banking Enquiry Committee. We cannot analyze here the causes

for which a large portion of these debts are incurred. However, it cannot be gain-said that partly these debts are incurred for meeting the bare needs of life. This is especially true when sickness intervenes, as it must in a sub-tropical province like ours and when the principal bread-winner is himself sick, and all income stops immediately. He has next to no savings to fall back upon, except perhaps his wife's few pieces of jewellery, for which again by the way we see no item of expenditure entered in the budgets submitted to us. It is unlikely that he will be a member of a Co-operative Society. So the incurring of debt becomes a matter of dire necessity. The stark possibility of starvation faces the worker and his family.

97. Workers reduced to such a situation cannot but view with bitterness the entire arrangement of things. Little wonder that pictures of a different type of civilization, which they are informed is a reality, and not a mere Utopian dream, have such an irresistible fascination and attraction for them. If they can bring about such a change, which they are taught they can, if they only "will", they are prepared to face untold hardships, even worse, if need be. This situation we are convinced is not a mere creation of our academic imagination. We have been sufficiently long in Cawnpore, in raw personal touch with the workers, to see that this type of mentality has been fostered and engendered amongst them with zeal and tireless energy.

98. Be this as it may, we are not in a position to recommend a minimum of the magnitude indicated in the Mazdur Sabha memorandum, i.e. Rs.33-4-10 or even the figure of Rs.25 indicated by its President in the course of his evidence upon this matter. Such a figure would require, definitely, all-India deliberation, and much comprehensive calculation of a number of factors. Also we may indicate that a number of very powerful, prosperous and wealthy countries, like the United States, England, or Japan have not fixed such minimum wage exclusively on the basis of cost of living. The principle of what the industry can reasonably be expected to bear, is the method employed fixing the figure. We ourselves therefore cannot go beyond this method. Nearer home, we find that the Bombay Committee (Interim Report, 1937-38) have fixed Rs.15-8 as the upper limit for the lowest paid categories of workers in the cotton industry. We, therefore, suggest Rs.15 as the minimum. We suggest this figure as the minimum in the cotton and woollen industry in Cawnpore. No adult male worker should receive less than this amount reckoned either on a daily or monthly basis, except those who cannot reach the minimum standard of efficiency on account of old age or infirmity.

99. It is not necessary for us to point out that to safeguard the value of our minimum wage rate per month, there will have to be the apparatus of the cost of living index number. For it is in terms of real wages that we wish to relate the money wages of the workers. The sliding scale system will have to be recognized and operated upon. For this purpose mutual co-operation between the employers and workers will have to be brought into play. The wage fixation machinery we have suggested elsewhere will have to function in connection with this matter also.

100. We desire to point out that the minimum we suggest is not to be regarded as the minimum for all time. Examination of the question, seven yearly or ten-yearly, may warrant revision of the minimum. Workers are entitled to an increasing share in the good things of life. Less disparity is the only sure guarantee of civic security.

CHAPTER IV

STANDARDIZATION OF WAGES

Existing
disparities in
allocation of work
and wages.

101. We have been struck by the wide disparities both in regard to the nature of work entrusted to an operative having the same occupational designation and his earnings in the different mills. The various mill managements have supplied us with statements of average earnings of the workers in some of the principal occupations in their mills. They are not strictly comparable in the absence of detailed information regarding the allocation of work. But they conclusively establish the facts that no attempt has hitherto been made to fix any wage standards for the various occupations, and that the existing disparities cannot be explained on any rational basis. In the following table the data supplied by the various mills have been tabulated for four important occupations in which a large number of operatives are engaged.

Frequency table showing the range of variation in the earnings of operatives in four occupations in Cotton Mills in Cawnpore in 1937

Average earning per month of 26 working days		Number of mills in which the average earnings are as per column (1)			
		(a) Roving tenters	(b) Ring siders	(c) Grey winders, old type	(d) Two loom weavers
Below	Rs.15 ..	1	2	2	..
Between	15 to 17 ..	..	..	1	..
Do.	17 to 19 ..	1	2	1	..
Do.	19 to 21 ..	3	4	3	..
Do.	21 to 23 ..	1	1	..	1
Do.	23 to 25 ..	2	1	2	..
Do.	25 to 27 ..	2	..	..	1
Do.	27 to 29 ..	..	..	1	..
Do.	29 to 31 ..	..	..	..	..
Do.	31 to 33 ..	..	..	..	..
Do.	33 to 35 ..	..	..	..	1
Do.	35 to 37 ..	..	..	..	3
Do.	37 to 39 ..	1	..	..	3
Do.	39 to 41 ..	..	..	..	1
Do.	41 to 43 ..	..	..	..	..
Variation from	Variation from	Variation from	Variation from		
Rs.13 15 0 to	Rs.12 6 0 to	Rs.10 5 0 to	Rs.22 14 0 to		
Rs.37 2 8	Rs.23 10 0	Rs.27 0 6	Rs.39 12 0		

Necessity for a
uniform system of
wage
determination.

102. It will be noticed that the variations are of a magnitude which cannot be overlooked. We can understand that there are bound to be certain variations in earnings between the workers in the same occupations from mill to mill on account of variations in type of and conditions of machinery, material, working conditions, character of goods and the efficiency of workers. But the disparities disclosed are too big to be accounted for by all these

reasons. They can only be due to the lack of uniformity in the system prevailing in the various mills for determination of wages. In our opinion, such wide disparities in wages paid to workers in similar occupations are sources of discontent and endanger peace in industry. We would therefore urge on the Employers' Association the immediate need of their carefully examining the wages paid for different occupations in the different mills and evolving a uniform system of wage determination suitable for the textile industry of Cawnpore.

103. Such a work would necessarily involve the preliminary work of fixing standard names for various occupations. What we find at present is that the workers designated by the same name have different duties in different mills. It is obvious that before any uniform system of wage determination can be evolved for the industry as a whole, the nomenclatures for various occupations must first be standardized. The drawing up of standard designations must therefore be taken up as soon as possible. It is quite probable that the attempt to do so may arouse the suspicion of the workers, particularly when some readjustment of duties is involved. We therefore consider that the Employers' Association will be well advised to consult and enlist the co-operation of the Government Textile Expert and the representatives of Labour before they finally draw up a list. We suggest that they should appoint a technical committee for this purpose.

Standard designations for various occupations.

104. As regards the actual standardization of wage rates, we are aware that there are numerous difficulties. But we find that a standardization scheme was prepared by the Bombay Millowners' Association in June, 1928, vide Appendix VIII on pages 202 to 235 of the Report of the Bombay Strike Enquiry Committee, Vol. I. This scheme was discussed by that committee and their recommendations with regard to it are contained in para. 197 on page 94 of the report. We understand, however, that the Bombay Millowners' Association has adopted a standard wage list for time-rate occupations only. It may not be possible immediately to lay down standard rates providing for automatic adjustments for every conceivable variety of work, but we are inclined to believe that progress in certain directions is certainly possible. Representatives of some of the mills examined by us admitted the desirability of the levelling up of wages.

Standardization of wage rates.

105. So far as the time-workers are concerned, we do not think that there should be any insuperable difficulty. Once standard designations for the various classes of time-workers and the duties attaching to those designations have been determined it should be possible to lay down standard rates of their wages. In the case of the piece-rate workers, the system to be evolved will have to allow for variations in production arising out of maladjustment of speed, variations in quality of material and working conditions. The view of the Employers' Association is that the fixing up of standard rates for piece-rate workers is too technical to be practicable. But the present system (if it can be called a system at all), according to which the rates for piece-workers are so adjusted as to limit the maximum earnings of the operative, is, in our opinion, certainly wrong. Though the employers representatives denied the application of any such limit it was clear from the evidence that a limit arbitrarily fixed is in operation. The rates must be so fixed that an average worker should be enabled to earn an average earning for a particular occupation at a reasonable standard of efficiency, while no arbitrary limit should be imposed on his earnings which result from his greater efficiency. The system should be so designed that it encourages him to increase his efficiency and earn a higher wage. One of the mills did evolve

a system of automatic adjustment in wages in their spinning department which made allowances for variations in quality of output due to changes in twist inserted in yarn and changes in working conditions. We consider this to be a commendable effort, but we were told that the workers were opposed to it as they did not understand its principles and the management had therefore decided to revert to the old system which provides no stimulus for increased efficiency or adjustments for changes in quality, etc. On a personal inquiry of the case from some of the workers of the mill we found, however, that their dislike was not based so much on their inability to understand the system, as on the basic rates being fixed at such a low level that the actual average earnings fell short of the earnings of workers on the old system. The representatives of the Mazdur Sabha have urged the desirability of introducing a system of wage determination for piece-workers which would take variable factors of work into consideration. While, as we have said above, we realize the technical difficulties involved, we do not regard them as insuperable. Even if a uniform rates list cannot be laid down for the industry as a whole immediately, standard rates can certainly be laid down to start with by individual mills for themselves which will provide for automatic adjustment on the introduction of new varieties. Variable factors from mill to mill may be many and of considerable diversity, but the limits of variations in a given mill can be laid down with sufficient precision.

Standardization of wages.

106. It has been suggested to us that, instead of considering the determination of standard rates, we should aim at the determination of standard wages. That is to say, the actual earning of an operative in the various mills should be compared occupation by occupation and where the earnings in a certain mill is below the average of the industry as a whole, an effort should be made to pull up the average of that mill by inducing it to enhance either its rates, or its efficiency. This is no doubt possible and may have the result of increasing the earnings of the under-paid operatives. But mere standardization of wages (as distinguished from rates) cannot provide the stimulus which is necessary for a workman to increase his efficiency. The only sound method, in our opinion, is to standardize the rates which will enable an operative to earn according to his efficiency without any arbitrary limitations.

CHAPTER V

RATIONALIZATION

107. The movement towards rationalization has been one of the most important features of industry throughout the world in the post-war period. According to the International Labour Office, Geneva, rationalization means "the methods of technique and of organization designed to secure the minimum waste of either effort or material. It includes the scientific organization of labour, standardization both of material and of products, simplification of processes and improvements in the system of transport and marketing." The International Economic Conference which met at Geneva in May, 1927, passed a number of resolutions on the subject of which, for our purpose, the following is important :

What is rationalization?

"The Conference considers that one of the principal means of increasing output, improving conditions of labour and reducing costs of production is to be found in the rational organization of production and distribution. The Conference considers that such rationalization aims simultaneously—

(1) at securing the maximum efficiency of labour with the minimum of effort;

(2) at facilitating by a reduction in the variety of patterns (where such variety offers no obvious advantage), the design, manufacture, use and replacement of standardized parts;

(3) at avoiding waste of raw materials and power;

(4) at simplifying the distribution of goods; and

(5) at avoiding in distribution unnecessary transport, burdensome financial charges and the useless interposition of middlemen.

Its judicious and constant application is calculated to secure—

(1) to the community, greater stability and a higher standard in the conditions of life;

(2) to the consumer, lower prices and goods more carefully adapted to general requirements; and

(3) to the various classes of producers, higher and steadier remuneration to be equitably distributed among them.

It must be applied with the care which is necessary in order while at the same time continuing the process of rationalization, not to injure the legitimate interest of the workers and suitable measures should be provided for cases where during the first stage of its realization it may result in loss of employment or more arduous work.

It requires further, as far as regards the organization of labour in the strict sense of the term, the co-operation of the employees and the assistance of trade and industrial organizations and of scientific and technical experts.

108. It will therefore be seen that rationalization covers every aspect of industry, on the manufacturing, the selling and the distribution sides. In this enquiry we are, however, concerned primarily with the human factor, that is to say, the effect on the worker of methods designed to secure the efficiency of labour and of the machines on which he works.

109. In this sense schemes of rationalization include (1) changes in the plant, (2) changes in the character of production, and (3) intensification, Rationalization in Cawnpore Textile Industry.

that is asking one operative to tend more machines. As far as we could gather from the statements and the oral evidence produced before us, there is enough evidence to show that there has been a fair amount of rationalization in various mills at Cawnpore. Some of them have introduced high-draft system in ring spinning, self-stripping devices on cards, high speed winding and warping machine in their preparatory processes. In the case of a few mills new humidification plants have been installed and some mills have gone in for repairs and adjustment on a large scale; replacement of parts; putting up of new and up-to-date machinery; and improved methods of drive. The character of production has also altered in the case of some mills, and there appears to be a tendency towards better mixings. Rationalization in the sense of intensification is to be found only in two or three mills on any extensive scale, and only rarely has intensification been introduced in complete sections.

Its effect on
Workers'
earnings.

110. All these changes must result in greater efficiency both of the machine and of the operative. It is difficult to evaluate the increase in the efficiency of the operatives in terms of money; or to arrive at any figure which could show how the average production of the worker has risen because of the introduction of better plant, better mixings and improved working conditions. Speaking generally, we find, however, that the results of rationalization have not been reflected in the earnings of the operatives to the extent that one might have expected. This is specially true in the case of the spinning department and other departments where the operatives are paid by time and not by piece. While in some cases the piece-workers could derive the benefit of rationalization by way of higher wages on increased production, we have noticed a definite tendency on the part of the employers to adjust the piece-rates in such a way as to limit their maximum earnings. The time-worker has not only not obtained an increase in the wage due to intensification, but his work also has increased. This point is, however, strenuously disputed by the employers. They maintain that with better grades of cotton, more suitable and careful mixing, superior machinery, and better conditioning within the department's work is much easier. There are fewer breakages and fewer stoppages, and less running about to do. We must bear testimony to this fact that whenever conditioning plants have been installed, and modern methods adopted, to our untrained observation, there seemed to be less strain on the workers, especially in the spinning sections of the industry. Some of the departments in some of these mills appeared to us to resemble University Laboratories, so clean and orderly were they in contrast with those mills where work is still carried on in the old ways. We have no doubt whatsoever that work in those mills is far more strenuous and exacting than in the newly reconditioned mills. An experienced, go-head and sympathetic employer affirmed before us that those modern methods of production in the textile industry actually meant less exertion, because of layout of frames and other factors, in spite of the fact that the men were called upon to look after more spindles than before.

Views of
Employers'
Association.

111. The views of the Employers' Association on this question of rationalization are summarized in the following quotation from their memorandum :

"The Association desire to state that rationalization and intensification as known in other centres in India has not been introduced into Cawnpore as yet. But the Employers' Association appreciate their tardiness in this direction since they fully realize that rationalization and intensification were today a world-wide policy. Therefore

if the textile industry of Cawnpore is to survive, it must be placed in a position to compete with other centres both indigenous and foreign and this can only be achieved by introducing rationalization and intensification.

The Association further desire to stress that schemes of rationalization and intensification assist both the employer and the employee. The former is able to retain his market and so continue to give employment to the latter. Such schemes increase the earnings of the operatives and therefore raise their standard of living and comfort. Health and efficiency are not impaired and, as there is no appreciable difference in the productive efficiency, it would indicate that it is well within the capacity of the operatives to look after more machines than at present."

112. The Mazdur Sabha in their memorandum state—

View of the
Mazdur Sabha.

"We accept the principle of rationalization as a necessary factor in social and economic progress. But it is at the same time necessary to safeguard the interest of labour.

"To sum up, rationalization should be permitted only if all additional profits resulting from intensification after deducting interest on additional investment and depreciation charges is paid to the workers; there is no throwing out of employment of the present workers in the mill, additional facilities for training and rest are provided, and the whole scheme is subject to the approval of the representative of the workers' organization."

113. It will be observed that even the Mazdur Sabha accept the principal of rationalization, and the conclusion emerges that a wider adoption of rationalization schemes or intensification and efficiency schemes as known in the local and other textile centres, is desirable. In fact, it is inevitable if the industry at Cawnpore is to maintain its present rate of progress. We welcome the tendency towards rationalization mentioned in a previous paragraph. It is essential, in the face of world competition that Indian industry, of which textiles is the premier industry, should employ up-to-date methods. Economy and efficiency cannot otherwise be secured. Constant and comprehensive vigilance and adaptation is necessary. Exploitation not of the worker, but of material and machinery should be the key-note, of our employers. One important employer, we are glad to note, in the course of his evidence stated that his main concern was to exploit his machines rather than his men. If this spirit became general, the suspicion against intensification and rationalization would be very greatly diminished.

Our view.

114. We note that Japan within a period of 30 years, from the first establishment of a spinning concern, has risen to the third position as a cotton manufacturing country, in the world. She has adopted intensification and rationalization whole-heartedly. But it is on all sides. It is not merely confined to labour. From the buying of cotton to its mixing and final sales of the woven fabrics, every single aspect of the business including finance, management and control is thoroughly rationalized.

115. Whatever the reasons, we have to admit the undeniable fact of Japanese rationalization schemes that gives them high efficiency and low operating costs. This is in spite of the fact that individual Japanese wages are higher than the Indian wages, especially when we take into consideration the welfare costs that Japanese employers incur on behalf of their workers. A cotton authority reckons these costs to be about 6d. to 7d. per worker per day on the average. Due to all these causes we find there are for every 1,000 spindles 6.1 operatives in Japan as against 15 in India, or to put it in another

way, an operative in India will look after one side of a spinning frame whereas in Japan a girl will be minding three sides. As for weaving, a girl weaver in Japan looks after 6 looms while our weaver minds about two. Regarding the famous Japanese Toyoda automatic looms, an operative will look after 50 such looms with 95 to 96 per cent efficiency. The weekly wages per worker in yen, in 1932, in Japan, for 20s. counts yarn, was 5·8 as against 9·07 in India. The weekly wage-bill per, 1,000 spindles in Japan was 35·3 yen, and in India 136·1 yen. Thus clearly, intensification and rationalization are indicated, if the Indian cotton industry is to withstand foreign competition at all. We have the great advantage over Japan in this that while Japan does not grow a single bale of cotton within her islands, we grow it at our mill doors, so to speak. More than half of our cotton crop has to find markets abroad. Also while Japan has to seek markets abroad we have the buyers within our own borders. The position is therefore both humiliating and tragic at the one and the same time.

Conditions preliminary to rationalization.

116. Our advocacy of rationalization is, however, conditioned by several considerations. As urged by the Mazdur Sabha, the interests of labour should be safeguarded in certain respects before rationalization schemes are introduced. We believe the fulfilment of conditions specified in succeeding paragraphs will not merely prevent an excessive burden falling upon the operatives in consequence of indiscriminate rationalization, but will also be of benefit to the industry.

Standard allocation for each occupation.

117. It is not possible for us to lay down a standard of allocation of work for each occupation in the textile mills in Cawnpore. Such allocation would necessarily vary within certain limits from mill to mill, depending upon the conditions of the machines, quality of material used, character of goods manufactured and the general conditions of work. We would, however, recommend that the Employers' Association should examine this matter carefully and lay down a fair standard regarding the allocation of duties in each occupation of the industry. This standard allocation should precede any attempt at rationalization. Unless the nature and quantum of work normally attaching to any given occupation are clearly defined, it will not be possible to judge at what point intensification begins. It is obviously of great importance to determine whether a particular scheme is or is not an intensification scheme by some fixed standards. If there are fixed standards of work for each occupation, it should be easy to prevent the confusion or misunderstanding that may arise from reallocation of work, which one mill may consider to be an intensification scheme and another may not in the absence of such standards. In the attempt that the Employers' Association may make to lay down the standards that we have just advocated, we would suggest to them that they should take the representatives of labour into confidence and seek their co-operation without which any scheme of rationalization may prove a failure, even though it may be of some benefit to the workers and enable them to earn a better wage.

Extra remuneration to workers and conditions for various types of efficiency schemes.

118. There are two other matters the examination of which should be undertaken immediately by the technical experts of the Employers' Association. We refer to the question of extra remuneration to be paid to an operative for undertaking work above the normal under an efficiency scheme, and the control of conditions under which efficiency schemes may be introduced. We regard it as only fair that with higher productivity the employers should be prepared to share with the workers more largely than they have hitherto done the proceeds of the industry. In this connection, we may draw the attention of the Employers' Association and the Mazdur

Sabha to the report, dated the 15th August, 1934, of the Special Sub-Committee of the Bombay Millowners' Association which has gone into both these questions carefully. We reproduce the report as Appendix V. We agree in general with the principles laid down by that sub-committee, both as regards the conditions preliminary to the introduction of efficiency schemes and the mode of remunerating the extra work involved in the various sections of a textile mill. They have laid down for all main occupations what additional work may be imposed and what the payment therefore should be. When the standard allocations for various occupations have been determined, it should be possible to evolve a similar system in Cawnpore. Here again we would impress on the Employers' Association the desirability of close collaboration with the representatives of labour in order to remove likely misgivings. As regards the actual conditions under which efficiency schemes may be introduced it may be pointed out that intensification generally comes into play when new machinery is introduced or the existing machines are replaced or realigned. As two of the mills in Cawnpore where such schemes are already in progress to any appreciable degree pointed out, there should be better mixings of cotton processed. There must also be suitable working conditions inside the sheds, such as controlled humidity so that extra work does not result in an avoidable increase of fatigue on the part of the workers. A careful examination should be made of these and similar considerations and it should be possible to lay down what set of conditions should be fulfilled for the various types of rationalization schemes.

119. We now come to the question of unemployment that may result from the introduction of rationalization. Rationalization schemes should be so adjusted with schemes of expansion that as far as possible all the workers that may be thrown out of employment are absorbed in their own mills or in some other mills without an intervening period of unemployment. The task would be greatly simplified if the names of all the workers engaged in the industry could in the first instance be brought on a common role maintained by the Labour Exchange so that a worker rendered superfluous by rationalization in one mill may promptly be absorbed by another, in the event of his own, employer being unable to retain his services. One prominent employer while giving evidence before us stated that rationalization in his mill, if freely allowed, could proceed side by side with expansion, and if assured of peace, he could guarantee that all workers discharged as a result of rationalization would be re-employed. We commend this example to the notice of the other millowners. Every effort should be made to see that no worker is thrown out of employment as a result of rationalization. When, however, absorption is not immediately possible, we would recommend that the workers who have put in two years or more of service be paid an employment benefit of a fortnight wages for every year of service to enable them to return to their villages or to assist them to tide over the period till they secure some other employment. Further, the names of such workers must be on the waiting list of the Labour Exchange, and they should receive preference over other workers at the time of recruiting at a future date. The obligation should be cast on the employers that no fresh workers be entertained until those on the waiting list have all been absorbed. Such an arrangement would allay any misgivings on the part of labour regarding efficiency schemes and promote the chance of their success to the advantage both of the employers and the employed.

Unemployment
due to
rationalisation.

CHAPTER VI

SHIFTS

Shift systems in
Cawnpore.

120. There are four systems of shifts prevailing in the Textile Mills at Cawnpore. They may be called (1) the Single Shift System, (2) the Double Shift System, (3) the Overlapping Shifts System and (4) the Multiple Shift System.

121. Only a few mills have the single shift system. The work is carried on during the day and is continuous for nine hours except for an interval of one hour when the work is suspended.

122. The majority of the mills have two straight shifts, one during the day and the other at night. In either shift the work is continuous for nine hours except for an interval ranging from one hour to two hours during the night. During the intervals the work is suspended.

123. The overlapping shift system is a modification of the double shift system by which the continuity of the work is not interrupted during the intervals. All the workers are not allowed to recess at the same time. They are split up into groups, and while one group is enjoying the interval, its work is looked after by the other group. When the first group returns to duty, the second group goes to recess, the first group taking charge of its work. In this way every worker is called upon to do double the ordinary work for one hour or more, according to the length of the interval. In effect, therefore, this system is a form of intensification for a short period every day. This system also obtains only in a few mills.

124. The multiple shift system is in force only in a group of mills under the same management. It is meant to ensure continuous work for 24 hours without any breaks. The workers are divided into a large number of groups and some group or other is always working. The result is a spread-over of the hours of work to 12 hours for practically every group, although no one is called upon to work on the machines for more than 9 hours.

125. None of these systems technically contravenes the Factories' Act which allows a maximum spread-over of 13 hours. Serious objection has, however, been taken to the overlapping and multiple system on behalf of the workers. As regards night shifts, it is not contended that they should be done away with, but it is urged that night work should be paid for at enhanced rates.

Drawbacks of over-
lapping and
multiple shifts.

126. One great drawback of the overlapping and multiple shifts arises from the fact that every piece of work has to be handled by more than one workman. This entails a division of responsibility which may result in inefficiency and damage which could otherwise be avoided. It also leads to friction amongst workmen who naturally blame their partners for the defect. The unscrupulous amongst the mistries get a chance of backing their favourites and reporting against those who have incurred their displeasure. We are aware that certain mills have recently taken the precaution of distinguishing the work of one operative from that of another by getting suitable marks placed at points where one operative leaves the work and another takes it up; but there can be no gainsaying that this system is liable to abuse by unscrupulous persons and even when conscientiously practised may prove to be unfair.

127. The overlapping system is certainly unfair to the time-worker in another way. While the piece-rate worker may be able to earn increased wages for the period that he is engaged on increased work the time-worker gets no extra return for the increased work that he is called upon to shoulder. This appears to us to be grossly unjust.

128. There is yet another good reason why the overlapping and multiple system should be condemned. They make supervision extremely difficult. They make it possible for unscrupulous employers to break the provisions of the Factories Act relating to hours of work with impunity. The Chief Inspector of Factories in his last annual report noticed the increasing tendency to adopt overlapping shifts, and commented upon it adversely. He said, "it is very difficult and in some cases practically impossible effectively to check periods of employment and detect irregularities." In giving evidence before us also the officiating Chief Inspector of Factories was clear that the overlapping and the multiple-shift system were not easy to supervise. He declared himself definitely in favour of the straight shift system. We attach much value to his evidence. For the same reason the Royal Commission on Labour appointed in 1929 disapproved of these systems.

129. From the point of view of the workers, a larger spread-over will naturally be more inconvenient, in spite of longer intervals, than a shorter one. Except in those few cases where his house is within a reasonable distance from the mill, he has to remain loitering about the premises and waste his time which he could better employ away from the scene of his work. Whatever the interval, it cannot be utilized for proper rest inside the mill, for no mill in Cawnpore has adequate accommodation or satisfactory rest arrangements. The rest interval so spent within the mills cannot be recuperative as it is intended to be. Tired limbs and bodies remain unrefreshed. This process cumulatively has bad effects. Also in so far as the workers cannot get back home, their prolonged absence from the family cannot be healthy. Everything that can be suggested to make family life normal and natural should be considered with great care.

130. For all these reasons we are forced to the conclusion that the overlapping and multiple systems should be abandoned. As we have said above, only a few mills resort to them and we do not see why they should not fall into line with the rest. There may be some force in the contention that seasonal changes in the products of the textile mills tend to throw the various units out of balance and differing shifts might have to be adopted in different departments in order to keep the successive departments fully occupied. But we have found that the better managed mills are always more evenly balanced than those not so well managed, and the great majority of mills in Cawnpore actually do not find it necessary to resort to complicated systems. One or two employers giving evidence before us expressed a definite dislike for them, and we agree with their views.

Our opinion of the various systems.

131. As for night work in general, while we cannot conceal our dislike of it, we cannot go so far as to recommend its discontinuance. Night work unquestionably involves greater strain than day work, except during the hottest months of the year, when it was suggested by some employers that the men preferred to work in the cool of the night. It is inconvenient and if enforced for long periods, must prove prejudicial to health. Some workers in Cawnpore have to do continuous night work; that is to say, they are always employed on night shifts alone. This is extremely undesirable. Even the President of the Employers' Association in his evidence before us said that

Inevitability of night work.

he disliked night work. But under the present conditions obtaining in India and elsewhere night work becomes necessary at times.

Analogy of
Japanese
conditions.

132. While, therefore, night work is to be looked upon as a necessary evil for periods of brisk demand an effort should be made to alleviate its rigours. One method is to change the working hours on the Japanese lines. The Japanese mills usually work the two straight shift system. Their shifts are of $8\frac{1}{2}$ hours each, with half--an-hour's rest. The first shift is from 5 a.m. to 2 p.m. and the other from 2 p.m. to 11 p.m. The second shift is known as the afternoon shift. The advantage of this arrangement is that the workers can get back to their homes for the greater part of the night.

133. We would suggest to the Employers' Association that they should make a serious attempt to evolve two straight shifts on the Japanese model having regard to Indians' conditions and hours of work.

CHAPTER VII

RECRUITMENT

134. The existing methods of recruitment of labour by the mills, our inquiries have convinced us, lend themselves greatly to the evils of bribery and corruption. The existence of these evils have been acknowledged even by the Employers' Association. In their memorandum they say, "It is the Association's view that all members can and do endeavour to combat bribery and corruption, and they cannot, nor can they be expected to eradicate a system which appears to be the accepted idea of obtaining, or continuing in, employment."

135. We are convinced that as long as bribery and corruption remain a feature of our labour situation, we can never attain that high degree of industrial efficiency reached in other countries, intensification and rationalization notwithstanding. It is a deadly cancer which will destroy our industrial structure. It requires the combined efforts of employers and workers to eradicate it. Happily we find that both the employers and the Trade Union leaders are fully alive to the necessity of dealing with this evil. It injures the moral stuff which is, after all is said and done, the ingredient that builds up the quality and dignity of the workman and adds to his efficiency.

136. The main reason for this state of affairs is to be found in the employment of the mistries for the recruitment of labour. One witness who has been associated with the textile industry for over 25 years and to whose opinion we attach great weight described the mistri system of recruitment as a "baneful" one. A mistri is really a fitter and his job should be to keep the machine in order and supervise the operatives working thereon. He should have no concern with the obtaining of labour. This important work, the mishandling of which has been and is bound to be a source of friction and irritation, must be undertaken directly by an officer who is not of a lower standing than the department head. It is not enough, as we have found in the case of some mills, that he merely supervises the recruitment. If mistries are called upon to advise and assist him, they are apt to become *de facto* recruiters. We have found that even where the new appointments have ultimately to be approved by the departmental manager, the preliminary selection of candidates, who are presented for interview and test, is made by the mistries. In other words, they are associated with the process of recruitment at a stage which is most susceptible to corruption. We consider it essential that there should be complete dissociation of mistries from recruitment.

137. We are glad that the Employers' Association have recently started the experiment, recommending by the Royal Commission on Labour of securing labour through a special Labour Officer of their own. We cannot too strongly endorse the Commission's view that "integrity", personality, energy, the gift of understanding individuals and linguistic facility are the main qualities required" in such a Labour Officer. We agree too, that it should be among his functions to ensure that no worker is discharged without adequate cause. We would draw the attention of both the Government and the employers to the further remark of the Commission, that where trade union is in existence, its co-operation should be sought in stamping out bribery.

The best among the existing systems.

138. On the whole, the most satisfactory system now in force in Cawnpore appears to us to be that adopted by one of the mills. Its main features may be briefly described. The great majority of appointments are made on written applications. All applications are filed on a waiting list. When a vacancy occurs on the substitute list, a selection is made from the waiting list directly by the manager of the department concerned, and the selected candidate is sent for a medical examination. If the medical report is satisfactory, the candidate is made a substitute and issued a brass disc bearing a number. Each department has a recognized quota of substitutes, and all substitutes are supposed to present themselves at the mill each day and their attendance is recorded. When a permanent worker absents himself a substitute is offered the vacancy and those substitutes who are not required leave the mill premises. When a permanent vacancy occurs, it is filled by the substitute with the longest service, as far as possible. On leaving the substitute list, the worker returns his substitute disc and is issued another disc bearing his departmental number.

Labour Exchange.

139. Even this system, it was admitted, is not completely free from corruption. The trouble seems to us to lie at the first stage, namely, the preliminary enrolment in the waiting list. To overcome it, we strongly recommend the establishment of a Labour Exchange. Both the employers and the workers have advocated it. We believe that if vacancies on the substitute list are filled by reference to the Labour Exchange, a very important step will have been taken towards the elimination of bribery and corruption associated with recruitment.

Control of Labour Exchange.

140. In the opinion of the employers the Labour Exchange should be and unofficial body. In the conditions obtaining at present in Cawnpore, we cannot accept this view. If there had been wholehearted co-operation between the employers' and the workers' organization, that factor in itself would have gone a long way towards removing corruption and other evils, but until such relations are firmly established, we think that the Labour Exchange should be under the supervision of, and controlled by Government. Attached to it there should be a Recruiting Officer, with whom skilled and semi-skilled workers in search of employment should register themselves and whose main function it will be to provide employment to the applicants on demand from factories. It is perhaps needless to add that between the Government's Recruiting Officer, the Labour Officer of the Employers' Association and the Central Executive of the Workers' Union, there should be frequent contact and close liaison.

Factors contributing to efficiency of labour force.

141. Before we conclude our remarks about the question of recruitment, we wish to invite attention to certain factors which must have a direct bearing on the efficiency of the workers. We shall have to say a good deal about this matter in other chapters dealing with the problems of housing, medical facilities and welfare work. But at this stage we would confine our observations to three main factors in the matter of the recruitment of labour.

Physical fitness.

142. One is the question of physical fitness. Particularly in all the preparatory processes and in spinning, we noticed a considerable number of persons with weak physique, bad teeth, and defective eye-sight. From an examination of the registers kept by several of the mills in their mill dispensaries (which, by the way, are rendering commendable services to the workmen and their relatives under the care of qualified and devoted doctors, dispensary and nurses and are not merely administering doses of "iodine" as deposed to by one of the witnesses) we find that there is a general prevalence of elementary and skin diseases. It is obvious that physically a "C" class

labour force cannot be an asset to industry. We, therefore, consider that it would be advantageous to have a preliminary medical examination before recruitment. Further in our opinion, it will be desirable to have a periodical medical examination of all the permanent workers. In this examination special attention should be given to eyes, teeth, skin and pulmonary troubles. In the periodical reports of mortality in India, Cawnpore occupies an unenviably high place. A feature which inevitably attracts attention in the detailed statistics is the regrettably high incidence of what in general are called "respiratory diseases." It is difficult to resist the conclusion that tuberculosis claims an increasingly large number of victims. Another matter which, in our opinion, should receive particular attention is venereal disease. As the Royal Commission on Labour pointed out in its report, Cawnpore is prominent among the industrial centres in India where the sex disparity is striking. Investigations in regard to these diseases seem to us urgently called for, both in the interests of the general health of Cawnpore and, in particular, of the working class population of the city. The trouble and extra cost will be amply rewarded, we are confident, in a healthier and more satisfactory labour force. It is essential for a comprehensive tackling of the problems enumerated above that there should be a co-ordination of the activities and a pooling of the resources of the Government, the municipal board and the employers.

143. The second point to which we would draw attention is the desirability of some kind of educational test in the recruitment, particularly of child and adolescent labour. For adult labour such a requirement would obviously be utopian. It is desirable in making permanent selections to give preference to such adolescents as satisfy the required educational test—simple reading, and writing and arithmetic—the three R's—Mental welcome is always good, and at this stage particularly desirable. It will impart intellectual alertness and promote efficiency, which are both essential features for industrial expansion under modern conditions. We trust that such a demand upon our young labour force will not be resented. In fact, if facilities for reading and writing are provided, through municipal schools or other agencies, the response, we are sure, will be keen and full-blooded. A literate labour force, it can hardly be denied will contribute to the efficient conduct of industry. Educational Qualifications.

144. The third matter to which we would call particular attention is the question of technical training of the operatives. While, undoubtedly, experience in the mills themselves is the best teacher, yet we are certain that instruction in a technical institution would yield good results. A preliminary training, or subsequent part-time course of instruction, should be required from workers seeking permanency. It was brought to our notice by Mr. Murthy, our Technical Adviser, that a certain number of his students have found employment in some of the mills. Active efforts, it seems to us, should be made by the Government to expand the possibilities of such absorption of trained young men far beyond the present rate. We can see great advantage in recruiting educated men of this type, some of whom, at any rate, are bound to possess the requisite qualifications, both moral and technical, for leadership to replace the present mistri type. This is a point which in the long run will so vitally affect the foundations upon which the industrial system in India has been reared that we trust that the Government will recognize the advantage of regarding the Textile Institute at Cawnpore as a nursery for all but the workers of the unskilled type. We would suggest the addition of continuation and night classes to the Central Textile Institute, Cawnpore. Technical training.

Causes of the lower efficiency of the Indian Workers.

145. In the course of our inquiry we were frequently reminded of the greater efficiency of the cotton operatives in Lancashire and Japan. We were also pointedly informed that they were mostly girls. Our workers, who are mostly men, were shown up in contrast as being lethargic, unambitious and inefficient. But even assuming the description to be correct, the main responsibility for the admittedly lower efficiency of our operatives must be borne, we fear, by the State and the employer rather than by the worker himself. What steps has the State, the municipality or the employer so far taken in removing illiteracy or in imparting technical training? In Japan technical schools abound and lead through a chain of institutions right up to the polytechniques and the universities. Where again are the well-planned and well-conducted welfare schemes which are so common a feature of the Japanese cotton textile industry? We make no excuse for the workers' individual and personal lack of effort. Nor do we stand for these aspects of the social system which are unhelpful. But today the worker is the helpless victim of circumstances beyond his control, and we would invite attention to forces that have not been brought into play for increasing his efficiency. More positive and energetic steps will have to be adopted if we wish to put a stop to this ceaseless cry of the inefficiency of the Indian workmen. Unaided he can do little for himself. He must be helped. We hope to indicate in other parts of the report ways by which this may be done.

Terms of employment.

146. Having discussed the methods of recruitment we may make a few observations as to the terms of engagement. We are glad to note from the memorandum of the Employers' Association that it is considering the question of establishing a standard form of recruitment. When this is considered the Association will, no doubt, also turn its attention to the question of laying down a uniform set of rules for all mills governing the terms of employment. It is very desirable in our opinion that these rules should be evolved in consultation with the representatives of the Mazdur Sabha. Not all mills have at present any written rules on the subject. We have two comments to offer on the rules that have been presented to us. One or two mills prohibit their employees from being members of any labour organization. It is extremely surprising, to put it mildly, that any employers should place such a ban on the right of association of the workers. Trade Unionism has come to stay in India, and we are convinced that it is as much in the interests of the employers as of the workers that this fact should be recognized without qualification. We deal with this question in greater detail in another part of the report. But it is most essential in the interests of industrial peace that the employers should make it clear, both in their terms of engagement of labour and in actual practice, that active membership of a Trade Union will not stand in the way of a worker, either in regard to recruitment or the improvement of his prospects.

Display of wage rates.

147. Another matter which seems to us to deserve the immediate attention of the Government is in regard to the rules made under the Payment of Wages Act. The display of wage rates on the notice board by all mills would minimize the possibilities of misunderstanding on the part of the workers. In the course of our inquiry we found no serious objection from the employers to the adoption of this course. But it was pointed out to us, by at least two witnesses that this is not obligatory in the United Provinces under the Payment of Wages Act. We would therefore suggest the inclusion of such a provision by a suitable amendment of the rules under the Act.

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148. It may be convenient here to refer to another suggestion made **Wage cards.** by the Mazdur Sabha that every worker should be provided with a wage card at the end of each wage period. This card should indicate both the amount of his wage and the rate or rates on which the calculation has been based. This suggestion would remove a possible cause of misunderstanding and has our support.

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CHAPTER VIII

Punishments

Circumvention of
the Payment of
Wages Act.

149. One of the primary objects of the Payment of Wages Act, 1936, was to regulate the scale of deductions from workers' wages either on account of fines or other causes. We found that the actual result in Cawnpore has been an almost complete abolition of fines and other deductions imposed as punishments, followed in some mills by the adoption of various devices which deliberately or otherwise have the effect of circumventing the law.

Forced leave.

150. It seems to have become a more or less general practice in Cawnpore to send a worker, guilty of negligence or some other offence which in the pre-Act days would have merited a fine, on what is euphemistically described as forced leave: that is to say, he is asked to stay away from work for a certain period which may be as long as a week or ten days or even more, at the discretion of the employer. One witness referred to it as tantamount to fining and expressed the opinion that it was an illegal practice. Its effect is certainly to curtail a worker's earnings by a proportion which in several instances has far exceeded the maximum for fines laid down in the Act. This practice is, therefore, to be strongly deprecated; and we would suggest to Government that legal opinion should be obtained without delay on the matter. If Government are advised that it is not an illegal practice, we recommend that steps should be taken for amending the Payment of Wages Act suitably so as to render it illegal.

Playing off.

151. While on the subject of forced leave or suspension, we may refer to what is called "playing off" in the textile industry. Owing to maladjustments in the work of various departments, it may sometimes happen that the volume of work in one or more departments falls below the normal. Under such circumstances all the workers in those departments cannot be kept fully employed, and the necessity arises to "play off" some of them for brief periods. This playing off is not a form of punishment, but results from a temporary reduction in work. Our proposals relating to forced leave would not apply to a genuine case of playing off, though in view of the ingenious practices adopted in some of the mills for circumventing the Payment of Wages Act, we think a word of caution is called for in this respect. Even as regards genuine playing off for trade reasons some restrictions are necessary. Where the playing off is a species of "short time" and involves merely the giving of less work to an operative than he would normally have, no limitation is ordinarily called for; but where it means complete cessation of work for him, a maximum limit should be imposed, and if the period exceeds that limit, he should be duly compensated. The question has been discussed at length in the Fawcett Committee Report at pages 33 to 36. That Committee considered that playing off should be limited to two days at a time. This limit may, in our opinion, be accepted in Cawnpore subject to the further limitation that the total period for playing off in a year should not exceed twelve days. We would have no objection to a revision of this limit by mutual agreement between the employers and the workers, but if it is exceeded we consider it would be fair to give a worker 50 per cent. of the normal wages for each extra day over the maximum.

152. We found another practice in mills under one employer which we have even less hesitation in regarding as a gross violation of the Payment of Wages Act. Three differential rates of payment have been introduced for the same work, one for "good quality", another for "indifferent quality" and a third one for "poor quality." The good quality rate is the pre-Act rate, while the other two are reduced so as to cover possibly more than what the former fines would have yielded. The wages of the workers are undetermined and remain indeterminate until the end of the wage period when the employer pays at one of the three rates, according to his judgment of the work. This, in our opinion, is obviously a most objectionable method of evading the provision of the Payment of Wages Act which limits fines and deductions to half an anna per rupee of the wages earned. Our attention was drawn to a circular issued by the Chief Inspector of Factories in Bombay (dated 27th November, 1937) to factory managers in the Presidency declaring such a practice to be against the law. We would suggest immediate action on the same lines in the United Provinces.

153. We now come to the question of dismissals which is of paramount importance, particularly in the present tense atmosphere of Cawnpore. Though it is true that five cases of alleged victimization by the employers were referred to a judge in the month of November, 1937, and his judgment unreservedly supported the action of the employers concerned, it is necessary to bear in mind that the workers attach the greatest importance to security of service. If one examines the history of industrial disputes in India, it will be found that the major cause for several of them was the extreme discontent caused by victimization, direct or indirect. The Mazdur Sabha does not question the right of the employers to dismiss a worker for a sufficient cause, but the criticism is that active members of the Mazdur Sabha or of the Mill Committees are dismissed on some pretext or the other which would not have led to dismissal in the case of other workers. On the other hand, the employers contended in their evidence that the number of dismissals in recent months had not been appreciably larger than at any other period. We have not had the time for a detailed inquiry nor could we even otherwise afford to be diverted from our main task to a detailed investigation of the matter. At the same time, we must say that we regard it as of the greatest necessity that some machinery should be provided whereby the workers can be satisfied that a particular dismissal was justified. It is vigorously denied by the employers that any dismissals have taken place for other than a just cause. There should, therefore, be no difficulty in explaining to the worker concerned, or to a responsible representative of his Union the precise reasons for such action. The worker should have the right of having his case taken up by the Trade Union of which he is a member with the mill concerned. The services of the Labour Officer and the Conciliation Officer may be utilized at a later stage, if necessary. If the reason for dismissal hinges on a technical matter, the services of an independent technical expert may also be requisitioned. The main point is that the worker should be convinced that there has been no victimization. If on inquiry the grounds for dismissal are found to be inadequate, we trust that there would ordinarily be no difficulty in getting him reinstated.

154. It is impossible to lay down with precision what should be regarded as adequate grounds for dismissal. Arguing, however, on the analogy of one of the provisions in the Payment of Wages Act, which limits the power of an employer in regard to fines, both as regards the amount and

as regards the reasons for such punishment, it seems to us that the right of dismissal should be restricted in a similar manner to gross misdemeanour or wilful and serious neglect of duty. This is not a challenge to the inherent right of an employer to employ or dismiss, but we wish merely to ensure that dismissals are imposed only for offences of a certain gravity. Even at present a worker who feels that he has been wrongfully dismissed, is at liberty to go to a civil court and sue his employer for damages. But this procedure is so tedious, cumbersome and costly that it is seldom, if ever, resorted to. Our proposal that the dispute should be referred to a Conciliation Officer is merely a simplification of that procedure. What we urge further is that the Conciliation Officer should have the power, if on investigation he is convinced that the dismissal was unjust or based on inadequate grounds and reinstatement is not agreed to, to convert it into a discharge and reckon, the compensation to be paid either at the rate of 15 days' wages for every year of service or a lump amount not exceeding six months' wages. He may in addition award at his discretion the full or a part of the wages of the period subsequent to the dismissal.

155. We wish to bear witness to the fact that previous to recent months, the number of dismissals in Cawnpore mills on the whole was small. We hope that this record may soon be recaptured and mutual trust established. Employers themselves informed us that they had no desire to lose their good workmen.

Censure notices.

156. Apart from summary dismissals, which we trust will be few and far between, we would recommend the practice now adopted in some mills in Cawnpore, of issuing censure certificates or warning notices. In these mills three warnings, given within a fixed period of time, will render a worker liable for dismissal. The fault for which he is warned has to be duly adjudicated and recorded in his service sheet or card. In this manner men will gain a sense of security. Nothing is feared by the workers so much as the liability to dismissal. We cannot accept the proposition that this feeling of insecurity of retaining their jobs is an element which keeps them up to the mark. Such fear inhabits and depresses the faculties. We rather think that a sense of security, coupled with the assurance of fair dealing, will lend confidence to men, and release and promote in them all those latent forces which make for a contented and efficient labour force. We cannot too strongly emphasize this point.

CHAPTER IX

Leave

157. One of our terms of reference asks us to lay down the terms under which leave should be granted to workers in cases of sickness or other emergency. We have given this question our anxious consideration. At present all leave is without pay both for time and piece-workers. From the employers' evidence led before us the position seems to be that reasonable facilities are afforded to operatives who wish to go on leave and, except perhaps during some special periods, for example the marriage season, occasions when reasonable requests for leave are turned down are not many. The operatives seldom, if ever, give any previous intimation of their intention to take leave, and sanction of leave must necessarily sometimes take two or three hours. On the other hand, we have had the allegation from the workers' side that mistries create impediments in the way of a worker getting leave, and that they expect a cash payment or other benefit before they make a recommendation in favour of the applicant. Unless the general tone of the mistriship system, about which we have made observations elsewhere, is improved, complaints of this nature are bound to occur, and we trust that the employers will continue to investigate them with care whenever they are brought to their notice and take punitive action as the circumstances of the case may warrant.

158. We feel, however, no hesitation in coming to the conclusion that there should be some provision for leave with pay. The average Cawnpore worker comes from the countryside where he is accustomed to work in the open. In the factory he is employed on work which needs constant attention and vigilance. The change is bound in time to impair his health. Further, in Cawnpore he has to live in surroundings whose squalor and filth defy description. This places an additional handicap on him. Though detailed figures of the incidence of sickness among the workers are not available, we have reasons of believe that it must be very high. Ill-health accounts for a large number of leave applications and under the present conditions, a worker is deprived of his earnings at a time when he most needs them. Anything that is done therefore to alleviate his sufferings should be looked upon by the employers as a part of welfare work. While we recognize the merit of the welfare work that is already being done by the employers in Cawnpore, we think it is fair to add that they are doing comparatively little and have been less responsive in this direction than employers in many other textile centres. We would therefore, strongly urge the adoption of the proposals that we are going to make for leave with pay. The weekly holiday is utilized by the workers for much needed rest after a strenuous week, and for such purposes as washing their clothes and making sundry purchases for themselves and their families. The various religious holidays serve a definite purpose and are not designed to suit the workers' health or other personal requirements. What is needed is some relief from the financial burden of the periods during which the worker must of necessity stop work.

159. We believe that suitable provision for leave with pay will also tend to reduce the evil of absenteeism. When leave is without pay, a worker will frequently overstay it. On the contrary, if he were granted leave with

Facilities for leave.

Desirability of a provision for leave with pay.

Effect of leave with pay on absenteeism.

pay, it would act as a psychological incentive to return to work punctually. If a yearly limit for leave with pay were fixed, we are of the opinion that most of the workers would not exceed that limit. We propose therefore to relate our proposals to the extent of absenteeism.

Extent of
absenteeism.

160. We have no definite date by which to judge the actual extent of absenteeism in the Cawnpore mills. Most of the mills informed the Committee that they had kept no records of absenteeism. On behalf of the Mazdur Sabha it was contended that normal absenteeism was about 10 per cent., a statement which we are inclined to accept. The report of the Royal Commission on Labour, Evidence, Vol. III, Part I, page 250, contains the written evidence of the Upper India Chamber of Commerce which says, "In regard to absenteeism, it has been extremely difficult to arrive at any precise figure but it is stated that absenteeism prevails to the approximate extent of 10 per cent. with a 10 per cent. loss of wages." The "Wages and Labour Conditions in Cawnpore" at page 114 gives a statement showing absenteeism in a representative textile mill, day by day, for one month which leads to the conclusion that in that month absenteeism amounted to 10.5 per cent. One employer in the course of his evidence before us said that absenteeism in his weaving shed was 7.2 per cent. while another estimated it to be just under 15 per cent. for the entire mill. It will, therefore, be safe to conclude that the average absenteeism is approximately 10 per cent. or 30 days in a year, the average number of working days being 300.

Our recommenda-
tion about leave
with pay.

161. We therefore recommend that provision should be made for 15 days' privilege leave with full pay subject to the limitation that only workers with not less than two years' continuous service should be entitled to it. In addition, such workers should be eligible to get 15 days' sick leave on half pay. This should be converted into full pay for those whose period of service extends beyond five years. The sick leave is intended to be given only in cases of actual sickness to be certified either by the mill doctor or any other registered physician. Either kind of leave may be obtained either at one stretch or in broken periods, according to the necessities of the case. These provisions, we are sure, will ensure efficiency, and make industrial life more attractive than it is. They will also help to build up a permanent labour force. If the millowners afford facilities to their workers to go home to recoup their health or to join their relations on occasions of marriage or other ceremonies, they would return with better health and increased efficiency and be more ready to face the difficulties and hardships of city life.

It is of interest to note that the Bombay Government are proposing legislation for sickness and old age benefits which according to the estimate of the Bombay Labour Enquiry Committee would impose a burden on industry equivalent in amount to 21 days' wages per worker in a year.

162. We suggest that necessary rules in this connection may be made by the Employers' Association in consultation with the Mazdur Sabha and the Government Labour Commissioner.

Financial effect of
our proposals.

163. The proposals that we have made are by no means an innovation for the textile industry. Somewhat similar schemes are already in operation elsewhere, for instance in Madras in the Buckingham and Carnatic Mills. The financial burden that they will impose on the employers will not be heavy. If all the workers were entitled to 30 days' leave with full pay, the addition to the labour costs would be about one-eleventh or about 9 per cent. But in view of the qualifications we have suggested above for the grant of such leave, the total addition should not exceed 6 per cent. The

greater contentment and efficiency, which will result will lighten the burden on the industry still further.

164. As regards the determination of the rate of pay during the period of leave, in the case of the time-workers there is no difficulty. They are paid either at a daily or a monthly rate and the calculation will be simple, but there may be some difficulty in the case of the piece-rate workers. A ready method will be to reckon on the basis of the average of three months' previous to the leave, and we recommend this for adoption. To take the yearly average may introduce unnecessary complications and cause misunderstanding and discontent

Determination of
rate of pay
during leave.

CHAPTER X

GENERAL WORKING CONDITIONS

Scope of the chapter.

165. In this chapter we propose to pass in brief review some aspects of the general conditions of work inside the textile mills in Cawnpore of which mention has not been made elsewhere in the report.

Cleanliness, ventilation and lighting.

166. The general standard of cleanliness and ventilation in Cawnpore textile mills is up to the requirements of the Factories Act. Lapses are not frequent and the factory inspectorate has not had many occasions for finding fault on this ground. The same may be said of lighting arrangements.

Drinking water facilities.

167. Some criticism was made of the arrangements for the supply of drinking water. The complaint was not about the adequacy of water supply, but it was alleged that during the hot weather the water was not cool enough for drinking. One or two mills stated that they had a provision for the supply of ice-cooled water, but it was alleged on the other side that the arrangement was ineffective. We bring this complaint to the notice of the employers in the hope that they will do what they can to remedy it. We would recommend for their consideration the spray system of providing drinking water adopted in some centres in India wherever water is supplied outside in mill compound. We desire that adequate shade should also be provided to protect the workers from sun and rain. If some kind of creepers could be run on such structures it would make the drinking spot cooler and pleasanter.

Use of latrine and urinals.

168. From the workers' side an allegation was made that in several mills undue restrictions were placed on the use of latrines and urinals. For instance in one case it was said that no worker was allowed to use them for an hour after the work was started and an hour before the work closed. In another case the complaint was that if a worker went to the latrine very often or stayed there for a period of time, which in the opinion of his supervisors was too long, he was taken to task. The majority of the mills, however, impose no such restrictions, and in our opinion the others should fall into line. We would wish that more urinals at least should be provided at convenient points to save the workers and particularly the older workers from going up and down a great deal. Wherever possible flush latrines should be provided.

Cooling and humidification arrangements.

169. Complaints against cooling and humidification arrangements were louder. Some mills are equipped with air-conditioning plants which operate in the main departments of the mill and secure for the worker the best possible atmospheric conditions. Arrangements, however, in several other mills leave much to be desired. In view of our advocacy of rationalization schemes, we must lay the greatest emphasis on cooling and humidification arrangements. The workers must be saved unnecessary exhaustion and physical exertion. Exhaust fans are in some cases admittedly not very efficient and they should be improved in order to meet the dust evil effectively.

Resting places.

170. The mills, generally, do not provide any resting place where the workers can take shelter during the recess periods. The shade of the mills is the only protection from heat and rain, and we fail to understand how any worker can sleep during the night recess in winter. Some mills allow him to bring his bedding and blanket, but he has to find for himself where he can sleep. Generally the only place available is the space between two machines or the corner of a shed where sleep is impossible owing to the noise of the

mill. The rules framed under the Indian Factories Act empower the Local Government to compel the owner of any premises, where 50 or more men work, to provide adequate resting places. We advocate the use of that power. Resting places should be provided separately for men and women. The provision of adequate resting places would be a substantial gain to the workers, especially during the hot days of the summer months. Mere erection of sheds will not be satisfactory. Large halls, with due protection from heat and cold would be better.

171. Some mills have mill-gardens. We advocate the adoption of this practice by all. Every effort to make mill premises pleasant and attractive reaps its own reward. Rest halls that we advocate should be located near such mill-gardens.

172. There has been some complaint of lack of facilities for taking meals. Facilities for taking meals. The practice in this respect differs from mill to mill. While some mills allow freedom within certain hours, others insist that meals can be taken only during the recess. Dining sheds are provided only by a few mills but even these are hardly adequate.

173. We recommend uniformity of rules in respect of meal hours. Regarding the provision of dining sheds, the problem is complicated by caste restrictions and differing social customs in this country. But there is no reason why a beginning should not be made. Conditions are changing rapidly and the existing barriers are fast crumbling. We are of the opinion that more dining sheds should be erected.

174. We now come to an important question, namely, the number of Holidays. working days in a year. Under the Factories Act, the maximum number of working days in a year of 365 days is 313 : all that the Act requires is a weekly holiday. In the course of their evidence before us the workers expressed a desire that Sundays should be observed as holidays invariably. In addition they wanted holidays on the occasion of the principal Hindu and Mohammedan festivals. These total up to about 30 days. If therefore all Sundays and festivals are allowed, the number of working days will be reduced to about 285 days in a year. This will manifestly be unfair to the Cawnpore textile industry. The productive capacity of the industry should not be handicapped to such an extent as to give other centres an undue advantage over Cawnpore. According to the Employers' Association, in some other parts of India the number of working days varies from 300 to 313, with certain Indian States working up to 316 days. The lists of holidays observed by the Bombay mills show that their average number of working days is 310. From the figures supplied to us by the Mazdur Sabha the all-India average, excluding Cawnpore, for 1936 was 297 days. The average of Cawnpore itself in that year was 302.5. Any serious departure from the proximity of these figures is therefore likely to tell adversely upon Cawnpore industry.

175. We, feel, however, that the practice of allowing a fixed day every week (which can only be Sunday) is a very salutary one. The workers are very keen on a fixed weekly holiday which introduces in their lives a much-desired regularity. It gives them rest after a strenuous week and enables them to meet their friends and relatives. At the same time, national and local festivals are equally important. Their observance enable the workers to participate in religious, social and cultural functions. A compromise has therefore to be evolved which will allow the workers the necessary holidays facilities and at the same time give the industry a reasonable number of working days.

176. We are of opinion that it will be reasonable to work up to an average of 305 working days in Cawnpore. The Employers' Association should prepare a list of holidays in consultation with the labour representatives in such a manner that it contains the maximum possible number of Sundays and the minimum number of festivals.

177. Before we conclude this chapter we should like to draw the attentions of the Government to the inadequacy of the factory inspectorate in these provinces. Besides the Chief Inspector of Factories, there is at present only one wholtime Assistant Inspector of Factories.

Factory
Inspectorate

The four Inspectors of Boilers are also empowered to inspect factories, but they seldom find time to make any factory inspections. With this staff we are convinced that it is not possible effectively to enforce the provisions of the various Acts and Rules which the department of the Chief Inspector of Factories is called upon to administer. The total number of registered factories in the province was 576 in 1936, and there is likely to be a rise in the future. The question is not merely one of visiting the factories once or twice every year. What is of equal and perhaps of greater importance is the follow-up work these visits involve. A factory inspector should have adequate time and resources at his disposal to see that defects discovered by him are speedily removed. He should not be content, as is the case at present, with a visit of inspection; it is his duty also to apply remedial measures effectively and promptly. He is not able to do this at present; in fact, we are told that some factories even escape inspection altogether every year. We would therefore suggest an immediate strengthening of the staff by the addition of at least two wholtime assistant factory inspectors.

CHAPTER XI

LABOUR ORGANIZATION

178. It is hardly necessary for us to stress the desirability of a sound labour organization in every industry, which in the present circumstances of Cawnpore may be regarded as a matter of vital importance. Practically every employer who appeared before the Committee stated that he would welcome one run on sound Trade Union lines. In fact, some of them expressed an anxiety to deal with a properly constituted trade union. We felt that such anxiety was genuine, whatever may have been the attitude in the past. It is essential for the industrial and general peace of Cawnpore that the employers should unreservedly accept the principle of organization of the workers for the purpose of collective bargaining. The experience of Cawnpore confirms that of other industrial centres in India that where Trade Unionism has been discouraged by the employers, more extreme principles have found congenial soil. It would be both shortsighted and wrong for the employers to deny to the workers any longer the right of organization and to refuse to discuss with their accredited representative, matters affecting their wages and working conditions. From the point of the view of the worker too, we are confident that provided he feels assured of the effectiveness of a healthy Trade Union capable of protecting his legitimate interests he will submit to its discipline and willingly accept its guidance in his relations with the employer. His present mood in Cawnpore we interpret as essentially one of despair, and there is probably some justification for such an attitude. Some employers told us that complaint boxes in their mills had always been empty. It would be impossible to infer that there were no complaints to register. According to our reading of the situation, complaints were not registered, either because the complainants thought such procedure to be futile, or because they feared that the complaints might recoil on themselves. In these circumstances it is abundantly clear to us that a proper Trade Union should be allowed to function without any obstacles being placed in its way. A strong Union is an invaluable asset in several ways and is an insurance against unauthorized, irregular and lightning strikes.

Desirability of
labour
organization.

179. We have examined in some detail the constitution and working of the Mazdur Sabha which is practically the only labour organization of textile workers in Cawnpore. The Sabha was registered under the Companies Act in 1920 and later on under the Trade Unions Act in 1927. Immediately after registration under the Trade Unions Act, the President sent a circular letter to all the employers of labour in Cawnpore asking for an opportunity to work in co-operation with them for the discussion and redress of the workers' grievances. Only one concern agreed to consider representations made by him regarding the workers employed in the mills controlled by them. Another mill recognized the right of the Mazdur Sabha to represent the workers' grievances in 1929; but this recognition was also withdrawn in a short time. It was on August 9, 1937, after the acute unrest amongst the workers had culminated in a general strike and only through the personal intervention of the Premier, that the Employers' Association, representing most of the mills in Cawnpore, recognized the Mazdur Sabha as a representative Union on behalf of the workers. But this recognition again proved a short-lived phase.

The Mazdur
Sabha.

Employers' objections to Mazdur Sabha.

180. The employers have challenged the representative character of the Mazdur Sabha and its ability to control and guide labour on proper lines. They have complained seriously of lack of discipline among the workers who, they consider, are deceived and misled by Communist propaganda. In their memorandum the Employers' Association allege that "the men at present do not understand the true function of Trade Unions and seem to be under the impression that they can form mill committees by arbitrary methods and dictate the action of the management in the control of labour." The memorandum points out that this attitude has to be abandoned before there can be any real peace, and proceeds to lay down a series of conditions which should be fulfilled before a Trade Union can be recognized.

Reorganization of Mazdur Sabha.

181. It is relevant to point out, however that the past attitude of the employers in general towards the Mazdur Sabha cannot be described as either sympathetic or liberal-minded. Yet no one, we think, can fairly deny that the present constitution of the Mazdur Sabha is weak. It needs overhauling in certain respects. The existing rules prescribe an annual payment of subscription and contact between the Central Executive and the members has been at best slender and fitful. Mill committees have in recent months sprung up under the guidance and inspiration of left wing leaders without any place in the constitution, and acted on their own initiative without the consent of the Mazdur Sabha. Steps are, however, being taken to remedy these inherent weaknesses, and we have reasons to believe that in its new form the Mazdur Sabha will be run on generally accepted Trade Union principles. Without in any way wishing to dictate to the Mazdur Sabha we would like to make particular mention of some salient features which may suitably find a place in the reorganized constitution.

Method of election.

182. It will generally be conceded that the method of election of the office-bearers and of the Executive should be by secret ballot. The importance of this in the interests of the workers cannot be denied, for it would furnish them with experience in the conduct of all elections and thus train them in one of the most essential arts of citizenship, namely, correct procedure in voting. We have no doubt that the value of this will be appreciated by the Mazdur Sabha as lending both reality and strength to the organization.

Representation of various interests.

183. Equally desirable, in our opinion, is the necessity for adequate representation on the Executive for all categories of workers, so that no particular section or grade obtains predominance. Also in view of the peculiar problems of unskilled workers and of women, who form a small but important proportion of the total number, the advantage of securing special representation for them in the Executive of the Mazdur Sabha need hardly be elaborated.

Principle of rotation.

184. Due weight will no doubt be accorded to the principle of rotation in the composition of the Executive Committee, without impairing the principle of continuity or sacrifice of efficiency. The essential point, it seems to us, is that the Mazdur Sabha must remain and function on a thoroughly representative and democratic basis.

Declaration of strikes.

185. The procedure in regard to the declaration of strikes is also a matter of considerable importance. The workers' right to strike is undeniable. But the strike weapon is a double-edged sword and needs to be wielded with the greatest of caution and only in the last resort. It is extremely undesirable from any point of view that lighting strikes should be declared, any more than sudden lock-outs. Both are reprehensible methods of industrial warfare and inflict injury not only on the two disputant parties, but tend seriously to dislocate industrial activity, and may, on occasions, endanger the peace of the city.

186. Strikes and lock-outs should be the last possible step in the settlement of a dispute. Strikes should be undertaken with due deliberation. In

the first instance, the Executive Committee should not decide upon a strike by a bare or simple majority of votes. Some proportionate majority, say two-thirds, should be required over a simple majority.

187. The decision of the Executive Committee in favour of the strike should be submitted for ratification to a properly constituted general body of voters of the Trade Union. The decision in favour of the strike should be by a similarly proportioned majority and not by a simple majority.

188. Voting on this matter of strike, both in the Executive Committee and in the general meeting, should not be by show of hands as now, but by the well-recognized democratic process of the secret ballot. Secrecy of voting is fundamental.

189. We were glad to note from the evidence of the representatives of the Mazdur Sabha that there is a growing realization among the workers that due deliberation should precede the declaration of strikes and that the normal method of settlement of grievances should preferably be through representation and negotiation. We are confident that in reorganizing the Mazdur Sabha its leaders will attach proper weight to the need for outlining the procedure in regard to strikes so that such direct action may not be forced upon a large body of workers by an assertive but well-organized and militant minority. The assurance was given to the Committee by the President of the Mazdur Sabha that he would have no objection to accepting the method of representation and conciliation in regard to matters in dispute and to adequate notice being given in the event of a strike becoming a necessity.

190. Mill committees may perform a useful service and be given a definite place in the constitution, provided they undertake the duty of collecting information regarding wages and general conditions of work in their respective mills. They should not, however, be empowered to take any independent action, much less declare a strike without the consent of the parent body. They should, in short, act merely as agencies to gather and supply to the Mazdur Sabha such information as the Central Executive may call for. Mill committees.

191. As regards the constitution of the Executive Committee, its present strength is fifty members, of whom only nine are outsiders. This proportion is much less than is permissible under the Trades Union Act and was accepted as a fair one by the representatives of the Employers' Association in giving evidence before us. The time must come sooner or later in India when leaders of the Trade Union movement will be found from amongst the workers themselves. But at present an outside element is both necessary and inevitable and for that reason the Trade Unions Act has made suitable provision in that regard. Executive Committee.

192. As we have already pointed out, with one or two exceptions, the employers have not only not recognized the Sabha but have consistently ignored its existence in the past, except for short periods at the end of a strike. It is only after the general strike in July last, when the membership of the Mazdur Sabha grew from 3,000 to 12,000 that any notice seems to have been taken of it by the employers. In these circumstances it is not possible to take seriously the objection of the employers that the Mazdur Sabha is not sufficiently representative of the workers. In any case, we would refer to the view of the Royal Commission on Labour which pointed out with great cogency that the argument of a Union not being sufficiently representative of the workers is unsound in principle. We would urge, therefore, that the Mazdur Sabha reorganized on sound lines, should be recognized by the employers without any further conditions being imposed. We are glad to note that the representative of the Employers' Association while giving evidence before us said that the conditions laid down in the Association's memorandum were not the final word on the subject. Recognition of the reorganized Mazdur Sabha by employers.

193. The suggestion was made to us that there should be a statutory obligation upon employers to recognize all registered Trade Unions. This is certainly not an unknown method and is adopted in a leading democratic country. Industries that receive special State protection or assistance may well be obliged to accord such recognition. We are, however, not disposed at this juncture to make such a recommendation. We feel that automatic adjustment rather legislation is more salutary in the mutual relationship of employers and workers. We are confident that both employers and workers will recognize the imperative need of this essential matter and accord to each other the consideration due. Permanent peace and progressive collaboration cannot otherwise be guaranteed.

Welfare activities
of the Mazdur
Sabha.

194. The present activities of the Mazdur Sabha include institution and prosecution of cases under the Workmen's Compensation Act for its members; a free charitable dispensary; and a library and reading room. After reorganization it should be possible for the Sabha to systematize and expand these activities and to take up some other pressing problems of the workers with the support and co-operation of the employers. One has already been mentioned, namely, the elimination of bribery and corruption. Then there are problems connected with housing, the education of the workers and their children in regard to some of which, at any rate, there should be no difference of opinion between the workers and their employers. Such co-operation will go far towards the improvement of the lot of workers, encourage joint efforts by their organization and that of the employers and thus strengthen the prospects of industrial peace. As long as our economic structure is based upon the right of personal property and the principle of private profit, divergence of interests is bound to appear from time to time. A struggle at times becomes inevitable. Unions therefore cannot afford to neglect their fighting efficiency. But that should not form their only concern.

195. We would invite the Trade Union officials to devote particular attention to the education of their members and especially of that of their children and young people. The Municipality should be called upon to assist in this matter through Trade Union representatives. Next to education, the Sabha officials must take up the problem of workers' indebtedness. Factors leading to workers' indebtedness should be thoroughly scrutinized. Public opinion should be fostered and brought to bear upon all anti-social expenses leading to indebtedness. Frugality should be inculcated through savings banks, co-operative credit societies and investment in workers' building societies. We have dealt with some aspects of the matter elsewhere in the report.

196. We would also draw the attention of the Sabha officials to the need of a statistical department as a constituent element of their Trade Union structure. Maintenance of accurate facts and figures will well repay the trouble and expense involved. "An ounce of fact is worth a ton of theory" is an adage that is especially applicable to all types of labour disputes. This is an aspect of Trade Union activity that cannot too forcibly be emphasized. The Sabha should endeavour to secure the services of men who are conversant with the intricacies and technicalities of the question involved.

Contact between
employers and
Mazdur Sabha.

197. We express the hope that when the Mazdur Sabha has been re-organized and has secured the recognition of the Employees' Association, the fears expressed before us by workmen—however ill-founded they may have been—that the Mazdur Sabha officials or members draw to themselves the hostility of the employers will completely disappear. Men should know that merely active work on behalf of their Trade Union would not jeopardize the

security of tenure of their jobs. Also the fear of espionage of the workers—they often used the “ C.I.D.” of the employers—should be completely eradicated. An atmosphere of fairplay and freedom must be created and maintained. It is only under such conditions that a healthy and helpful workers' organization can grow up. Any other attitude displayed by the employers is bound to deflect it into unwholesome and undesirable channels. The intelligent and active co-operation of the workers is an essential requisite in the conduct of modern industry. Employers in their evidence before us, we are glad to note, have begun to accept this fact.

198. The progress of the industry, many of them told the Committee, would be impossible beyond a certain limit without the active co-operation of the workers. Collaboration rather than conflict should be the new note, and employers must give every encouragement to this attitude. It is essential that contacts should be fostered between employers and workers and not brought about only when there is likelihood of friction or a dispute to be settled. Consultations for their mutual benefit and the good of industry in general cannot but produce wholesome and lasting results. It is for the employers no less than for the responsible leaders of the workers to strive for the building up of this mutual regard and thus create confidence in each other.

CHAPTER XII

HOUSING

Cawnpore the biggest industrial centre in Northern India.

199. Cawnpore has developed in recent years into the biggest industrial centre in Northern India. In 1900 its population was 172,694, in 1931 it was 219,189, and now it is estimated to be nearing 3 lakhs. The area covered by the Municipality during this period has remained the same, i.e. about 9 square miles. In one section of the city, Talaq Mohal of Anwarganj ward, the density of population is 1,229 persons per acre.

200. Besides having a large number of cotton, spinning and weaving mills, Cawnpore is an important centre for the tanning and manufacture of leather goods. There are also a number of sugar refineries, engineering works, foundries, brushware factories, oil and flour mills, jute and woollen mills, ice factories and chemical works. The total number of persons employed in all the factories is about 75,000. A number of mills namely the Cawnpore Woollen Mills, the Elgin Mills, the Muir Mills, the New Victoria Mills, Cooper Allen Co., the North-Western Tannery and the Electric Power House are situated in the heart of the city.

Housing accommodation provided by employers.

201. Very little attention was, until recently, paid to the question of housing this large and rapidly increasing population. The British India Corporation, which controls a number of important cotton, woollen and leather factories did pioneer work towards the provision of suitable house accommodation for various classes of their employees. The actual provision consists of three settlements known as (1) the MacRobertganj settlement, (2) the Allenganj settlement, and (3) the Kakomiganj settlement for the workers employed primarily in the Woollen Mills, the Cooper Allen Tannery and the Cawnpore Cotton Mills. These settlements provide accommodation for about 8,000 people. Besides these, several tanneries, sugar works and other factories also provide accommodation for a limited number for their workers. Recently, the Elgin Mills Co., Ltd., purchased over a hundred quarters from the Improvement Trust for their employees. Altogether the accommodation provided by employers consists of about 3,000 tenements which house about 10,000 persons. Details about accommodation including rents charged, in the important of the settlements, are given below :

I—MacRobertganj—

Number and type of quarters	Rent per month.		
	Rs.	a.	p.
655 single	1	4 0
105 double	4	8 0
30 double (superior)	8	0 0
12 bungalow type	16	0 0
Total number of houses—802			
Number of workmen—937			
Total village population—3,084			

The average size of single quarter is 12' x 10' with a verandah 10' x 6'.

II—Allenganj—

Number and type of quarters	Rate per month.		
	Rs.	a.	p.
72 single	1	2 0
700 single	1	10 0
50 double	3	4 0
8 double	4	0 0
14 double (superior)	5	0 0
5 4-unit	10	0 0
2 6-unit	11	0 0
4 6-unit	12	0 0
2 6-unit	17	0 0
Total number of houses—853			
Number of workmen housed—1,102			
Total village population—3,472			

The 72 single quarters with the lowest rent measure 10' x 8' with a verandah 8' x 5'3"; the other 700 single quarters have in addition a courtyard measuring 8' x 6'.

III—Kakomiganj—

Number and type of quarters				Rent per month	
				Rs. a. p.	
167	single	..	..	1	8 0
143	single	..	..	2	0 0
1	double	..	..	7	8 0
1	shop	..	..	3	8 0
5	shops	..	..	5	0 0

Total number of houses—318

Number of workmen housed—318

Total village population—1,000

Of the single quarters, there are 165 measuring 9' x 9' with a verandah 9' x 5'4"; 11 have in addition a courtyard 10' x 9'; 61 have rooms 9' x 9' and verandah 9' x 8'; 63 have built-in verandahs, fitted with doors; and 10 of similar construction also have, courtyard measuring 18'6' x 9'.

IV—Elgin Settlement—

The settlement is situated on the banks of the Ganges. The total number of quarters is 145. They are of three kinds—a room with a verandah at Re.1-2 per mensem; a room with a verandah and a walled courtyard with door at Re.1-8; two rooms with a verandah and a courtyard with door at Rs.3-8 per mensem. The last mentioned are provided with electric lights. Besides his wife and children no relations other than a widowed mother and sister are allowed to stay with an occupant. Workmen, unaccompanied by wives, are permitted to live in groups of three and four. Flush latrines are provided for both men and women.

V.—Maxwellganj Khalasi Lines Settlement for the Elgin Mills workers :—

The total number of quarters is 104. The "A" type of house has two rooms, a verandah and a storeroom with wall shelves, a pucca cooking place, a walled courtyard with door and a two-seated latrine. The rent is Rs.6-8 per mensem. The "B" type is the same as "A" but only one room. The rent is Rs.3-4. The "C" type has only one room and a verandah. Then rent is Rs.2-8 per mensem. The roofs of "A" and "B" types are flat and cemented.

VI.—Jaggeryganj (The Cawnpore Sugar Works, Ltd.)—

There are 120 houses for the sepoy, the workmen, the sweepers and the clerks. These are all rent-free. The settlement is adjacent to the factory.

VII.—Nishartganj—(The Cawnpore Sugar Works, Ltd.)—

There are 70 houses, all rent-free. The settlement is situated outside the municipal limits on a canal bank and enjoys all the advantages of open village life. Every house has a plot of land for cultivation. There are two blocks of quarters of pucca bricks and each block is made up of houses built back to back. Two rows of the quarters are of one type, with a room and verandah, and the other two have a room a verandah, and a walled courtyard. The settlement has three wells, ten kerosine oil lights and a clock.

VIII.—The Cawnpore Textiles, Ltd.—

There are only 40 quarters in this settlement, intended mainly for the sepoy and watchmen who are housed free of rent. When workmen occupy them they pay a rent of Re.1 per mensem per quarter.

202. Apart from the above, the general housing conditions are extremely unsatisfactory. The Census of India, 1921, shows that in the city of Cawnpore 62.5 per cent. of the families live in one room tenements; 24.8 per cent. in two rooms; 7.5 per cent. in three rooms; 2.9 per cent. in four rooms and 2.3 per cent. in five or more rooms.

203. Most of the workers have to live in slums locally known as *ahatas*, where small dingy rooms are let out on exorbitant rents. Most of these *ahatas* are extremely insanitary and over-crowded and lack adequate sunshine and ventilation, to say nothing of water, light and conservancy. Quite a number of huts are under the street level. The conditions under which men, women and children in their thousands—about 40,000 souls—live in these *ahatas* are indescribable. The space within each tenement where the worker with his family lives, often numbering 8 to 10 persons, is smaller than the space we usually have in our bathrooms. An animal, specially if it be a horse or a cow is given more room than the poor owner. A night visit for a stranger to these areas is a positively risky undertaking a sprained ankle is almost a certainty, while a broken neck by stumbling into a blind well, or a goodly-sized hole, would not be an impossibility. Even the elementary service of public lighting is denied to these people. As for drainage and water-supply, such luxuries are thought to be superfluities. The underground rooms, in which thousands of Cawnpore workmen live, reminded one of the members of the Committee of the "dug-outs" of France during war-time. While the slum-dwellers would be somewhat protected from shot and shell in the event of an aerial bombardment, they are but an easy victim to those ever active enemies of mankind, namely, the germ and the bug. These have wrought havoc especially amongst the ranks of infants, the young and the women. The rate of infant mortality in Cawnpore is still appallingly high. The paradox of the situation is that the *ahata*-owner, who has done the least for his tenants, stands to gain the most at the time of acquisition of land either by the Municipality or the Improvement Trust. The entire situation is iniquitous. It should not be permitted to continue a day longer than possible. Little wonder that the so-called agitator in Cawnpore has such widespread and whole-hearted response from the labouring classes. The wonder is that they have kept silent for so long.

204. The pathos of the position is deeply impressed upon one's mind when one actually visits these workmen's quarters and spends some time in their homes. Far from within, these hovels are spotlessly neat and clean. We have not found the houses of the well-to-do people neater. We know several which would not be considered as clean. On the walls within and without there are to be seen drawings of human and animal figures, and floral decorations, all giving expressions, be it however so primitive, to the inherent instinct for beauty in these slum-dwellers. Animal pets are also kept with great care and devotion. Wherever possible tiny plots of kitchen vegetables are grown with skilled attention. There is great richness of creative instinct within our workpeople. If only they could be given the opportunity to express and develop it! The frequent processions and endless shouting of slogans and the parading of streets are but manifestations of a restless energy which needs opportunities for expression. None could equal the absorbing outlet that good housing with garden plots could provide. What we saw in the Gutaiya area, developed by the Improvement Trust, convinces us beyond a shadow of doubt, that workmen have to be provided with such facilities, if Cawnpore is to enjoy civic security and tranquillity.

205. There are about 200 such *ahatas* within the municipal limits which provide living accommodation to a very large number of people. They have existed in manifest contravention of municipal by-laws with regard to ventilations, building, water-supply, conservancy, etc. They must be hot-beds of disease and judged on accepted standards of health most of them are absolutely unfit for human habitation. Both the Chairman and the Executive Officer of the Municipal Board in their evidence before the Committee deplored this state of affairs, but pleaded helplessness in the matter, firstly because of powerful vested interests and secondly because of the lengthy and uncertain legal procedure involved.

206. The Improvement Trust has now earmarked a separate area outside the city proper on the Kalpi Road for mills and factories. A number of factories have already been set up in this area and the workers employed therein reside either in the surrounding villages or in the workmen's dwellings constructed near about in the area not apart by the Improvement Trust for the purpose. The Executive Officer of the Improvement Trust stated in his evidence before the Committee that this area would provide house accommodation for about 40,000 people. At present, however, there is a distinct shortage of workmen's houses, resulting in congestion and high rents.

Efforts of the Improvement Trust.

207. The Committee attaches the greatest importance to the question of housing. We have been unable to get any definite figures to establish the relation between good housing and efficiency of work, but we have it on the authority of Mr. A. L. Carnegie, who has 30 years' experience of the problem that the incidence of sickness amongst workers living in the settlements is substantially lower than amongst those living outside, particularly during August and September when malaria is prevalent and that their general record of attendance is also more satisfactory. We firmly believe that better housing and better efficiency go together and it is therefore of the utmost importance to devise suitable means of meeting the housing needs of the industrial workers of Cawnpore.

Relation between housing and efficiency.

208. The problem is clearly two-fold. The first is to improve or reconstruct the existing workmen's dwelling which fall below the minimum standard of health and sanitation. This will apply to most of the existing *ahatas* in the city proper as well as to many so-called temporary quarters set up by private individuals outside the city limits. The second and more important problem is to construct model workmen's dwellings both within the city as well as in the new industrial area. These dwellings should be designed to provide the maximum of comfort on the least possible outlay and be within the reach of the lowest classes of workers.

The housing problem.

209. As regards the question of dealing with the existing *ahatas* it is desirable that determined action should be taken to improve or acquire and refashion them. A joint committee of the members of the Municipal Board and the Improvement Trust styled the Slum Clearance Committee has been formed, and we understand that a list of 15 of the worst *ahatas* has been prepared so that they may be taken up first. Schemes for acquiring them are said to be ready and will be considered shortly by the Improvement Trust. Action on these lines should be pursued with determination and persistence. What is necessary is the provision of funds to meet the losses in acquiring and improving the slums and a suitable amendment of section 25 of the United Provinces Town Improvement Act providing for a less cumbersome procedure in dealing with the matter. Under the

Action to deal with existing *ahatas*

existing law, the preparation of a detailed improvement scheme with complete plans and estimates is necessary before Government will sanction a slum acquisition proposal. The number of slums is large and the preparation of schemes in detail takes considerable time. A simplification is therefore necessary by which the necessity for detailed schemes will be done away with and the Trust will be authorized to assume powers under section 49(1) of the United Provinces Town Improvement Act and prevent further undesirable constructions in the *ahatas*. The Trust has already moved the Government for amending section 25 of the Act and we support that request. As we conceive it, the general plan of action will be that the *ahata*-owners will first be persuaded to improve the *ahatas* themselves according to the Trust design, but if they fail to do so within a specified time no time should be lost in undertaking the acquisition and improvement proceedings. Not only should this procedure result in better progress in the absence of adequate finances, but it is probable that the *ahata*-owners who may not like to part with their property will welcome it.

New dwellings to be constructed by Improvement Trust.

210. As regards the new dwellings to be constructed, local bodies have constructed houses for industrial workers in several foreign countries out of loans raised directly or by the State. There is no reason why the same should not be possible in Cawnpore. Both the Chairman, Municipal Board and the Executive Officer, Improvement Trust consider the need for industrial housing imperative, and expressed readiness to undertake the work provided Government could make available the necessary funds and invest them with reasonable powers to administer the scheme. Since the Improvement Trust has undertaken construction work on a large scale within recent years and is fully equipped with technical staff for the purpose this work may suitably be entrusted to it, with this provision that there should be some representative of the workers on the Trust. Men in whose interest the houses are being constructed should be consulted. The Mazdur Sabha or the Workers Building Co-operative Society, if such a body should be revived once more in Cawnpore, would be the fittest channel of representation.

Money to be raised by loan.

211. The Executive Officer of the Municipal Board considered that a loan of rupees three crores would be needed to solve the housing problem in Cawnpore. On the other hand the Executive Officer of the Improvement Trust placed before us a more modest scheme involving a loan of rupees fifty lakhs. The full details of these schemes we need not discuss in this report. According to the rough estimates given by the Executive Officer of the Improvement Trust workmen's quarters consisting of a room 12 feet x 9 feet, a verandah 12 feet x 7 feet and a courtyard 12 feet x 10 feet will cost Rs.475 each including the cost of land, overhead charges, water, conservancy, etc. When the houses are constructed on a large scale further economies will be possible. By judicious planning and rigid economies it may be possible to bring down the cost to about Rs.400 per house. If double-storeyed houses are constructed within the city limits, the cost may be still further reduced. Houses of a better type consisting of an additional kitchen or also an additional room, a separate water tap and latrine can also be designed for superior grades of workmen. These may cost Rs.600, Rs.800 or Rs.1,000 each. Houses of various types could be constructed in blocks of 20 to 50 houses, each block having separate water-taps, latrines and open spaces. If a sum of rupees ten lakhs per annum is placed at the disposal of the Improvement Trust, about 2,000 cheaper and 500 superior quality houses can be constructed every year, and in five years there should

be available about 13,000 houses giving accommodation to approximately 40,000 persons. Taking the present conditions of the money market into account it should not be difficult to float a loan repayable in about 20 years at 3 per cent. interest. If the sort of houses that we have proposed are let out at rents varying from Re.1-4 to Rs.3-8 per mensem according to size, the realizations should cover the interest and depreciation charges. We strongly recommend, therefore, to the Government to float a loan for the purpose of providing suitable dwellings for industrial workers in Cawnpore.

212. The Improvement Trust has already constructed about 200 model workmen's quarters. Half of this number has been sold to Messrs. Elgin Mills Co., for the use of their workmen and the rest have been sold directly to workmen themselves on a 12 years' hire-purchase system. From the evidence led before us it appears that the hire-purchase system has been popular but there are considerations which seem to us to qualify the advantages of extending facilities of purchase to individuals. Outright sale carries with it the inevitable risk of the house passing from the hands of the original purchaser to those of one belonging to a class for whom it is not intended. Purchase facilities should, in our opinion, be restricted to genuine house building Co-operative Societies such as may be started by the Mazdur Sabha. We contemplate that the majority of the houses to be built by the Improvement Trust under the scheme proposed by us should be built for renting to the workmen. In order to enable the Trust to do this provision will have to be made legislatively to invest it with powers to collect the rents expeditiously. If it has to resort to the lengthy and tedious process of the civil court to collect rent from or obtain ejectments of the defaulting tenants, the scheme is bound to fail. A suitable remedy will be to invest it with powers similar to those possessed by the Municipal Board to collect taxes and we commend this proposal to the notice of the Government. Another burden from which the Trust will have to be freed is municipal taxation to which property owned by the Trust will be subject under the present rules. Under the existing rules a house or a set of tenements having a letting value of Rs.6 or more per month has to pay a tax to the Municipal Board on a graded scale. We recommend that the property owned by the Improvement Trust which is used exclusively for housing the industrial workers should be exempted from this tax.

New houses should be built for rent. Administrative powers to Improvement Trust.

213. A number of employers of labour explained during their oral examination by the Committee that the Improvement Trust and the Municipal Board had not co-operated with them in providing suitable house accommodation for their workers. It was suggested that if the Improvement Trust were directed to make available suitable plots of land at a special rate and the Municipal Board could provide water and sewage facilities, many employers of labour would be willing to construct model workmen's settlements in Cawnpore. In particular Mr. H. Horsman of the Swadeshi Cotton Mills offered to build quarters for 5,000 workmen if the Municipality could provide sewage and water-supply. This is certainly one method of solving the housing difficulty. The existing workmen's settlements constructed by the employers in Cawnpore are definitely superior to private houses available in the town and are besides distinctly cheaper. The workmen living in these settlements are also better looked after and have facilities of medical aid, education and sanitary arrangements which are not available elsewhere. We think, however, that if the Trust would be responsible for the scheme for building colonies, it would be a better proposition than allowing private

Building facilities to private persons.

speculators to profiteer at the expense of the poor workers or even allowing employers to build quarters. However good the intentions of an employer may be, the workers are at a disadvantage in living in quarters provided by them. They cannot feel absolutely free in such colonies; rightly or wrongly they feel that they are under some sort of surveillance. During a strike they are liable to be turned out, although no employer has done it in Cawnpore. Psychologically also it is not good for a worker to feel that he is under some restriction or other imposed by the employer not only during the working hours but also for the rest of the day.

Transport
arrangements.

214. We would like to see the relief of congestion in the over-crowded areas of the city by the development of the new Factory Workmen Area, under the Improvement Trust. The movement of the work people will be facilitated by a cheap and quick bus transport service developed between this area and the other mills situated within the municipal areas. For, it is for obvious reasons that men wish to live as near to their place of work as possible. This matter of the bus service should not prove difficult of solution. There is already the municipal bus service in existence. Arrangement with mill authorities for the transport of their workmen could be worked out. In any case, the transportation problem has to be considered in close relationship with the housing difficulty. In Cawnpore, as in most other congested industrial cities, the two are intimately connected with each other, and should command careful consideration.

Provision for
open spaces.

215. We would also wish to indicate that in the Factory Workmen's area scrupulous care should continue to be exercised to maintain sufficient open spaces for parks and playing-fields and other requisites for the institutional and co-operative life of modern cities. The planning out of workmen's dwelling areas should not be considered merely from the point of view of brick and mortar, but should be considered from the larger and broader aspect of the citizen of the future, who will be demanding and desiring a richer and fuller life. Houses are erected not for the day, but for the generations to come.

216. We would like to conclude this chapter with a pregnant statement from one of the great English authorities on the subject, and leave it for the reflection and we trust also the action, of those who are in authority in one way or the other for the good of the working classes. The statement reads "no housing evils are necessary none need be tolerated. Where they exist, they are always a reflection upon the intelligence, right-mindedness and moral tone of the community."

CHAPTER XIII

Labour Welfare

217. Modern methods of production in big factories have put an end to the personal relationship between the employer and his workmen characteristic of the earlier systems of production where the workman apprentice used to work with the artisan in his house under more or less homely and human surroundings. In the present complex organization of production, the individual proprietor or the shareholders rarely have any personal contact with the workers. Even the Managing Director or the Manager is surrounded by such a large and varied class of overseers and has to look after such an ever-increasing and pressing variety of technical, administrative and financial problems that personal contact between the employer and the employees is hardly possible. The modern *entrepreneur* or captain of industry is a hard-worked individual. He is involved in the study of things and situation rather than in the direction or development of the human factor in industry. Modern industry has been depersonalized, if not actually dehumanized. It is one of the basic reasons for friction and strife in industry.

Absence of personal contact between the employer and the employee in modern factories.

218. Under these circumstances, the good employer, in order to improve the lot of the worker, provides some recreation and amenities of life. The growth of competition with producers in other countries and at home, however, has necessitated the concentration of all the energy and ingenuity of the management on reducing expenses of production and distribution rather than on the betterment of the conditions of labour. The gross illiteracy among the workers coupled with low wages, unemployment, inefficiency and lack of organization intensify the separatist tendencies between the employers and the employees. With a view to provide some bounds of mutual interest and sympathy, employers in Western countries have often spent their accumulated fortunes in providing comfortable conditions of life and work for their employees. The numerous garden-cities and industrial suburbs scattered over England, the United States and the Continent serve to remind one of their benevolence, sense of humanity and fellow feeling. Even in India many employers have spent large sums of money to provide suitable dwellings and other amenities of life to their workmen. In fact it is being realized that the welfare and contentment of the workers may not be looked upon merely as a humanitarian and charitable proposition. It is in many ways a profitable expenditure or an investment in so far as a contented healthy and intelligent labour force is a great asset to industry. Far-sighted and enlightened employers, therefore, not only cater for the housing, medical relief and recreation of their workers, but also welcome organization, education and enterprise among them.

Value of labour welfare work to employers.

219. We have dealt with the question of housing in a separate chapter and will therefore confine ourselves here to other welfare activities.

Scope of this chapter.

220. In Cawnpore the British India Corporation led the way by establishing three workmen's settlements, namely MacRobertganj for the employees of the Cawnpore Woollen Mills, Allenganj for the employees of the North-Western Tannery and the Cooper Allen Boot Factory and Kakomiganj for the employees of the Cawnpore Cotton Mills. They are

Welfare work by employers in Cawnpore.

justifiably proud of these settlements which provide house accommodation for 2,358 workmen or about a third of the total employees of these mills. The accommodation available in these settlements is distinctly better and cheaper than that available in private *basties*. The settlements are, besides, clean and sanitary a feature conspicuous by its almost entire absence in private *basties*. Education is provided free in boys', girls' and night schools maintained by the Corporation. Medicine and medical attendance are also available to the residents free of cost. Free milk is distributed to children and also food and clothing to specially necessitous cases from time to time. A fully qualified doctor is in charge of each of these settlements. Co-operative Societies have also been organized. Detailed information regarding welfare work under the British India Corporation settlements is given below :

	MacRobertganj	Allenganj	Kakomiganj
I—Education—			
(1) Enrolment in boys' school	177	120	..
(2) Enrolment in girls' school	186	97	..
(3) Enrolment in night school	65	34	..
II— Medical Aid—			
(1) Cases treated in male dispensaries during last year.	12,770	8,488	..
(2) Cases treated in female dispensaries during the last year.	10,887	1,706	18,226
(3) Cases in baby welfare centres during the last year.	3,810	6,956	3,698
(4) Cases treated in mill dispensaries ..	34,214	80,448	62,717
	Lalimli	Cooper Allen	Kakomi
III—Co-operative Societies—			
(1) Number of shareholders	504	642	870
(2) Loans advanced during the last financial year.	Rs.42,988	28,422	42,728
(3) Reserve Funds	Rs.9,779	1,189	2,862
(4) Rate of interest per annum*	12 per cent.	9 per cent.	2½ per cent.

* 6½ per cent. charged on loans for building purposes

Messrs. Begg Sutherland & Co. also finance welfare activities among the employees of the Cotton and Sugar Mills, Brushwares and the Electric Supply Corporation under their charge. These activities have been placed under the charge of the Y.M.C.A. (the present secretary being Mr. Manohar Lal who has been incharge of the work for some years). They conduct boys' and girls' schools, distribute milk to school children and organize indoor and outdoor games, sports, dramas, etc. Medical attendance is also provided free of charge to workmen. Messrs. Juggilal Kamlapat, another important factory group in Cawnpore under the direction of Mr. Padampat Singhania have started a club for the recreation of the workers. They held an annual sports meet. This is a great event. One striking feature of this annual function is that women also participate. This should be encouraged more. They have also recently acquired a big plot of land from the Improvement Trust where they intend to set up model houses for various classes of workers.

Messrs. H. & A. Horsman of the Swadeshi Cotton Mills Co. have made a munificent donation of Rs.3 lakhs for the construction of the Ursula Horsman Memorial Hospital which has just been completed and provides the most modern conveniences for the treatment and care of the poor.

221. The pioneer work in the field of labour welfare has thus been done in Cawnpore through the generosity and far-sightedness of some of its industrial magnates. But what has been accomplished is nothing as compared to what is required. There are about 75,000 industrial workers in Cawnpore today. The welfare work organized by factory owners does not reach a great majority. The conditions of housing, sanitation, water-supply and conservancy for most of the other workers are appalling. Education and medical relief are of the most primitive type and recreation facilities there are none. The average worker starts with debt which he secures from the Kabulee, the mistri or the bania who alike manage to keep their principal intact from month to month and year to year in spite of substantial contributions from the workers' monthly or fortnightly earnings. The only relief available to the worker from the dirt and squalor of his house and its surroundings and the clutches of the money-lender is the liquor or the grog shop. To raise the worker from degradation and disease it is necessary not only to provide cheap and sanitary house accommodation and clean and healthy surroundings, but also wholesome and healthy recreation, medical relief and education. It is necessary that the State and the municipality should come forward to relieve the sufferings of the factory workers whose importance to national and municipal economy none can deny. It also should be borne in mind that with the shortening of the working day, and consequent increasing leisure at the disposal of the worker, steps should be taken in time to create amenities which the worker can utilize gainfully. Idle hands are otherwise apt to find unhealthy and anti-social outlets. Utilization of leisure for pleasure and for profit requires planning. It cannot just be left to hazard.

Extent of work
hitherto done.

222. It is a matter for satisfaction that Government have come forward with a modest grant of Rs.10,000 in the present budget to provide some amenities of life to the workers. This grant deserves to be continued and substantially increased with a view to start a number of well-equipped welfare centres for the moral and material improvement of the workmen. The administration of the money has been vested in a welfare committee consisting of the Director of Industries and Commerce, the local M.L.A.'s and M.L.C.'s and a representative of the Municipal Board and the Labour Officer, who acts as Secretary. Four welfare centres have been started at Gwaltoli, Deputy-ka-Parao, Juhi and Jarib-ki-Chowki. The work of each centre is controlled by a paid organizer with the help of an assistant. Mr. Suraj Prasad Avasthi, M.L.A., the representative of unorganized labour in the Legislative Assembly has been appointed the Honorary Chief Organizer to supervise and co-ordinate the work of the various centres.

Welfare work
undertaken by
Government of
United Provinces.

223. Each welfare centre has an allopathic dispensary with a whole-time compounder and a part-time qualified doctor incharge. A reading room, a library and a gymnasium are also attached to each centre. It is intended to organize sports, picnics and welfare entertainments for the benefit of the workers in each centre. It is also proposed to arrange useful talks on subjects like health, cleanliness, co-operation, education and organization with the help of the microphone and magic lantern for the instruction and benefit of the workers. On the representation of the Welfare Committee the local Municipal Board has passed a resolution sanctioning a sum of

Rs.500 per month for the distribution of milk to working class children and for the supply of warm clothing to labour class women in confinement through the Government welfare centres. Much will depend upon the personnel and qualifications of the staff available and the amount of zest which they put into their work. But there can hardly be two opinions as to the usefulness of the project which deserves all encouragement. We should, however, very much wish to make the Welfare Committee more comprehensive. We are convinced that room on the Committee should be found for Employers' representatives. Welfare work is a type of activity where the largest measure of co-operation between employers and men can be secured. Full advantage should be taken of this. Hence employers' representatives should be given adequate representation.

224. We feel that the educational institutions which have experience of welfare work should be brought into close touch with these activities. In the local educational institutions enough men of ripe and rich experience can be found, who could with distinct advantage be made members of this committee. Their presence would be a desirable and at the same time a valuable addition to the Committee.

225. The Y.M.C.A. throughout India have rendered helpful service in this field. In many ways they were the pioneers of such activities. At various industrial centres they have much developed work, which is being efficiently carried on. We suggest that they should be given representation on the committee. Their trained assistants should be enlisted in this direction.

226. The Seva Samiti should also be included in this committee. They have much valuable experience to offer in this connection.

227. Athletics form a very large part of welfare work. It is good that this is so. We therefore suggest that the United Provinces Olympic Association should be linked with the welfare activities in Cawnpore. We suggest that the Secretary of the Cawnpore District Olympic Association should be given a place on the committee. This is a very necessary addition.

228. The Rama Krishna Mission have rendered commendable work in ministering to the sick. This useful work should be recognized. They should find a place on the committee. Their varied and valuable experience will supply much strength to the committee.

229. In view of the increasing attention paid to balanced diets it will be appropriate to have on the committee at least one who has had the benefit of training in dietetics facilities for which exists in more than one centre in India.

230. A welfare work committee without women on it is but a one-sided affair. One of the reasons of the great success of welfare work in Bombay has been due to the active participation of women in this type of work. We hope the enlightened ladies from Cawnpore may find place on this committee. They will import keenness and zest into the work and grace which men are incapable of achieving, however much they may wish it.

231. We, therefore, suggest a general Welfare Council, where all these interests can be combined for this whole purpose and then a representative Executive Committee.

232. It is satisfactory to note that the United Provinces Government have brought forward a Bill providing for the payment of maternity benefits to women employed in industry both before and after confinement for a total

period of 8 weeks. The necessity of such benefits has been emphasized time and again by the International Labour Office, the Royal Commission on Labour and other authoritative persons and bodies.

233. Another important direction in which attention may be directed is maternity and child welfare. The Red Cross Society had generally taken up this work with the assistance of funds from the Municipal Board. It is, however, desirable to extend further these activities and to have an organization of health visitors and child welfare centres in important centres of industry like Cawnpore for the medical examination of industrial workers and their children. These centres might also form the nuclei of systematic propaganda on diet, prevention of disease and general principles of health. These centres have largely to be organized and financed by big employers of labour or important factory groups. Financial assistance might also be given by municipal authorities and provincial Governments for approved schemes, subject to inspection, supervision and maintenance of reasonable standards of efficiency. Arrangements should also be made by Government for the training of health visitors and midwives for employment in these centres.

Maternity and
Child Welfare work

234. We have been particularly impressed by the great want of adequate arrangements for medical assistance to working class families. The ravages of malaria, tuberculosis and respiratory diseases among the industrial population are responsible for loss of efficiency and irregularity of attendance. Medical facilities are no doubt available in some measure at factories but these are generally inadequate. It is, therefore, desirable to examine the possibilities of a regular scheme of sickness insurance for industrial workers. As the Royal Commission on Labour has pointed out, the incidence of sickness in India is substantially higher than in the West. The wages generally paid make it impossible for most of the workers to get through more than a very short period of illness without borrowing. The Commission have recommended a scheme of sickness insurance by the employer on a contributory basis by small deductions from wages of the workers. We unhesitatingly endorse that recommendation for adoption in Cawnpore. One witness suggested a contribution of 2½ per cent. of the wages earned by the workers and an equal amount to be subscribed by the employers for the purpose. The scheme deserves further consideration. There is no doubt that it could be worked. It will, however, be necessary to collect much more detailed statistical data before the details could be filled in. Organization and expansion of the medical arrangements will also be necessary. Probably the State should also make some contribution to the scheme, either directly or by the provision of a larger number of free dispensaries in workmen's areas.

Sickness insurance.

235. We are anxious that some provision should be made for the worker in his old age. We, therefore, suggest a contributory Provident Fund Scheme. This too is not an innovation. We indicate the broad lines on which this may work. Modifications may be introduced by the Employers' Association in consultation with the Mazdur Sabha.

Provident Fund
scheme.

236. Since we have suggested in an earlier chapter that the minimum wage should be Rs.15 in the textile industry, it follows that no adult male worker will get less than this amount. Those receiving this wage and above will contribute every month half anna per rupee of wages earned, and the employers will add an equal amount. No worker would be entitled to receive the employers' contribution until he has put in at least ten years' service, or is discharged earlier for physical disability or in consequence of rationalization or retrenchment. But in cases of dismissal, no forfeiture of

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the employer's contribution should be assumed, unless the employer has obtained an award to that effect from the Conciliation Officer. Similarly, in cases of voluntary resignation, the primary responsibility for proving the claim to the employers' contribution rests on the worker. We need hardly add that the Provident Fund should be duly invested by each employer in accordance with rules to be made for the purpose. All women workers receiving less than Rs.15 will be exempted from making any contribution, but will be entitled to receive the employers' contribution.

Protection of
indebted workers.

237. More than one witness pointed out the necessity of protecting industrial workers from molestation and intimidation by unscrupulous money-lenders whose methods and practices are too well known to need description. We ourselves attach great importance to the solution of the problem of indebtedness amongst the industrial workers. The exorbitant rates of interest charged and the rough and ready methods adopted by some classes of money-lenders need to be definitely controlled, and we recommend that a measure for the protection of debtors somewhat on the lines of the Central Provinces Protection of Debtors' Act of 1937, be immediately considered by Government. The main features of that Act are that molestation of a debtor by a creditor has been made a cognizable offence punishable with imprisonment up to three months or fine up to Rs.500, and molestation has been so defined as to include the use of violence, intimidation, persistent following about and loitering near a debtor's residence or his place of work. There is a more restricted Act in force in Bengal, but the Central Provinces Act is of wider application and we would prefer action on the Central Provinces lines in order that it may be effective. At the same time the formation of co-operative societies for lending out money at reasonable rates of interest should be fostered.

Co-operative
stores and
canteens.

238. In another direction also the co-operative principle must be applied, namely the formation of co-operative stores in each mill. The establishment of canteens is another matter which should engage the attention both of the employers and the workers. Pure and wholesome food at the cheapest rates should be provided, as is in fact being done at several industrial centres. These canteens may be utilized also as centres for propaganda in regard to cleanliness, nutrition, etc.

CHAPTER XIV

Labour and Industrial Statistics

239. The need for detailed and accurate statistical data regarding earnings and expenditure of factory labourers as also prices, employment, labour turnover, industrial disputes, etc., has been stressed from time to time by various committees and commissions appointed by Government. We have ourselves indicated in our report how very seriously we have been handicapped in our inquiry for lack of sufficient and reliable statistical information and other data. In the absence of such details conclusions, however carefully arrived at, cannot be precise. Statements and counter-statements were made before us by the Employers' Association and the Mazdur Sabha regarding the rates of wages, bonuses and allowances which we were not in a position to confirm or challenge. It is imperative both in the interests of labour and of industry in general that systematic information should be collected and published on various problems affecting them by an impartial authority. From the point of view of Government also it would be extremely helpful to have accurate data so that prompt and remedial action may be taken at the proper time. Our Committee was greatly handicapped in its work by the lack of precise material regarding wages and cost of living without which it is not possible to form any precise idea of the adequacy of prevailing wages. We consider it absolutely necessary that detailed statistics should be collected, maintained and published periodically by Government.

240. We would therefore strongly recommend the establishment of a regular Labour Office on the lines of the Bombay Labour Office for the collection and publication of information regarding labour conditions and welfare. In this connection, we would suggest, further, that an officer may be deputed for a reasonable period to Bombay, to study the working and constitution of its Labour Office. As soon as possible thereafter, a detailed wages census should be undertaken in Cawnpore, and in other industrial towns to obtain accurate information regarding attendance, turnover of labour, rates of wages, actual monthly earnings, bonuses, allowances, fines, etc. It seems to us also desirable to collect information regarding prices and the cost of living with a view to measure the standard of living of the workers and to see how far wages have kept pace with the cost of living. The information so collected should be carefully compiled and published for general information. It will be desirable to keep this information up-to-date by periodical inquiries. Another detailed census may be necessary after a period of say five to seven years.

241. Statistics of the number of factories of each class together with the number of persons employed in each are published by the Chief Inspector of Factories. Information regarding rest, intervals, holidays and hours of work in these factories is also given. Statistics of the number of accidents, strikes and lock-outs and the number of factory inspections carried out by the Factory Inspectors together with the number of convictions obtained for violations of the provisions of the Factories Act are also maintained by him. The information, is, however, of a bald nature and needs to be presented in an intelligible and readable form. It is for example important to know the number of persons employed during the day and the night and the variations

in attendance from season to season. In the case of industrial disputes, detailed information regarding the causes of such disputes, the terms of settlement and the loss to labour and industry in the form of wages and production needs to be ascertained and published. The number of members of registered Trade Unions is recorded by the Chief Inspector of Factories. It is desirable, however, to have further information regarding the constitution of such Unions; the benefits, if any, conferred by them on their members; the subscriptions realized and other relevant details. It is also desirable to have some information regarding Unions which are not registered.

Statistics maintained by the Municipal Board.

242. Statistics of births, mortality and disease are collected by the Municipal Officers of Health. This information, however, is not classified according to the nature of the population. It will be useful to analyse the incidence of mortality and disease amongst industrial workers. Statistics of the number of persons treated for various diseases at municipal and other dispensaries, if systematically compiled, will yield valuable information on the prevalence of sickness among various classes of people and possibly suggest the need for special measures of prevention and cure.

243. Statistics of the number of houses per acre and the number of occupants per house and per room were collected at the time of the 1921 and the 1931 censuses. But no attempt has been made to compile such statistics annually by municipal boards. In view of the grave congestion and insanitation in the city, it seems desirable to undertake a comprehensive survey of housing conditions in Cawnpore. Such a survey is likely to be of great value in determining the policy and line of action that can most usefully be pursued and besides help welfare workers and health visitors in their work. Records of rent for different types of workmen's houses should be maintained. The rise and fall of rent is a very important matter intimately connected with the health and comfort of workpeople and their families. The rent behaviour, as it were, should be ascertained over a period of years.

244. We give below a detailed list of subjects and heads under which statistical data should be collected and maintained by Government :

Detailed list of subjects under which statistics should be collected.

PRINCIPAL HEADS OF LABOUR STATISTICS

I—Wholesale and retail prices—

(1) Wholesale prices, raw material and manufactured goods—cotton, gur, oilseeds, oils, ghee, tobacco sugar, coal, hides and skins, leather, iron and steel, yarn, textiles, metals, machinery building materials, etc.

(2) Retail prices, consumption of goods—Wheat, wheat flour, barley, gram, rice, maize, *juar*, *bajra*, *bejhar*, pulses (*urd*, *arhar* and *mung*), sugar *gur*, *ghee*, mustard oil, castor oil, kerosene oil, milk, meat, salt, potatoes, firewood, coal, matches, shirtings (*markin*), *dhotis* (Muir) and bar-soap.

Employment—

(1) Number of workers employed in factories—

- (a) men,
- (b) women, and
- (c) children.

(2) Number employed during day and during night.

(2) Classification of workers by occupation.

(4) Classification of workers by literacy and technical qualification.

(5) Unemployed workers of various grades.

III—Wages—

- (1) Rates for piece-work.
- (2) Average wages of various classes of workers—
 - (a) Time-workers.
 - (b) Piece-workers.
- (3) Bonuses, allowances, overtime, pay, etc
- (4) Fines and other deductions from wages.
- (5) Average attendance.
- (6) Period and method of payment.

IV—Cost of living—

- (1) Heads of expenditure.
- (2) Weights allotted per head.
- (3) Indices of cost per head.
- (4) General Index number of cost of living.

V—Sickness and Mortality—

- (1) Statistics of sickness—
 - (a) Number of persons treated for principal diseases.
 - (b) Rates per mille of population.
- (2) Statistics of mortality—
 - (a) Number and rate of births, deaths and causes of deaths by sex, age and *chaks* (municipal sub-wards).
 - (b) Number and rate of infantile and maternal mortality.

VI—Education and Welfare—

- (1) Education—
 - (a) Number of institutions and scholars—adults, boys, girls, average number of scholars attending.
 - (b) Source of finance—
 - (i) Private funds.
 - (ii) Municipal grants.
 - (iii) Government aid.
 - (iv) Fees charged.
 - (c) Nature and standard of education imparted.
 - (d) Reading rooms and libraries.
- (2) *Facilities of medical aid—*
 - (1) Public dispensaries—
 - (a) Allopathic. Number of dispensaries and number of cases treated.
 - (b) Homœopathic. Number of dispensaries and number of cases treated.
 - (c) Ayurvedic. Number of dispensaries and number of cases treated.
 - (d) Unani. Number of dispensaries and number of cases treated.
 - (2) Private practitioners—
 - (a) Allopathic. Number of dispensaries and number of cases treated.
 - (b) Homœopathic. Number of dispensaries and number of cases treated.
 - (c) Ayurvedic. Number of dispensaries and number of cases treated.
 - (d) Unani. Number of dispensaries and number of cases treated.

(3) Maternity and Child Welfare—

(a) Number of centres.

(b) Cases attended at each centre.

(4) Gymnasiums.

(5) Other Welfare work.

VII—Housing conditions and rents—

(1) Classification of houses and inmates.

(2) Number of tenements provided by—

(a) Employers.

(b) Municipality.

(c) Improvement Trust.

(d) Others.

(3) Conditions of sanitation, ventilation, lighting, water-supply, conservancy and roads.

(4) Rents—

(a) Settlements.

(b) Private Ahatas.

(c) Municipal quarters.

(5) Playgrounds and open spaces.

VIII—Hours of labour—

(1) Working hours and intervals.

(2) Number and arrangement of shifts.

(3) Overtime work.

(4) Holidays.

IX—Accidents and compensations—

(1) Number of accidents, fatal, serious and minor.

(2) Amount of compensation allowed in each.

X—Absenteeism—

(1) Sickness.

(2) Compulsory leave and play-off.

(3) Other causes.

XI—Conditions of work and recruitment—

(1) Methods of recruitment.

(2) Number of dismissals and discharges—

(a) For rationalization.

(b) For reduction in work.

(c) Summary dismissals.

(d) Other dismissals or discharges.

(e) Resignations.

(3) Fines.

(4) Facilities of latrines, drinking water, places of eating, cresses, medical aid, etc., inside the mills.

(5) Conditions of leave for maternity, sickness, etc.

(6) Miscellaneous reports.

XII—Trade Unions—

(1) Names, organization and strength of registered Unions.

(2) Other Unions.

(3) Subscription rates and funds.

XIII—Trade disputes—

- (1) Nature, duration and cause of strikes and lock-outs.
- (2) Number of workmen involved.
- (3) Loss in wages, working hours and production.
- (4) Method and terms of settlement.

XIV—Statistics of industrial production—

- (1) Number and size of factories of each class.
- (2) Details of production number of quality.
- (3) Wage bill—
 - (a) For workmen.
 - (b) For supervising staff.
 - (c) For clerical staff.
- (4) Profit and Loss Accounts—
 - (a) Capital invested.
 - (b) Gross profits.
 - (c) Depreciation and Reserve funds.
 - (d) Net profits.

CHAPTER XV

Summary

Scope of the chapter.

245. In conclusion we might usefully summarize our findings and proposals, and examine as far as possible their financial effect.

Our procedure.

246. In Chapter I we have given a brief account of the dispute which gave rise to our Committee and outlined the procedure followed by us in conducting our investigations into the questions referred to us for determination. We have explained our handicaps, and the causes of the delay in the inquiry.

Wage cuts.

247. In Chapter II we deal with the wage problem. The respective cases of the Mazdur Sabha and the Employers' Association have been set out in detail. Thirty-one categories of occupations in cotton textile mills were selected for a detailed examination. These categories may be taken to be representative of the entire working population in the sense that they account for over two-thirds of the total number of operatives. As explained in para. 48, we have been unable to make a proper comparison of the present wages with those prevailing in the previous years. The material at our disposal was not enough to draw any general conclusions of a positive character. An analysis of the statements furnished showed, however, that in 12 categories there was a decrease in monthly earnings, while 18 showed a rise. The decrease varies from 22.6 per cent. to 0.6 per cent. while the increase ranges from 55.4 per cent. to 0.3 per cent.

Our proposal regarding increment in wages.

248. We have then dealt with the position of the textile industry at Cawnpore, and come to the conclusion that not only has it expanded considerably since 1929, but that it is in a strong and healthy position. We have examined the disparity in the wage levels between Cawnpore and Bombay and found no justification for the markedly lower level in Cawnpore. We have therefore recommended that there should be a general rise in the wages of all the workers. We have divided the workers into five wage groups and suggested a graded increment from $2\frac{1}{2}$ annas in the rupee in the case of workers getting between Rs.13 and Rs.19 per mensem to half-an-anna in the rupee in the case of workers getting between Rs.40 and Rs.59 (para. 79). We have also recommended that all time-workers wherever they are at present engaged on a daily basis should be put on a monthly basis (para. 80).

Cost of living.

249. Although the cost of living has gone down since 1929, we do not let this factor influence our wage increment proposals for several reasons. The cost of living theory cannot, in our opinion, have valid application to those classes of workers whose wages are below a minimum wage level. More important still, we do not wish to see the workers wedded for all time to a given standard of the past.

250. Regarding bonuses, we urge that all monthly bonuses should be consolidated with wages and all annual ones converted into profit sharing schemes (para. 83).

251. Finally we recommend the establishment of a Wage Fixation Board to function on the lines of the British Trade Boards for the adjustment of wages from time to time (para. 85). This Board may consist only

of employers' and workers' representatives with a chairman who might either be one of themselves or an independent outside authority, the Commissioner of Labour for instance.

252. In Chapter III we consider the principle of a basic minimum wage for the textile industry in Cawnpore, and lay down that no worker should get a wage of less than Rs.15 per month of 26 working days (para. 98). This limit will operate really in the case of the unskilled workers who in some mills draw even less than Rs.10 per month. Minimum wage.

253. In Chapter IV we deal with the desirability of standardization of wages and ask the Employers' Association to take up this question (para. 102). Standard designations for various occupations should first be laid down and duties attaching to them defined as precisely as possible (para. 103). It should then be possible to take up the question of the standardization of wage rates which should provide for automatic adjustments required by variable factors of work (paras. 104 and 105). We are opposed to mere standardization of wages as distinguished from rates as it cannot provide the stimulus which is necessary for a workman to increase his efficiency (para. 106). Standardization of wages.

254. In Chapter V we state what we understand by "rationalization" and describe the extent to which rationalization has taken place in the Cawnpore textile industry. We advocate the adoption of rationalization and intensification schemes on condition that the workers' interests are duly safe-guarded (paras. 113 and 116). Any attempt at rationalization should be preceded by the determination of a standard allocation of work for each occupation, so that it may be possible to judge at what point intensification begins (para. 117). Then it will be necessary to lay down principles both as regards conditions preliminary to the introduction of efficiency schemes and the mode of remunerating the extra work involved (para. 118). All these matters should be considered by the Employers' Association in close collaboration with the representatives of labour without whose active help even the soundest rationalization scheme may fail. The next point that we urge is that the adoption of the various efficiency schemes in a mill should be gradual, so that the resulting unemployment is reduced to a minimum (para. 119). Given an atmosphere of peace and good-will, we anticipate that the industry will expand and be in a position to re-employ workers discharged in consequence of rationalization. Where, however, such absorption is not immediately possible, we recommend that the workers, who have put in at least two years' service should be paid an unemployment benefit of a fortnight's wages for every year of service (para. 119). Rationalization.

255. In Chapter VI we examine the various shift systems prevailing in Cawnpore, and condemn the overlapping and multiple systems (para. 130). The majority of the mills have two straight shifts, and we consider that the others should fall into line. Shift system.

256. We consider night work to be a necessary evil, but to alleviate its rigorous we recommend if possible the adoption of the Japanese hours of work and the replacement of the night shift by what is called an "afternoon shift." (para. 133).

257. Chapter VII deals with the question of recruitment of labour. We find that the existing methods lend themselves greatly to the evils of bribery and corruption and urge the complete dissociation of mistries from recruitment (para. 136). We recommend the establishment of a Labour Exchange under Government control which would provide employment to applicants. Recruitment.

on demand from factories (paras. 139 and 140). In the matter of recruitment of labour we lay emphasis on the questions of physical fitness, educational qualifications and technical training. Recruitment should, ordinarily be preceded by a preliminary medical examination and arrangements should be made for a periodical medical examination of all permanent workers (para. 142). We think that some kind of educational test is desirable particularly in the case of child and adolescent labour (paras. 143). A part-time course of technical instruction for workers seeking permanency will, we consider, be extremely desirable (para. 144).

Terms of
employment.

258. Next we turn to terms of employment and urge that a uniform set of rules applicable to all mills should be evolved by the Employers' Association (para. 146). It should be made clear in the rules that active membership of a Trade Union will not stand in the way of a worker either in regard to his recruitment or promotion (para. 146). Another matter on which we lay emphasis is the display of wage rates on the notice board by all mills. This should be made obligatory in the rules made by the Government under the Payment of Wages Act (para. 147). We support the proposal that every worker should be given a wage card at the end of each wage period (para. 148).

Objectionable
punishments.

259. In Chapter VIII we condemn the practice of "forced leave" resorted to by practically all the mills as a mode of punishment (para. 150). In a group of mills under one employer we found that three differential rates of payment have been introduced for the same work, one for "good quality" another for "indifferent quality" and a third one for "poor quality". Payment is made at the end of the wage period at one of the three rates at the discretion of the employer. This practice, in our opinion, is a gross violation of the Payment of Wages Act, and should be abandoned at once (para. 152). As regards "playing off" we think that it should be limited to two days at a time and twelve days in a year. If this limit is exceeded, we consider it would be fair to give the worker 50 per cent. of the normal wages for each extra day (para. 151).

Dismissal.

260. On the thorny question of dismissal we argue that just as the employers' right to fine has been limited by the Payment of Wages Act, dismissals should be restricted to gross misdemeanour or wilful and serious neglect of duty. In our view, it is of the utmost importance that the workers should be satisfied that the punishment of dismissal when inflicted is justified. A dismissed worker should have the right of having his case taken up by his Trade Union with the mill concerned. The services of the Labour and Conciliation Officers may be utilized at a later stage, if necessary. If on investigation a dismissal is found to be unjust and the employer cannot be persuaded to reinstate the worker, the Conciliation Officer should have the power to convert it into a discharge and ask the employer to pay compensation either at the rate of 15 days' wages for every year of service or a lump amount not exceeding six months' wages. He should also have the power to award at his discretion the full or part of the wages for the period subsequent to dismissal (para. 154).

Leave with pay.

261. In Chapter IX we deal with the question of leave and recommend that a provision should be made for 15 days' "privilege" leave with full pay for workers with not less than two years' continuous service to their credit. In addition such workers should also be eligible to get 15 days' "sick" leave on half pay. This should be converted into full pay for those whose period of service extends beyond five years (para. 161). We justify this recommendation on the grounds that it will promote contentment and efficiency in the

workers, reduce the evil of absenteeism, and help to build up a permanent labour force without an undue burden on the industry.

262. Chapter X deals with the general working conditions. We recommend greater facilities regarding supplies of drinking water (para. 167), better cooling and humidifications arrangements (para. 169), provision of resting places (para. 170); and dining sheds (para. 172); and 60 holidays in a year (para. 176). We conclude by pointing out the urgent necessity of increasing the strength of the factory inspectorate by the addition of two wholtime assistant factory inspectors (para. 177). Working conditions.

263. In the next chapter we impress on the employers' the desirability of placing no obstacles in the way of a Workers Union, and examine in some detail the constitution of the Mazdur Sabha. We make various recommendations regarding its reorganization particularly with regard to the method of election (para. 182), representation of various interests, (para. 183), composition of the Executive Committee (para. 191), and declaration of strikes (para. 195). Mill committees should, in our opinion, be given a definite place in the constitution, but should not be empowered to take any independent action (para. 190). In our opinion, contacts should be fostered between employers and workers and not brought about only when there is a dispute to settle. Labour organization

264. In Chapter XII we discuss the housing problem. We begin by describing the housing accommodation at present available to the factory workers through various agencies. The first problem is to improve or reconstruct the existing workmen's dwellings which fall below the minimum standard of health and sanitation. For this purpose, the Improvement Trust should be given adequate powers by an amendment of section 25 of the United Provinces Town Improvement Act in the manner they have asked for (para. 209). The second and the more important problem is to construct new dwellings which should be available to workmen on rent. This work should also, in our opinion, be entrusted to the Improvement Trust (para. 210). For this purpose it will be necessary to finance the Trust, to give it the power to collect rents as a tax, and to exempt Trust property meant solely for the use of workers from municipal taxation (para. 212). We recommend that the Government should float a loan of rupees fifty lakhs and place a sum of rupees ten lakhs every year for five years at the disposal of the Trust (para. 211). In our opinion, this will not be a losing, if not a profitable, venture, and at the end of five years about 12,000 houses providing accommodation to approximately 40,000 persons will be available. Housing.

265. We would prefer facilities for constructing workmen's houses being given to the Improvement Trust rather than to the employers or other private persons with the proviso that there should be some representative of the workers on the Trust (paras. 210 and 213). We say further that the facilities for purchasing houses should be restricted to genuine house-building co-operative societies (para. 212).

266. In Chapter XIII, we deal with the various aspects of labour welfare work. We point out what has hitherto been done by the employers and the Government and urge the establishment of a welfare council containing the representatives of various institutions interested in this work (para. 231). We lay emphasis on maternity and child welfare work and urge the necessity of a sickness insurance scheme on a contributory basis. We also lay down the frame work of a contributory Provident Fund scheme. All workers getting Rs.15 per mensem or over will contribute half-an-anna per rupee of the wages earned and the employers will add an equal amount. No worker will be entitled to receive the employers' contribution until he has Labour welfare.

put in at least ten years' service or is discharged earlier for physical disability or as a consequence of rationalization (para. 236).

267. For the protection of indebted workers, we recommend a measure on the lines of the Central Provinces Protection of Debtors' Act, 1937, and the formation of co-operative societies for cheap credit (para. 237).

268. We also advocate the formation of co-operative stores in each mill and the establishment of canteens (para. 238).

Laboure Office.

269. In Chapter XV we urge on the Government the desirability of maintaining and publishing detailed labour and industrial statistics. We recommend the establishment of a regular Labour Office on the lines of the Bombay Labour Office (para. 240), and append a detailed list of subjects under which statistics should, in our opinion, be collected.

Burden of our proposals on the industry.

270. Having thus outlined our proposals we now proceed to assess, as far as practicable, the burden that they are likely to place on the textile industry in Cawnpore.

Cost of the wage increments proposal.

271. It is not possible to say with great accuracy what the financial effect of our wage increment proposal will be. But as pointed in para. 81 on a rough calculation it will enhance the wage bill by between 10 and 12 per cent. The increments that we have proposed vary from 10 pice in the rupee to 2 pice. The lower the wages the greater the increase and the vast majority of workers get below Rs.30, but the wage bill of the better paid workers is comparatively higher. If on an average the increment is assumed at 7 pice in the rupee, the additional cost will be about 11 per cent. of the present labour costs.

Cost of the minimum wage proposal.

272. The burden of our proposal of a basic minimum of Rs.15 per mensem will be very light. Those getting Rs.13 and over will be covered by the wage increment proposal, and only those getting below Rs.13 will be affected by the minimum. The percentage of such workers will not be more than 4, and if their average earning is assumed to be Rs.12 they will get an increase of Rs.3. The addition to the wage bill should not therefore exceed $4 \times \frac{3}{12}$ or 1.0 per cent.

Cost of unemployment benefit.

273. There are no date on which we may calculate the effect of our proposal to give an unemployment benefit to the workers discharged as a result of rationalization. The number of workers so discharged will not be appreciable and in any case it will be only the newest workers who will be discharged. We think it is safe to say that this proposal will impose only an insignificant addition to the wage bill.

274. As we have shown in Chapter IX, our leave proposals will add to the wage bill about 6 per cent. Together with the restrictions placed on playing off, the addition may be said to be 6 per cent.

275. The cost of our Provident Fund scheme should be about 2.5 per cent. of the present wage bill. The employers will have to contribute half-an-anna per rupee of the wages earned. This gives an addition of 3.1 per cent. to the labour costs, but the burden will be lightened on account of the restriction that only workers with a minimum of ten years' service will be entitled to the employers' contribution.

276. To sum up, as a result of all our proposals, the labour costs will be enhanced by about 21 per cent. As we have pointed out elsewhere, the labour costs in Cawnpore are lower than those in Bombay and Ahmedabad, and if our analysis of the present position of the Cawnpore industry is at all correct, we are confident that this burden will be easy to bear. In addition to this increase in the wage bill, there will be some rise in the cost of production

owing to the reduction in the possible number of working days to 305. We cannot assess it exactly, but it should not be appreciable.

277. Before concluding we wish to make it clear that our proposals apply both to cotton and woollen industries. We have not examined the case of other industries and have therefore been unable to frame any specific proposals with regard to them.

J. NEGAM,
Secretary.

RAJENDRA PRASAD,
Chairman.

S. K. RUDRA,
Member.

B. SHIVA RAO,
Member.

The 4th April, 1938.

APPENDIX I

Agreement, dated the 9th August, 1937, between the Employers' Association of Northern India and the Cawnpore Mazdur Sabha

THE strike situation at Cawnpore was further discussed today and the terms suggested by the Mazdur Sabha were considered. The following terms were accepted by the representatives of the Northern India Mill-owners' Association as well as by the office-bearers of the Mazdur Sabha and Labour leaders of Cawnpore :

(1) The Mazdur Sabha shall be recognized by the Mill-owners as a duly constituted organization to represent the factory labour of Cawnpore.

(2) There shall be no victimization of workers for the active participation in strike or in normal Union activities.

(3) The Mill-owners shall continue to stop bribery, maltreatment and dismissal by the jobbers.

(4) Wage rates shall be displayed in the mills and the rates for each variety and count shall be made known to each worker before he is required to begin work on that particular variety or count.

(5) Each worker shall be supplied with a card showing the rates of wages for each variety and the total produce of the same to be stated indicating the total earning.

(6) Wages shall be distributed to the workers one by one and each worker shall be given opportunity to examine the coins and money received by him.

(7) There shall be no overtime work without payment.

(8) All workers joining the work within five days of the opening of the mill shall be employed.

(9) The existing practice, according to which wages are distributed in one or two days fortnightly shall be maintained wherever it obtains at present, and as regards other mills wages will be paid up in not more than three consecutive days every fortnight.

(10) All notices issued by the company shall be written and placed on its notice-board.

(11) There will be no work on Sundays during the pendency of the inquiry and the question as to whether Sundays should be observed as holidays after the completion of the inquiry, irrespective of any holiday in the week, shall also be referred to the Committee of Inquiry. In the meanwhile, the question may be further discussed between the Mill-owners' Association and the Mazdur Sabha and whenever they agree any mill may be worked on any Sunday even during the pendency of the inquiry. The provision that no work need be done on Sundays during the pendency of the inquiry should not prejudice the inquiry into the question for the future.

(12) The question of short shifts and the proposal that every worker shall be continuously employed for ten hours with an interval of one hour shall also be referred to the Committee of Inquiry.

(13) Workers dismissed during the last two months for participating in strikes or other Trade Union activities shall be reinstated in their original posts.

(14) No wage cuts, direct or indirect, nor any further intensification shall take place pending the report of the Committee of Inquiry.

(15) If any dispute arises regarding the execution of the terms of this Agreement, it will be referred to the Committee of Inquiry to be appointed by the Government.

(16) There shall no strike without due notice and none during the pendency of the inquiry.

(17) The mill-owners will not make any rule prejudicial to the general conditions of labour without reasonable notice to the Mazdur Sabha.

(18) An inquiry committee consisting of one representative of the Mazdur Sabha, one representative of the employers and such number, not exceeding three, as may be nominated by Government, shall be appointed to inquire into—

(a) the question of wage cuts,

(b) the percentage of increase in wages in case the wage cut is established,

(c) the question of increase in wages in case they are found to be too low irrespective of whether or not there has been a wage cut,

(d) the schemes of intensification of labour introduced or intended to be introduced by the mill-owners and ways and means of safeguarding the rights of workers in this connexion,

(e) the general condition of labour in factories,

(f) the working of the jobber system and the advisability or otherwise of abolishing the same, and

(g) the question of emergency leave with pay for 15 days in a year.

(The Committee to submit its report within two months of the date of appointment.)

(19) The strike will be called off and labourers shall return to work by Tuesday morning (August 10).

(20) The above Agreement shall apply to all the mills and mill-workers in Cawnpore.

The terms of reference to the Committee of Inquiry shall be settled by the Government and it will be open to them to refer any matter or matters besides those mentioned above to the said committee.

HARIHAR NATH SHASTRI,

President,

Cawnpore Mazdur Sabha.

S. S. YUSUF,

Secretary,

Mazdur Sabha.

ARJUN ARORA,

RAJA RAM SHASTRI.

Joint Secretary,

Mazdur Sabha.

THE above terms are the outcome of an undertaking intimated on the 8th August, 1937, on behalf of the Employers' Association of Northern India to the Hon'ble the Prime Minister personally and having been submitted to the Association by the Prime Minister are accepted by the Employers' Association of Northern India.

The Association wish to point out that clauses nos. 3, 6, 7 and 10 have continually been adhered to by the employers in the past and involve no change in procedure. Accordingly it is not apparent why these points have been raised at all.

H. W. MORGAN,

Secretary.

T. GAVIN JONES,

Chairman.

9-8-'37.

APPENDIX II

Questionnaire by the Committee appointed by Government to inquire into wages and conditions of labour in Cawnpore

The following questionnaire is issued by the Committee appointed by Government to inquire into wages and conditions of labour in Cawnpore with a view to elicit information, opinions, and suggestions. The questions are not exhaustive, nor it is expected that all questions should be answered.

Persons or Associations who may be willing to help the Committee by separate notes or memoranda on any subject referred in the questionnaire and with which they are intimately connected, are invited to do so.

All papers should reach J. Nigam, Esq., I.C.S. (Director of Industries and Commerce, United Provinces), Secretary of the Committee, Nawabganj, Cawnpore, before the 15th of October, 1937.

Oral evidence may be called for on the basis of and as required by the replies and statements received.

Copies of the questionnaire can be obtained from the Secretary.

RAJENDRA PRASAD,
President.

Questionnaire issued by the Committee appointed by Government to inquire into wages and conditions of labour at Cawnpore

1. Please state the average rates of time-wages paid to various classes of workers for various classes of works in your mills for (1) 1929 or the year nearest thereto and (2) 1937. If there has been any decrease, please state the reasons for the same?

2. On what basis is the allocation of work made to the operatives in different sections of your mill, particularly when they are engaged on daily wage rate? Please give details, e.g. number of cards allocated for lap carriers, cards attended by a tenter, number of spindles assigned per piecer, number of frames assigned per set of doffers, etc. if any additional duties are assigned to them other than indicated by their designation please specify the same.

3. Please give the piece-wage rates for different operations in each section of your (1) carding, (2) spinning, (3) weaving, (4) dyeing and bleaching and (5) finishing and (6) packing departments of your mill. How is the actual wage earned by an operative computed from the list, please illustrate.

4. On what basis is the piece rate for each operation fixed? Has there been any decrease in the same since 1929 and how has it affected the earning of the worker?

5. What changes, if any, are made in the piece rates due to variations in quality of material, count of yarn, intricacy of weave and design, altered working conditions?

6. Are the workers aware of the rates of wages to which they are entitled and are the rate lists put up in each department?

7. What bonus or extra allowance is being paid to the workmen in your mill in addition to time or piece-wages? Have there been any changes since 1929?

8. Please give, if possible, the rates of time and piece-wages prevailing in Bombay, Ahmedabad, Sholapur, Nagpur, Delhi, Madras, Calcutta and Indian States for similar occupations?

9. How have the standard and the cost of living of industrial workers in Cawnpore varied since 1929?

10. Please give a general idea of the total profits made, the rates of dividends declared to various classes of share-holders and the amount of Reserve Fund maintained by your mills from year to year since 1929?

11. Do you think the prevailing rates of wages in Cawnpore sufficient to enable workers of all grades to maintain, working efficiency and a reasonable standard of comfort? If not, what adjustments do you think necessary to achieve this object? Please support your view by facts and figures.

12. Should a minimum rate of wages be prescribed for any class of labour at Cawnpore? If so, please indicate the classes and the minimum rates advocated for each.

13. What are the existing arrangements as regards shifts in your mill? Is it possible to evolve a system in which no labourer need remain in or near the mills for more than 10 hours including an interval of one hour? If not, please state the effects on industry and labour of adhering to the two shifts system.

14. Is it desirable to prohibit the system of overlapping shifts altogether? If so, should the law be amended to permit textile mills at their discretion to have three continuous shifts of 8 hours each as in continuous industries like sugar, oil, etc.? If this results in lowering wages due to lesser hours of work, should any conditions be imposed in order to prevent a decrease in wages payable for various kinds of work?

15. Are there any schemes of rationalization or intensification of labour in force or under contemplation in your mills? If so, please give details. To what extent have similar schemes been introduced in other mills in outside Cawnpore?

16. To what extent and in what ways are the earnings of employees and the interests of the employers affected by these schemes? What in your opinion is the effect of these schemes on the health and efficiency of labour?

17. Please describe in detail the system of recruitment and supervision of labour in your mills? What steps are taken in your mills to verify the reports of the supervising staff regarding the work and conduct of labourers? What opportunities are given to a worker to explain his position before dismissal or other drastic punishments are inflicted?

18. How complaints made against the supervising staff by workers individually or collectively, particularly as regards mal-treatment or corruption, dealt with by the management?

19. Can you suggest any means of combating bribery, mal-treatment and corruption, if any, under the existing arrangements of recruitment, supervision, suspension and dismissal of mill-workers?

20. Is it desirable to fix the number of working days in a year? If so, what should that number be taking into consideration the number allowed in other parts of India?

21. What days, if any, should be observed as holidays in factories in addition to or in lieu of Sundays?

22. For what period should leave be granted to workers in cases of sickness or emergency (a) on full pay, (b) on half pay and (c) without pay?

23. Do you think mills should grant leave to their workmen with or without pay, for each year of service (when they could go home, or take a rest)? If so, what period of such leave would you fix? What effect, in your opinion, will such leave have on absenteeism and continuity of service?

24. Are any improvements required in the general working conditions inside the mill in respect of matters such as facilities for meals, drinking water, attending to calls of nature, medical relief, etc.?

25. Are there any special difficulties experienced by employers and employees in the working of the mills? If so, what remedies do you suggest?

APPENDIX III

**Names of witnesses who appeared before the Labour
Inquiry Committee**

On behalf of the Employers' Association of Northern India, Cawnpore

- (1) Sir T. Gavin Jones, President, Employers' Association, assisted by Messrs. Carnegie and Tosh.
- (2) Mr. H. A. Wilkinson, Managing Director, Elgin Mills, assisted by Mr. S. Catterall, Manager (3 days).
- (3) Mr. J. Tinker, Managing Director, Cawnpore Cotton Mills, assisted by Mr. B. Shaw, Manager.
- (4) Mr. Padampat Singhania, representing the Juggilal Kamlapat Group of Mills (4 days).
- (5) Mr. G. D. Price, Managing Director, Muir Mills, assisted by Mr. Rhodes, Weaving Master.
- (6) Rai Bahadur L. Bhagwan Das, Proprietor, Messrs. Bevis & Co., assisted by Mr. P. L. B. Ridsdale, Manager.
- (7) Mr. H. Horsman, Managing Director, Swadeshi Cotton Mills.
- (8) Mr. C. A. Watt, Managing Director, Cawnpore Woollen Mills, assisted by Mr. Bancroft.
- (9) Mr. Ali Ahmad, Mistri, Cawnpore Cotton Mills.
- (10) Mr. Abdul Latif, Mistri, Cawnpore Cotton Mills.
- (11) Mr. Mohammad Khan, Mistri, Cawnpore Cotton Mills.

On behalf of the Mazdur Sabha, Cawnpore

- (12) Mr. Harihar Nath Shastry, President, Mazdur Sabha.
- (13) Mr. Shitla Prasad Saxena, M.A., Lecturer, Lucknow University, Government Adviser to Mazdur Sabha.
- (14) Laloo, employed in the weaving department of the Elgin Mills.
- (15) Shivadhar, working on a winding machine in the Elgin Mills.
- (16) Ram Charan, employed in the weaving department of the Cawnpore Textile Mills.
- (17) Zawwar Husain, employed, in the weaving department of the Cawnpore Woollen Mills.
- (18) Mangli Prasad, employed in the drawing department of Cawnpore Cotton Mills.
- (19) Musahib Ali, ex-employee of the Lakshmi Ratan Cotton Mills. (His evidence could not be completed and it was decided to ignore it altogether).

On behalf of the Municipal Board, Cawnpore

- (20) Mr. B. P. Srivastava, Chairman, assisted by Dr. S. N. Tewari, Executive Officer.

On behalf of the Improvement Trust, Cawnpore

- (21) Rai Bahadur L. Sri Narain, Executive Officer.

On behalf of the British India Corporation

- (22) Mr. A. L. Carnegie, Chairman of the Board of Directors.

On behalf of the Department of Factories and Boilers, United Provinces

- (23) Mr. Abdul Hai, officiating Chief Inspector of Factories and Boilers, United Provinces,

APPENDIX IV

Category no. 1—Opener attendants

N.G.=Information not given.

1	2	3	4	5	6	7	8	9	10	11	12	
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	8	14 18 8	'91	91	118·625	1937	10	14 14 7	1·02	89	149·114
B .. .. .	..	Not working	..	Started 1935	..	..	1937	2	17 0 0	1·16	N.G.	84·000 April given.
C	1933	4	17 9 7	1·08	1·0	70·408	1937	4	17 14 0	1·22	N.G.	71·500
D	1931	15	18 0 0	1·11	95	70·000	1937	10	17 10 6	1·21	96	178·582
E	1929	12	16 14 0	1·04	96·5	202·500	1937	12	17 1 0	1·17	96·5	204·750
F .. .. .	..	Not working	..	Started June, 1938.	..	..	1937	2	11 6 0	·78	N.G.	22·750
G	1929	18	15 10 0	'96	..	281·250	1937	18	15 10 0	1·07	..	281·250
H	1929	N.G.	19 8 0	1·20	N.G.	..	1937	N.G.	19 8 0	1·33	N.G.	..
I	1929	6	14 1 8	'87	N.G.	84·468	1937	7	18 12 8	'94	N.G.	96·359
J	1930	2	15 6 0	'95	50	30·750	1937	2	16 0 0	1·09	100	82·000
K	1934	2 Feeder	16 8 0	1·02	N.G.	93·000	1937	2 Feeder	16 8 0	1·13	N.G.	38·000
		3 Front	18 0 0	1·11	..	54·000		3 Front	18 0 0	1·23	..	86·000
Total columns 3 and 7	..	70	..	..	..	1144·999	..	71	..	..	..	1,197·265

Result of 7 ÷ 8 average per person reported 16·35
 Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour 1·008
 × by 16 to give annas ÷ 284 = annas per hour 16·08
 Decrease
 Increase 8·94 (annas per hour) 1·96

Category no. 2—Scutcher tenters

N. G. = Information not given

1			2	3		4	5	6	7		8			9		10		11	
Name of mill			1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied					
					Rs. a. p.			Rs.			Rs. a. p.			Rs.					
A	..	..	1980	16	16 5 0	1'00	91	261'000	1987	17	15 12 11	1'08	91	268'728			
B	..	..	..	Not working	..	..	..	..	1987	1	17 0 0	1'16	N.G.	17'000
C	..	..	1988	6	17 12 2	1'09	N.G.	106'562	1987	8	17 14 0	1'22	N.G.	148'000			
D	..	..	1981	9	18 0 0	1'11	95	162'000	1987	9	17 10 6	1'21	86	158'908			
E	..	..	1929	8	16 14 0	1'04	100	135'000	1987	8	17 1 0	1'17	100	138'500			
F	..	..	..	Not working	..	..	..	..	1987	6	11 6 0	·78	N.G.	68'250
G	..	..	1929	81	15 10 0	·96	N.J.	481'875	1987	81	15 10 0	1'07	N.G.	484'875			
H	..	..	1929	N.G.	19 8 0	1'20	N.G.	..	1987	N.G.	19 8 0	1'33	N.G.	..			
I	..	..	1929	27	15 4 9	·94	N.G.	418'015	1987	28	14 15 8	1'02	N.G.	418'687			
J	..	..	1980	9	14 15 0	·92	70	134'487	1987	9	14 0 0	·96	95	126'000			
K	..	..	1934	7	18 0 0	1'11	N.G.	126'000	1987	7	18 0 0	1'23	N.G.	126'000			
Total columns 3 and 7			..	118	..	..	..	1,822'889	..	124	..	..	..	1,947'441

Result of 7÷3 average per person reported 16'13
 Result of 7×16 (to give annas) ÷ 260 to give annas per hour 992

× by 16 to give annas ÷ 234 = annas per hour .. 15'70
 Decrease 8'28 per cent. (annas per hour) .. 1'074
 Increase

Category no. 3—Lap carriers

N.G.=Information not given.

1	2	3	4	5	6	7	8	9	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total colt:mns nos. 8 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total colt:mns nos. 8 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1980	12	15 15 7	'98	94	191'687	1987	18	14 2 4	'97	85	254'624
B .. ..	..	Not working	..	..	..	..	1937	6	1 0 0	1'09	N.G.	96'000
C	1983	7	16 5 3	1'00	N.G.	114'818	1987	8	17 7 6	1'19	N.G.	139'750
D	1981	12	17 14 0	1'10	96	214'530	1987	8	23 8 6	1'54	95	180'250
E	1929	17	20 14 6	1'29	94'8	855'408	1937	16	29 8 6	1'52	93'8	855'500
F .. ..	..	Not working	..	..	..	..	1937	8	11 6 0	'78	N.G.	94'125
G	1929	16	15 10 0	'98	N.G.	250'000	1937	15	15 10 0	1'07	N.G.	234'375
H	1929	N.G.	19 8 0	1'20	N.G.	..	1937	N.G.	19 8 0	1'28	N.G.	..
I	1929	8	15 4 0	'94	N.G.	122'000	1937	10	14 14 6	1'02	N.G.	149'062
J	1980	6	15 4 0	'94	72	91'500	1937	6	18 9 0	'98	84	81'375
K	1934	8	16 8 0	1'02	N.G.	49'500	1937	4	16 8 0	1'13	N.G.	66'000
Total columns 3 and 7	..	81	..	..	..	1,888'906	..	94	..	..	..	1,591'061

Part of a team.

(109)

Result of 7÷8 average per person reported 17'15
 Result of 7×16 (to give annas) ÷ 260 to give annas per hour 1'055
 X by 16 to give annas ÷ 234 = annas per hour 16'92
 Decrease 9'67 per cent. (annas per hour) 1'157
 Increase

Category no. 4--Carding machine attendants

N. G.=Information not given.

1929							1937						
1	2	3	4	5	6	7	2	3	4	5	6	7	
Name of mill	Year or nearest	Number employed	Average earnings	Annas earning per hour	Per centage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per centage attendance	Total columns nos. 3 and 4 multiplied	
			Rs. s. p.			Rs.			Rs. s. p.			Rs.	
A	1930	12	11 6 0	70	92	186'500	1937	16	10 15 5	75	88	175'416	
B .. ..	..	Not working	..	..	..	..	..	6	16 0 0	1'09	N.G.	96'000
C	1933	9	16 11 6	1'08	N.G.	150'468	1937	14	17 7 6	1'19	N.G.	244'532	
D	1981	16	17 14 0	1'10	96	286'000	1937	14	22 8 8	1'54	95	315'487	
E	1929	15	20 14 6	1'29	94'3	318'593	1937	14	22 3 6	1'52	93'3	311'062	
F .. ..	..	Not working	..	..	..	..	..	5	11 6 0	78	N.G.	53'875
G	1929	31	15 10 0	98	N.G.	484'375	1937	29	15 10 0	1'07	N.G.	453'125	
H	1929	N.G.	17 8 0	1'08	N.G.	..	1937	N.G.	17 8 0	1'20	N.G.	..	
I	1929	26	15 4 3	94	N.G.	396'906	1937	24	14 14 9	1'02	N.G.	358'124	
J	1930	8	10 14 0	67	96	87'000	1937	8	10 11 0	73	94	85'500	
K	1934	9	16 8 0	1'02	N.G.	148'500	1937	9	16 8 0	1'13	N.G.	148'500	
Total columns 3 and 7	..	126	..	..	..	2,008'342	..	139	..	..	..	2,244'601

Part of a team.

(110)

Result of 7÷3 average per person reported 15'90
 Result of 7×16 (to give annas) ÷ 260 to give annas per hour '978
 X by 16 to give annas ÷ 234=annas per hour 16'15
 Decrease
 Increase 12'88 per cent. (annas per hour) 1'104

Category no. 5 - Fly gatherers.

N. G. = Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total, columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	4	15 6 1	'95	87	61'520	1937	4	15 6 9	1'05	100	61'687 96'000
B .. .. .	..	Not working	..	..	..	..	1937	6	16 0 0	1'09	N.G.	35'938
C	1933	2	16 14 1	1'04	N.G.	33'766	1937	2	17 15 6	1'23	N.G.	135'187
D	1931	10	17 14 0	1'10	95	173'750	1937	6	22 8 6	1'54	95	177'750
E	1929	9	20 14 6	1'29	94'3	189'156	1937	8	23 3 6	1'52	93'3	22 750
F .. .. .	..	Not working	..	..	..	..	1937	2	11 6 0	'78	N.G.	125'000
G	1929	7	15 10 0	'96	N.G.	109'875	1937	8	15 10 0	1'07	N.G.	..
H	1929	N.G.	17 8 0	1'08	N.G.	..	1937	N.G.	17 8 0	1'20	N.G.	84'468
I	1929	5	14 8 8	'83	N.G.	72'081	1937	6	14 1 3	'86	N.G.	29'250
J	1930	2	16 4 0	1'00	100	32'500	1937	2	14 10 0	1'00	100	33'000
K	1934	1	16 8 0	1'02	N.G.	16'520	1937	2	16 8 0	1'13	N.G.	801'030
Total columns no. 3 and 7 ..	..	40	..	..	..	692'592	..	46	..	..	..	..

3, 4 and 5 work in a team.
Part of a team.

(III)

Result of 7 ÷ 3 average per person reported .. 17'31
Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour .. 1'065

× by 16 to give annas ÷ 234 = annas per hour 17'41
Decrease 11'73 per cent. (annas per hour) 1'190
Increase

Category no. 6—Strippers and grinders

N. G.—Information not given.

1	2	3	4	5	6	7	8	9	10	11	12	
Name of mill	1949 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 8 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	18	16 1 10	'99	91	290'082	1987	16	14 8 6	'90	'87	232'500
B .. ..	..	Not working	..	..	..	..	1987	2	20 0 0	1'87	N.G.	40 000
C	1938	10	16 12 8	1'08	N.G.	167'937	1987	10	17 14 0	1 27	N.G.	178'750
D	1931	14	17 14 0	1'10	96	250'250	1987	10	22 8 6	1'54	95	245'312
E	1929	7	20 14 8	1'29	84'8	146'348	1987	7	22 8 6	1'52	93'8	155'581
F .. ..	..	Not working	..	..	..	..	1987	8	11 6 0	'78	N.G.	94'125
G	1929	42	16 4 0	1'00	N.G.	682'500	1987	39	16 4 0	1'11	N.G.	638'750
H	1929	N.G.	19 8 0	1'20	N.G.	..	1987	N.G.	19 8 0	1'88	N.G.	..
I	1929	27	15 1 6	'93	N.G.	407'531	1987	25	14 12 0	1'01	N.G.	306'750
J	1930	9	14 10 0	'90	76	131'625	1987	9	18 15 0	'95	84	125'487
K	1934	9	18 0 0	1'11	N.G.	162'000	1987	9	18 0 0	1'23	N.G.	162'000
Total columns 3 and 7	..	186	..	..	..	2'288'248	..	180	..	..	..	2'166'155

Result of 7+8 average per person reported 16'46 X by 16 to give annas+264=annas per hour .. 16'50
 Result of 7 x 16 (to give annas)+260 to give annas per hour .. 1'018
 Decrease 11'94 per cent. (annas per hour)
 Increase 1'184

Category no. 7—Drawing tenters

N. G.=Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns no. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	41	80 14 0	1'90	95	1,265'875	1937	59	25 1 9	1'72	84	1,481'458
B .. ..	..	Not working	..	..	..	..	1937	16	28 8 6	1'93	N.G.	451'500
C	1933	28	39 5 11	2'43	N.G.	1,102'437	1937	32	40 15 5	2'80	N.G.	1,311'078
D	1931	48	19 8 3	1'18	90	921'749	1937	36	27 5 6	1'87	98	984'375
E	1929	45	28 6 0	1'81	97'4	1,051'875	1937	6	28 12 0	1'61	98'8	172'781. New.
F .. ..	..	Not working	..	..	..	..	1937	(11) 30	24 4 9	1'36	93'7	728'803., Old.
G	1929	77	25 5 0	1'55	N.G.	1,949'062	1937	9	14 12 8	1'01	N.G.	182'890
H	1929	N.G.	27 7 0	1'69	N.G.	..	1937	86	27 7 0	1'87	N.G.	2,859'625
I	1929	100	19 14 3	1'22	N.G.	1,989'062	1937	N.G.	27 18 0	1'90	N.G.	..
J	1930	21	32 15 0	2'08	98	691'687	1937	82	30 8 9	2'09	N.G.	2,574'848
K	1934	22	34 11 7	2'14	N.G.	768'927	1937	21	25 7 0	1'74	92	534'187
	1937	24	30 7 0	2'08	N.G.	730'500						
Total columns 3 and 7	..	392		..	..	9,735'674		401	..	..	..	11,392'138
Correction	..	To correct Elgin to 10 hours subtract				95'625		To correct Elgin to 9 hours subtract				163'942
Net total	..	..	..	..	..	9,640'049		..	..	..	..	11,228'196

Result of 7÷3 average per person reported
 Result of 7÷16 (to give annas) ÷260 to give annas per hour

.. 25'23
 .. 1'553

× by 16 to give annas ÷284÷annas per hour
 Decrease 23'25 (annas per hour) ..
 Increase ..

.. 28'00
 .. 1'914

NOTE—Elgin new machine rates are 10 per cent. lower than old machines yet earnings higher. Worked 11 hours in 1929 and 1937.

(113)

Category no. 8—Slubbing tenters

N. G.=Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earnings per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earnings per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A .. ..	..	14	30 14 0	1'90	88	432'250	1937	19	24 8 7	1'68	83	466'192
B	1930	Not working	..	..	..	..	1937	7	27 3 0	1'86	N. G.	190'812
C	1938	10	42 14 2	2'64	N. G.	428'859	1937	14	43 6 8	2'97	N. G.	607'891
D	1931	16	26 11 9	1'65	94	427'749	1937	12 3	37 15 9 36 2 0	2'60 2'02	95 94'2	455'812 108'875 488'461
E	1929	18	82 8 0	1'80	95'5	579'976	1937	(11)15	32 3 6	1'80	89'6	New Old
F .. ..	..	Not working	..	..	..	..	1937	8	15 10 11	1'07	N. G.	47'046
G	1929	26	24 14 0	1'53	N. G.	646'710	1937	32	52 12 0	1'55	N. G.	728'000
H	1929	N. G.	27 2 0	1'67	N. G.	..	1937	N. G.	29 8 0	2'02	N. G.	..
I	1929	85	21 4 9	1'91	N. G.	745'390	1937	81	31 8 0	2'13	N. G.	966'812
J	1930	7	32 11 0	2'01	98	228'812	1937	7	25 11 0	1'75	77	179'812
K	1934	8	35 4 0	2'17	N. G.	282'000	1937	9	32 9 0	2'28	N. G.	299'062
Total columns 3 and 7	..	134	..	..	..	3,771'18	..	152	..	..	..	4,526'595
Correction	..	To correct Elgin to 10 hours subtract	..	..	..	52'499	..	To correct Elgin to 9 hours subtract	..	..	..	107'572
Net total	..	..	..	..	..	3,719'696	..	..	..	..	..	4,419'023

Result of 7+3 average per person reported 27'75 X by 16 to give annas ÷ 234=annas per hour 29'07
 Result of 7X16 (to give annas) ÷ 260 to give annas per hour .. 1'707 Decrease 16'46 per cent. (annas per hour) 1'988
increase

Category no. 9—Inter tenters

N.G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1929	22	26 18 0	1.65	91	589.875	1927	27	20 15 6	1.44	87	556.156
B .. ..	..	Not working	..	..	..	..	1927	14	29 15 8	2.05	N.G.	419.848
C	1928	20	38 4 2	2.35	N.G.	765.256	1927	28	38 1 4	2.60	N.G.	1,066.487
D	1921	22	24 12 9	1.53	85	545.531	1927	(10)22	29 5 0	1.80	96	644.875
E	1929	81	32 0 0	1.79	90	992.000	1927	(11)29	28 10 9	1.60	92.9	981.484 (old)
F .. ..	..	Not working	..	..	..	..	1927	7	12 15 6	.89	N.G.	90.854
G	1929	44	24 6 0	1.50	N.G.	1,072.500	1927	48	22 8 0	1.52	N.G.	954.062
H	1929	N.G.	22 15 0	1.41	N.G.	..	1927	N.G.	24 9 0	1.68	N.G.	..
I	1929	68	20 12 8	1.28	N.G.	1,370.531	1927	56	25 8 6	1.74	N.G.	1,429.750
J	1920	10	29 12 0	1.88	96	297.500	1927	10	22 14 0	1.53	88	228.750
K	1924	18	26 9 0	1.68	N.G.	478.125	1927	18	25 14 9	1.77	N.G.	466.598
Total columns nos. 3 and 7	..	298	..	..	..	6,111.328	..	254	..	..	..	6,698.804
Correction	..	To correct Elgin to 10 hours subtract				90.182	To correct Elgin to 9 hours and Tertiles to 9 hours subtract				215.665	
Net Total	..	..	..	..	..	6,021.146	..	..	..	..	..	6,482.639

Result of 7 ÷ 8 average per person reported 25.52
 Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour 1.590

× by 16 to give annas ÷ 234 = annas per hour 25.52
 Decrease 9.75 per cent. (annas per hour)
 Increase 1.745

Category No. 10—Roving tenters

N. G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent age attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent age attendance	Total columns nos 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	48	24 14 8	1.53	94	1,071.416	1937	44	19 11 0	1.35	98	866.250
B .. .. .	..	Not working	..	..	..	..	1937	10	37 2 8	2.54	N.G.	37.666 Two frames per man,
C	1938	51	85 9 5	2.19	N.G.	1,815.297	1937	64	26 2 10	1.70	N.G.	1,675.406
D	1931	50	21 13 3	1.34	95	1,091.466	1937	(10)50	24 12 0	1.52	95	1,237.500
E	1929	72	25 5 0	1.42	91.8	1,822.500	1937	(11)69	26 13 9	1.50	90.8	1,853.296
F .. .. .	..	Not working	..	..	..	..	1937	14	18 15 0	.95	N.G.	195.125.
G	1929	85	20 8 0	1.26	N.G.	1,742.500	1937	99	18 5 0	1.25	N.G.	1,812.837
H	1929	N.G.	19 0 0	1.17	N.G.	..	1937	N.G.	20 9 0	1.41	N.G.	..
I	1929	117	20 8 3	1.24	N.G.	2,363.765	1937	121	23 0 0	1.57	N.G.	2,733.000
J	1930	20	25 2 0	1.55	88	502.500	1937	24	21 4 0	1.45	82	510.000
K	1934	49	27 8 1	1.69	N.G.	1,347.754	1937	51	19 9 9	1.34	N.G.	1,000.078
Total columns 3 and 7	..	487	..	..	..	11,757.198	..	546	..	..	..	12,805.258
Correction	To correct Elgin to 10 hours subtract					165.682	To correct Textiles to 9 hours and Elgin to 9 hours subtract					460.712
Net total	..	..	..	..	..	11,591.456	..	..	..	..	..	11,844.546

Result of 7÷3 average per person reported. 23.80 x by 16 to give annas ÷ 234=annas per hour 21.69
 Result of 7x 16 (to give annas) ÷ 260 to give annas per hour 1.465
 Decrease 1.22 per cent. (annas per hour) 1.483
 Increase

Lakshmi Ratan provides one boy to help. Paid for by the mill.

Category no. 11—Doffers (carding)

N. G.=Information not given.

1	2	3	4	5	6	7	2	8	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	60	11 10 8	.72	88	698.437	1937	60	11 4 6	.77	80	676.875
B .. ..	..	..	Not working	..	..	..	1937	8	12 0 0	.82	N.G.	96.000
C	1933	29	11 12 0	.72	N.G.	317.250	1937	24	11 12 0	.80	N.G.	399.500
D	1931	67	13 0 0	.80	90	871.000	1937	50	13 0 0	.89	94	650.000
E	1929	72	13 2 0	.81	93	945.000	1937	69	13 8 6	.90	92	912.098
F .. ..	..	..	Not working	..	..	..	1937	14	11 6 0	.78	N.G.	150.250
G	1929	..	10 10 0	.65	N.G.	Boys	1937	128	10 10 0	.78	N.G.	1,306.875
H	1929	N.G.	12 12 0	.78	N.G.	..	1937	N.G.	12 12 0	.87	N.G.	..
I	1929	185	11 11 6	.72	N.G.	1,582.091	1937	155	10 15 0	.75	N.G.	1,695.812
J	1930	53	10 15 0	.67	80	579.687	1937	53	10 11 0	.73	86	566.437
K	1934	26	12 0 0	.4	N.G.	312.000	1937	26	12 0 0	.82	N.G.	386.000
Total columns 3 and 7	..	440	..	..	..	5,805.405	..	594	..	..	..	6,798.842

Result of 7 ÷ 3 average per person reported 12.06
 Result of 7 × 16 to give annas ÷ 260 to give annas per hour 742

× by 16 to give annas ÷ 284=annas per hour .. 11.45
 Decrease
 Increase 5.52 per cent, (annas per hour) 798

Category no. 12—Doffers (spinning)

.N. G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied
A	1980	74	Rs. a. p. 11 13 7	·73	92	Rs. 876·822	1937	116	Rs. a. p. 11 5 8	·78	77	Rs. 1,315·874
B .. ..	..	Not working..	..	..	..	..	1937	24	20 0 0	1·87	N. G.	480·000
C	1933	122	12 1 2	·74	N. G.	1,478·000	1937	166	12 1 11	·89	N. G.	2,011·875
D	1931	80	14 5 6	·88	90	1,147·500	1937	76	15 11 6	1·07	90	1,194·625
E	1929	54	15 10 0	·96	95	843·750	1937	70	16 6 3	1·12	82·3	1,147·848
F .. ..	..	Not working..	..	..	..	..	1937	20	11 6 0	·78	N. G.	227·500
G	1929	94	11 14 0	·78	N. G.	1,116·250	1937	108	11 14 0	·81	N. G.	1,228·125
H	1929	N. G.	12 12 0	·78	N. G.	..	1937	N. G.	12 12 0	·87	N. G.	..
I	1929	135	11 11 6	·72	N. G.	1,532·029	1937	155	10 15 0	·75	N. G.	1,695·812
J	1930	All Mule spinning.	..	..	..	..	1937	..	All Mule spinning.	..	..	..
K	1934	58	12 0 0	·74	N. G.	696·000	1937	60	12 0 0	·82	N. G.	7,30·000
Total column nos. 3 and 7	..	617	..	..	..	7,785·351	..	790	..	..	..	10,015·654

Result of 7 ÷ 8 average per person reported. 12·53
 Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour 771

× by 16 to give annas ÷ 234 = annas per hour 12·67
 Decrease
 Increase 12·45 per cent. (annas per hour) 867

Category no. 13—Siders (spinning)

N. G.=Information not given.

1	2	3	4	5	6	7	2	8	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1980	120	17 18 0	1.09	90	2,187.500	1937	264	20 6 4	1.89	87	5,384.500
B .. .. .	..	Not working..	..	..	..	..	1937	69	29 10 0	1.62	N.G.	1,630.125
C	1933	299	18 0 6	1.11	N.G.	5,385.187	1937	370	19 13 8	1.86	N.G.	7,844.813
D	1931	160	15 14 9	.98	87	2,547.499	1937	160	18 18 0	1.29	94	3,366.250
E	1929	108	15 10 0	.96	95	1,687.500	1937	108	21 8 9	1.45	93.2	2,253.811
F .. .. .	..	Not working..	..	..	..	..	1937	58	12 6 0	2.85	N.G.	717.750
G	1929	220	16 4 0	1.00	..	3,575.000	..	..	16 4 0	1.11	..	4,682.500
			16 14 0	1.04	N.G.	4,125.000	1937	282	16 14 0	1.15	N.G.	4,758.750
H	1929	N.G.	18 12 (L)	.85	..	..	..	..	19 12 0	.94	..	L—Galter (Boys).
			19 0 (B)	1.17	N.G.	..	1937	N.G.	19 0 (B)	1.30	N.G.	B—Big Piecer.
I	1929	571	18 2 8	1.12	N.G.	10,358.290	1937	434	17 14 3	1.22	N.G.	7,555.624
J .. .. .	..	All Mule spin-ning.	..	..	..	..	1937	..	All Mule spin-ning.	..	..	..
K	1934	198	19 2 6	1.18	N.G.	3,792.987	1937	198	19 2 6	1.81	N.G.	3,792.987
Total columns 8 and 7	..	1,676	..	..	..	29,550.663	..	1,958	..	..	..	86,805.985

Result of 7÷3 average per person reported .. 17.63
 Result of 7×16 (to give annas)÷260 to give annas per hour .. 1.085
 × by 16 to give annas÷284 = annas per hour .. 15.84
 Decrease 18.71 per cent. (annas per hour) .. 1.288
 Increase

Category no. 14 - Doubling tenters.

N. G. = Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total, columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total, columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	26	16 8 4	1.02	94	429.541	1937	26	14 10 6	1.00	94	381.062
B .. ..	..	Not working	..	..	..	..	1937	..	Nil	..	..	..
C	1938	Nil	..	..	..	..	1937	..	Nil	..	..	..
D .. ..	..	Nil	..	..	..	..	1937	..	Nil	..	..	..
E	1929	27	16 14 0	1.04	96	455.625	1937	29	17 1 0	1.17	89.5	494.812
F .. ..	..	Not working	..	..	..	..	1937	3	12 7 11	.88	N.G.	37.484
G .. ..	..	Figures not available.	..	..	..	..	1937	17	21 13 0	1.49	N.G.	370.012
H	1929	N.G.	19 10 6	1.21	N.G.	..	1937	N.G.	19 7 6	1.33	N.G.	..
I	1929	15	16 14 3	1.04	N.G.	253.859	1937	14	16 15 6	1.16	N.G.	227.562
J .. ..	..	Nil	..	..	..	..	1937	..	Nil	..	..	..
K	1934	Seldom worked	..	..	..	..	1937	..	Seldom worked	..	..	..
Total columns 3 and 7	..	68	..	..	..	1,133.525	..	69	..	..	..	1,521.732

Result of $7 \div 3$ average per person reported 16.74
 Result of 7×16 (to give annas) $\div 260$ to give annas per hour .. 1.030
 \times by 16 to give annas $\div 234 =$ annas per hour 17.10
 Decrease 13.60 per cent. (annas per hour) 1.169
 Increase

Category no. 15— Reelers

N. G. = Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total, columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	199	15 5 11	'94	82	3,056*597	1937	193	10 5 5	'71	83	1,995*888 Very little work.
B .. ..	..	..	Not working..	..	..	..	1937	18	12 14 0	'88	N. G.	167*875
C	1933	..	Very few ..	..	..	..	1937	..	Very few.	..	..	..
D	1931	42	22 13 11	1*41	95	960*531	1937	Nil	..	..	..	..
E	1929	188	17 13 0	1*10	83*2	3,348*750	1937	286	16 8 0	1*11	86*1	3,820*250
F .. ..	..	..	Not working..	..	..	..	1937	11	16 4 10	1*12	N. G.	179*822
G	1929	159	12 8	'77	N. G.	1,987*500	1937	215	11 4 0	'77	N. G.	2,418*750 Very little work.
H	1929	..	Not working regularly.	..	..	..	1937	..	Not working regularly.	..	..	..
I	1929	312	11 9 3	'71	N. G.	3,612*374	1937	369	9 8 0	'58	N. G.	3,136*500
J	1930	100	25 14 0	1*60	89	2,587*500	1937	100	18 7 0	1*26	87	1,848*750 Less work.
K	1934	24	21 4 3	1*81	N. G.	510*374	1937	24	22 15 9	1*37	N. G.	551*624
Total columns 3 and 7	..	1,024	..	..	..	16,065*616	..	1,161	..	..	..	14,112*909

Result of 7÷3 average per person reported 15*69

Result of 7×16 (to give annas) ÷ 260 to give annas per hour *966

× by 16 to give annas ÷ 234 = annas per hour .. 12*15

Decrease 18*98 per cent. (annas per hour) .. 0*881
Increase

Category no. 16—Grey winders (old type machine)

N. G. = Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Percentage attendance	Total columns nos. 3 and 4 multiplied
			Rs. s. p.			Rs.			Rs. s. p.			Rs.
A	1930	96	12 7 4	76	82	1,195*989	1937	48	13 12 2	94	87	660*489
B .. ..	..	Not working	..	..	..	..	1937	40	20 18 6	1*48	N. G.	888*750
C	1933	96	19 15 10	1*23	N. G.	1,019*297	1937	100	19 9 10	1*34	N. G.	1,961*422
D	1935	80	18 12 0	1*28	87	582*500	1937	19	27 0 6	1*85	90	513*598
E	1929	80	23 5 6	1*44	82*6	1,867*500	1937	68	23 15 0	1*64	98	1,827*750
F .. ..	..	Not working	..	..	..	..	1937	35	10 5 0	71	N. G.	860*987
G	1929	125	23 13 0	1*45	N. G.	2,976*562	1937	125	23 5 0	1*59	N. G.	2,914*062
H	1929	N. G.	17 18 0	1*10	N. G.	..	1937	N. G.	17 15 0	1*23	N. G.	..
I	1929	108	21 14 0	1*85	N. G.	2,363*500	1937	120	20 11 0	1*41	N. G.	2,462*500
J .. ..	..	Nil	..	..	..	..	1937	..	Nil	..	..	..
K	1934	70	16 14 11	1*04	N. G.	1,185*260	1937	72	15 12 2	1*03	N. G.	1,187*374
Total columns 3 and 7	..	605	..	..	..	12,069*618	..	627	..	..	..	12,491*887
Correction	..	To correct Textiles to 10 hours add	..	..	..	62*500	..	..	..	..	..	..
Net total	..	..	..	..	..	12,132*118	1937	..	..	..	..	..

Result of 7÷3 Average per person reported .. 20*05
 Result of 7×16 (to give annas) ÷280 to give annas per hour 1*238

× by 16 to give annas ÷ 284 = annas per hour 19*92
 1*362
 Decrease
 Increase 10*46 per cent. (annas per hour.)

Category no. 17—Grey winders (high speed type machine)

N. G.=Information not given.

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per-centage attend-ance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1920	None	..	..	..	..	1927	40	15 4 0	1'05	90	611'875
B .. ..	..	Not working	..	..	..	..	1927	..	Nil	..	..	..
C	1923	None	..	..	..	..	1927	70	25 1 2	1'71	N. G.	1,755'000
D	1925	82	2 18 9	1'48	92	667'499	1927	82	27 0 6	1'85	90	865'000
E	1928	None	..	..	..	..	1927	None	..	..	..	..
F .. ..	..	Not working	..	..	..	..	1927	See no. 16	..	..	..	..
G .. ..	..	Nil	..	..	..	..	1927	Nil	..	..	..	..
H	1929	Nil	..	..	..	..	1927	N. G.	19 12 0	1'85	N. G.	..
I	1929	Nil	..	..	..	..	1927	Nil	..	..	..	..
J .. ..	..	None	..	..	..	..	1927	None	..	..	..	..
K	1924	Nil	..	..	..	..	1927	Nil	..	..	..	..
Total columns 3 and 7 ..		82	..	..	..	667'499		122				8,281'875
Correction ..		To correct Textiles to 10 hours add ..				74'167						
Net total ..						741'666						

Result of 7÷3 (average per person reported) 23'18
 Result of 7×16 (to give annas)÷260 to give annas per hour 1'426
 × by 16 to give annas ÷ 234 = annas per hour .. 22'76
 Decrease
 Increase 9'12 per cent. (annas per hour) .. 1'558

Category no. 18. Warpens (Old Type Machines). N. G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns, nos. 3 and 4 multiplied	Years	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns, nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	19	35 10 0	2'19	97	676'875	1937	11	44 15 11	3'08	94	494'942
B .. ..	..	Not working..	..	..	..	..	1937	8	40 12 9	2'79	N.G.	326'375
C	1933	28	44 11 1	2'75	N.G.	893'875	1937	18	82 7 11	2'22	N.G.	584'988
D	1935	2	33 6 0	2'28	80	66'750	1937	2	43 2 0	2'95	96	86'250
E	1929	12	48 14 8	3'01	87'2	586'687	1937	18	40 12 0	2'79	98'2	521'750
F .. ..	..	Not working..	..	..	..	..	1937	5	21 6 7	1'46	N.G.	107'057 Old and new types together.
G	1929	26	36 13 0	2'26	N.G.	957'125	1937	29	44 8 0	3'04	N.G.	1,028'500
H	1929	N.G.	51 7 0	3'60	N.G.	..	1937	N.G.	47 1 0	3'22	N.G.	No change in rate.
I	1929	26	40 1 3	2'47	N.G.	1,042'031	1937	26	35 14 2	2'46	N.G.	933'958
J .. ..	..	Nil ..	..	..	..	..	1937	Nil	..	..	..	..
K	1934	1	39 7 7	2'43	N.G.	710'531	1937	16	35 0 1	2'39	N.G.	630'098
Total columns 3 and 7	..	128	..	..	..	4,993'874	..	75	..	..	..	4,716'878
Correction ..	..	To increase Textiles from 9 to 10 allow	..	..	..	7'417	..	..	..	..	..	..
Nett Total	..	..	..	..	..	4,941'291	..	..	..	..	..	..

Result of 7 ÷ 3 (average per person reported) 40'17
 Result of 7 X 16 (to give annas) ÷ 260 to give annas per hour .. 2'472

X by 16 to give annas ÷ 234=annas per hour .. 38'05.
 Decrease 5'26 per cent. (annas per hour) .. 2'620.
 Increase

Category no. 19. Warpere (High Speed Type Machine). N. G. = Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earning	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied
			Rs. s. p.			Rs.			Rs. s. p.			Rs.
A	1929	Nil	..	..	..	..	1927	2	71 0 11	4'86	100	842'114
B .. .. .	..	Not working	..	..	..	..	1927	Nil	..	..	..	..
C	1927	Nil	..	..	..	..	1927	4	60 4 1	4'12	N.G.	241'081
D	1927	2	84 9 0	2'86	100	69'125	1927	2	47 2 8	3'22	96	94'812
E .. .. .	..	Nil	..	..	..	..	1927	Nil	..	..	..	..
F .. .. .	..	Not working	..	..	..	..	1927	See no. 16	..	..	..	..
G .. .. .	..	Nil	..	..	..	..	1927	Nil	..	..	..	..
H	1929	Nil	..	..	..	..	1927	G.	48 12 0	3'38	N.G.	..
I	1929	Nil	..	..	..	..	1927	Nil	..	..	..	..
J .. .. .	..	Nil	..	..	..	..	1927	Nil	..	..	..	..
K	1924	Nil	..	..	..	..	1927	Nil	..	..	..	..
Total columns 3 and 7	..	2	..	..	..	69'125	..	8	..	..	..	477'457
Correction	..	§ To correct Textiles to 10 hours; add				7'680	..	..	..	..	..	..
Nett Total	..	..	..	..	..	76'805	..	..	..	..	..	..

Result of 7 ÷ 3 (average per person reported) 25'60
 Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour 2'868

× by 16 to give annas ÷ 284 = annas per hour 59'88
 Decrease 72'72 per cent. (annas per hour) 4'081
 Increase

Category no. 20. Warping Creelers. N.G.=Information not given

1			2	3		4		5	6	7		2			3		4		5	6	7	
Name of mill			1929 year or nearest	Number employed		Average earnings		Annas earning per hour	Per-cent. attendance	Total columns nos. 3 and 4 multiplied		Year	Number employed		Average earnings		Annas earning per hour	Per-cent. attendance	Total columns nos. 3 and 4 multiplied			
						Rs. a. p.				Rs.					Rs. a. p.				Rs.			
A	..	..	1980	6		15 2 7		'98	100	90'988		1987	9		16 3 0		1'11	98	145'687	
B	..	..	..	Not working		..		..	..	..		1987	2		15 0 0		1'08	N.G.	80'000	
C	..	..	1933	24		12 7 5		'77	N.G.	299'078		1987	27		18 11 4		'94	N.G.	870'135	
D	..	..	1985	8		15 14 0		1'09	95	127'000		1987	(9) 5		16 10 0		1'14	86	88'195	
E	..	..	1929	9		18 3 9		'82	100	19'109		1987	18		15 0 6		1'08	100	196'406	
F	..	..	..	Not working		..		..	..	..		1987	5		13 10 2		'98	N.G.	68'177	
G	..	..	1929	..		..		..	..	..		1987	..		..		..	..	..
H	..	..	1929	N.G.		19 0 0		1'17	N.G.	..		1987	N.G.		18 8 0		1'26	N.G.	..	
I	..	..	1929	8		14 11 2		'90	N.G.	117'625		1987	12		15 4 8		1'04	N.G.	188'187	
J	..	..	..	Nil		..		..	..	..		1987	Nil		..		..	..	..
K	..	..	1934	4		16 8 0		1'02	N.G.	66'000		1937	4		16 8 0		11'3	N.G.	66'000	
Total columns 3 and 7			..	59		..		..	..	819'780		..	77		..		..	..	1,141'707	
Correction			..	To correct Textiles to 10 hours add		..		..	..	14'111		..	..		..		..	..	..
Net Total			..	..		..		..	..	838'891		..	..		..		..	..	..

Result of 7 ÷ 3 (average per person reported) .. 14'14
 Result of 7 × 16 (to give annas) ÷ 260 to give annas per hour .. '87

× by 16 to give annas ÷ 284 = annas per hour .. 14'88
 Decrease ..
 Increase 16'55 per cent. (annas per hour) .. 1'014

Category no. 21. Front Sizers. N.G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied
			Rs. s. p.			Rs.			Rs. s. p.			Rs.
A	1930	10	35 0 0	2.15	99	850.000	1937	9	38 7 4	2.29	97	801.124
B .. ..	..	Not working	..	..	..	..	1937	4	37 0 0	2.53	N.G.	148.000
C	1938	9	29 4 4	1.80	N.G.	268.422	1937	13	33 13 6	2.31	N.G.	489.922
D	1935	4	27 10 0	1.89	92	110.500	1937	4	28 7 0	1.94	91	113.750
E	1929	12	37 12 3	1.71	92.2	338.187	1937	14	27 14 6	1.91	96.9	390.687
F .. ..	..	Not working	..	..	..	..	1937	2	26 0 0	1.78	N.G.	52.000
G	1929	18	27 7 0	1.69	N.G.	329.250	1937	12	27 7 0	1.88	N.G.	320.250
H	1929	N.G.	30 0 0	1.85	N.G.	..	1937	N.G.	38 0 0	2.26	N.G.	..
I	1929	12	21 14 6	1.35	N.G.	262.875	1937	17	38 0 3	2.26	N.G.	561.265
J .. ..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	1934	7	38 0 0	2.34	N.G.	266.000	1937	8	38 0 0	2.60	N.G.	304.000
Total columns 3 and 7	..	68	..	..	..	1,916.284	..	89	..	..	..	1,749.488
Correction .. ..	..	To increase Textiles to 10 hours add				..	..	..	..	..	..	..
Nett Total	..	..	..	..	..	1,927.511	..	..	..	..	..	..

Result of 7÷3 (average per person reported) 29.20
 Result of 7×16 (to give annas) ÷ 260 to give annas per hour 1.797
 X by 16 to give annas ÷ 284 = annas per hour 3.180
 Decrease 21.08 per cent. (annas per hour) 2.175
 Increase

Category no. 22. Back Sizers. N.G. = Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total, columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1920	11	20 9 4	1.27	95	226.416	1937	9	19 6 0	1.82	95	174.375
B .. ..	..	Not working	..	..	..	..	1937	4	20 0 0	1.87	N.G.	80.000
C	1933	13	21 2 0	1.90	N.G.	274.625	1937	14	21 1 11	1.44	N.G.	295.687
D	1935	4	18 4 6	1.25	85	78.125	1937	4	18 4 6	1.25	90	78.125
E	1929	20	18 14 3	1.16	91.8	377.812	1937	18	19 11 0	1.85	99.8	354.375
F .. ..	..	Not working	..	..	..	..	1937	2	17 12 0	1.21	N.G.	35.500
G	1929	12	19 8 0	1.20	N.G.	234.000	1937	12	19 8 0	1.88	N.G.	234.000
H	1929	N.G.	18 8 0	1.14	N.G.	..	1937	N.G.	21 0 0	1.44	N.G.	..
I	1929	12	16 12 0	1.03	N.G.	201.000	1937	17	23 1 0	1.58	N.G.	392.062
J .. ..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	1934	7	22 0 0	1.85	N.G.	154.000	1937	7	22 0 0	1.50	N.G.	154.000
Total columns 3 and 7	..	79	..	..	..	1,541.058	..	87	..	..	..	1,798.124
Correction..	..	To increase Textiles to 10 hours add				..	..	..	..	..	..	..
Nett Total	..	..	..	..	..	1,549.183	..	..	..	..	..	..

Result of 7÷3 (average per person reported) .. 19.61
 Result of 7×16 (to give annas) ÷ 260 to give annas per hour .. 1.206

× by 16 to give annas ÷ 234=annas per hour .. 20.4
 Decrease 16.83 per cent. (annas per hour) .. 1.40
 Increase

Category no. 23. Drawers-in. N.G.=Information not given

1			2	3	4	5	6	7	2			3	4	5	6	7
Name of mill			1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied		
					Rs. s. p.			Rs.			Rs. s. p.			Rs.		
A	..	..	1920	22	24 11 8	1'52	86	548'812	1927	19	31 7 8	2'15	92	598'104
B	..	..	..	Not working	..	..	..	..	1937	10	23 9 6	1'61	N.G.	235'937
C	..	..	1923	18	38 0 11	2'34	N.G.	684'684	1937	19	43 14 5	3'00	N.G.	834'031
D	..	..	1925	6	34 4 0	2'34	95	205'500	1937	8	34 0 6	2'38	96	272'250
E	..	..	1929	22	26 18 0	1'65	92'7	589'875	1937	32	30 1 0	2'08	91'8	982'000
F	..	..	..	Not working	..	..	..	..	1937	8	25 10 11	1'76	N.G.	77'045
G	..	..	1929	36	23 5 0	1'48	N.G.	839'250	1937	24	27 9 0	1'88	N.G.	661'500
H	..	..	1929	N.G.	30 6 0	1'87	N.G.	..	1937	N.G.	27 3 0	1'86	N.G.	..
I	..	..	1929	19	24 12 3	1'52	N.G.	470'546	1937	25	20 9 0	2'02	N.G.	789'000
J	..	..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	..	..	1924	21	22 6 6	1'88	N.G.	470'581	1937	21	25 1 1	1'71	N.G.	526'421
Total, columns 3 and 7			..	144	..	..	..	3,804'498	..	161	..	..	..	4,908'289
Correction			..	To increase Textile to 10 hours add				
Nett Total			..	..	..	..	..	3,927'891	..	..	..	..	..	..

Result of $7 \div 3$ (average per person reported) 26'57
 Result of 7×16 (to give annas) \div 260 to give annas per hour 1'635

\times by 16 to give annas \div 254 = annas per hour 30'47
 Decrease
 Increase 27'46 per cent. (annas per hour) 2'084

Category no. 24. Teachers. N.G.=Information not given

1				2	3	4	5	6	7	8	9	10	11	12		
Name of mill				1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent attendance	Total columns nos. 8 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent attendance	Total columns nos. 8 and 4 multiplied	
						Rs. a. p.			Rs.			Rs. a. p.			Rs.	
A	..	..	..	1930	24	13 5 5	.82	93	820*125	1937	19	12 14 0	.88	91	244*625
B	..	..	..	..	Not working	..	..	..	..	1937	10	15 5 6	1*05	N.G.	1 59*497
C	..	..	..	1932	24	13 1 8	.81	N.G.	818*006	1937	26	13 13 0	.94	N.G.	359*125
D	..	..	..	1935	6	14 8 8	.99	90	87*093	1937	8	14 4 9	.98	92	114*375
E	..	..	..	1929	30	11 8 3	.71	86*2	845*468	1937	30	18 11 0	.94	91*1	410*625
F	..	..	..	..	Not working	..	..	..	..	1937	4	14 10 0	1*00	N.G.	58*500
G	..	..	..	1929	24	12 8 0	.75	N.G.	292*500	1937	24	12 8 0	.83	N.G.	292*500
H	..	..	..	1929	N.G.	18 0 0	.80	N.G.	..	1937	N.G.	18 0 0	.89	N.G.	..
I	..	..	..	1929	23	10 6 8	.64	N.G.	236*984	1937	30	13 5 0	.91	N.G.	399*375
J	..	..	..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	..	..	..	1934	21	15 0 0	.92	N.G.	815*000	1937	21	15 0 0	1*03	N.G.	315*000
Total columns 8 and 7				..	152	..	..	..	1,913*076	..	172	..	..	..	2,847*562
Correction				..	To correct Textiles to 10 hours add				..	9*877
Nett total				..	..	..	..	..	1,922*758	..	..	..	..	..	..

Result of 7÷8 (average per person reported)

12*65

Result of 7×16 (to give annas) ÷260 to give annas per hour ..

.778

× by 16 to give annas+234=annas per hour ..

13*56

Decrease 19*92 per cent. (annas per hour. ..

.933.

Category no. 25. Weavers (basis 2 looms per weaver except where mentioned). N.G.=Information not given

1	2	3	4	5	6	7	8	9	10	11	12	
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	558	34 15 8	2'08	83	16,833'638	1937	566	85 15 0	2'46	89	20,340'625
B .. ..	..	Not working	..	..	..	..	1937	115	50 5 1	3'44	N.G.	6,989'718 4 looms per weaver.
C	1933	666	36 8 3	2'35	N.G.	25,448'047	1937	(10) 871	38 5 8	2'02	N.G.	33,386'318
D	1935	836	31 10 0	2'16	92	9,677'250	1937	832	38 8 0	2'37	87	12,782'000
E	1929	745	41 0 6	2'52	93	30,568'281	1937	751	39 12 0	2'72	92	29,931'750 1,203 looms
F .. ..	..	Not working	..	..	..	..	1937	200	22 14 0	1'56	N.G.	4,575'000 per 2 looms
G	1929	665	30 5 0	1'57	N.G.	20,157'812	1937	788	33 14 0	2'32	N.G.	24,830'375
H	1929	N.G.	39 12 9	2'45	N.G.	..	1937	N.G.	36 14 6	2'52	N.G.	..
I	1929	723	37 10 0	2'32	N.G.	27,202'875	1937	715	37 9 0	2'57	N.G.	26,857'187
.. ..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	1934	623	39 8 4	2'48	N.G.	24,831'477	1937	600	35 8 9	2'41	N.G.	21,140'625
Total columns 3 and 7	..	4,284	..	..	..	1,58,001'880	..	8,447	..	..	..	1,80,188'588
Correction	..	To correct Textiles to 10 hours add				1,076'250	To correct Textiles to 9 hours subtract				1,2 8'200	
Nett Total	..	..	..	..	..	57,016'630	..	..	..	..	..	1,81,411'788

Result of 7÷3 (average per person reported) 34'67
 Result of 7×16 (to give annas)÷260 to give annas per hour 2'258
 *Laxmi Ratan actual 125 weavers average Rs.50-5-1 paid on the basis of full earnings for two looms plus half the earnings of the other two.

× by 16 to give annas ÷284=annas per hour .. 87'07
 Decrease
 Increase 12'36 per cent. (annas per hour) .. 2'585

Category no. 26. *Folders (Machine). N.G.=Information not given*

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1909 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1980	19	16 0 9	99	95	804.890	1937	21	14 2 4	97	92	399.499
B .. ..	..	Not working	..	..	..	..	1937	10	18 0 0	1.23	N.G.	180.000
C	1933	16	15 0 6	91	N.G.	240.530	1937	22	14 2 9	97	N.G.	453.406
D	1985	6	15 0 0	1.03	95	90.000	1937	6	15 0 0	1.03	95	90.089
E	1929	3	14 6 0	89	100	43.125	1937	6	14 5 9	93	96.2	71.796
F .. ..	..	Not working	..	..	..	..	1937	Nil	..	..	..	..
G	1929	Not known	15 0 0	92	N.G.	..	1937	7	15 0 0	1.03	N.G.	103.000
H	1929	N.G.	18 8 0	1.14	N.G.	..	1937	N.G.	13 6 0	1.26	N.G.	..
I	1929	9	14 1 6	87	N.G.	112.750	1937	13	14 2 3	97	N.G.	183.828
J .. ..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	1984	8 Back 8 Front	17 0 0 10 9 0	1.06 1.17	N.G.	136.001 152.030	1937 1937	8 Back 8 Front	17 0 0 13 0 0	1.16 1.30	N.G.	133.300 152.000
Total columns 3 and 7	..	63	..	..	..	1,079.265	..	118	..	..	..	1,111.29
Correction	..	To increase Textiles to 10 hours add				10.000	..	..	..	..	..	..
Nett Total	..	..	..	..	..	1,089.265	..	..	..	..	..	..

Result of 7÷3 (average per person reported) 16.01
 Result of 7×16 (to give annas) ÷260 to give annas per hour 985
 X by 16 to give annas ÷ 285=annas per hour .. 15.16
 Decrease 5.18 per cent. (annas per hour) .. 1.086
 Increase

Category no. 27. *Folders-hand.* N.G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1939 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1980	12	16 4 0	1.00	95	195.000	1937	16	16 4 0	1.11	92	260.000
B .. ..	..	Not working..	..	..	..	..	1937	10	19 0 0	1.30	N.G.	180.000
C	1933	9	15 0 6	.98	N.G.	120.250	1937	16	18 10 10	1.14	N.G.	266.766
D	1935	5	15 0 0	1.03	95	75.000	1937	5	15 0 0	1.03	95	75.000
E	1929	67	15 3 6	.94	95	1,010.656	1937	132	16 4 0	1.12	96	2,151.187
F .. ..	..	Not working..	..	..	..	..	1937	4	10 0 0	.68	N.G.	40.000
G .. ..	..	Not knowna	14 6 0 to 15 10 0	.88 to .96	N.G.	..	1937	..	14 6 0 to 15 10 0	.98 to 1.07	N.G.	..
H	1929	N.G.	18 8 0	1.14	N.G.	..	1937	N.G.	18 8 0	1.26	N.G.	..
I	1929	9	16 11 8	1.08	N.G.	150.328	1937	13	18 9 0	1.27	N.G.	241.921
J .. ..	..	Nil	..	..	..	..	1937	Nil	..	..	..	..
K	1934	11	18 14 0	1.16	N.G.	207.625	1937	11	18 14 0	1.29	N.G.	207.625
Total columns 3 and 7	..	112	..	..	..	1,767.859	..	207	..	..	..	8,432.499
Correction	..	To correct Cawnpore Textiles to 10 hours <i>add</i>	..	..	..	8.333	..	..	..	..	..	..
Nett Total	..	..	..	..	..	1,776.192	..	..	..	..	..	..

Result of 7÷8 (average per person reported) 15.83
 Result of 7×16 (to give annas) ÷260 to give annas per hour 9.76

× by 16 to give annas ÷234=annas per hour 18.58
 Decrease 16.19 per cent. (annas per hour) 1.134
 Increase

Category no. 28. Coolies. N. G.-Information not given

1	2	3	4	5	6	7	2	8	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 8 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	per cent. attendance	Total columns nos. 8 and 4 multiplied
			Rs. a. p.						Rs. a. p.			
A	1930	201	13 15 0 to 19 5 0	.86 to 1.19	85 to 100	29 categories	1937	245	12 10 0 to 17 4 0	.86 to 1.18	83 to 100	29 categories.
B .. ..	..	Not working until 1935.	..	..	..	..	1937	151	12 10 8 to 16 12 0	.86 to 1.15	N.G.	6 ..
C .. ..	..	Particulars not given.	..	..	..	..	1937	..	Particulars not given.	..	..	..
D	1931	83	16 0 0 to 19 0 0	.98 to 1.17	95	4 categories ..	1937	51	14 0 0 to 18 4 0	.96 to 1.25	95	5 categories.
E	1929	180	14 12 0 to 16 0 0	.91 to .98	95 to 97.8	5	1937	538	12 18 0 to 16 14 6	.87 to 1.16	96 to 98	5 ..
F .. ..	..	Not working	..	..	..	..	1937	47	9 12 0 to 14 10 0	.67 to 1.00	N.G.	9 ..
G .. ..	..	..	13 11 0 to 16 4 0	.85 to 1.0)	..	..	1937	..	13 12 0 to 16 4 0	.94 to 1.11	N.G.	..
H	1929	N.G.	18 8 0	1.14	N.G.	..	1937	N.G.	18 8 0	1.26	N.G.	..
I	1929	80	14 6 6	.89	N.G.	Wearing 1152.500	1937	117	14 11 0	1.00	N.G.	Wearing 1718.84.
J	1930	88	14 9 0 to 18 0 0	.89 to 1.11	82 to 100	3 categories ..	1937	94	11 6 0 to 15 14 0	.78 to 1.09	86 to 100	3 categories.
K .. ..	..	Particulars not given.	..	..	..	..	1937	..	Particulars not given	..	..	..

There is so much diversion in the work allotted to cooly la hour that it is not possible to classify on a single sheet of paper.

Result of 7÷3 (average per person report) × by 16 to give annas ÷ 234 = annas per hour
 Result of 7×16 (to give annas) ÷ 233 to give annas per hour
 Decrease (annas per hour)
 Increase

Category no. 29. Oilmen. N.G.— Information not given

1				2	3	4	5	6	7	2	3	4	5	6	7
Name of mill				1939 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied
						Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	..	..	..	1930	37	17 5 4	1.07	96	641.939	1937	21	15 4 9	1.06	96	321.234
B	..	..	..	..	Not working	..	..	..	..	1937	9	16 8 0	1.13	N.G.	132.000
C	..	..	..	1933	6	21 11 4	1.34	N.G.	180.266	1937	6	22 7 7	1.54	N.G.	134.375
D	..	..	..	1931	4	18 0 0	1.11	95	72.000	1937	6	17 5 0	1.13	96	103.675
E	..	..	..	1929	17	17 7 6	1.08	93	296.969	1937	18	15 7 6	1.06	93	278.537
F	..	..	..	..	Not working	..	..	..	..	1937	2	16 4 0	1.11	N.G.	32.500
G	..	..	..	1929	..	14 6 0	.88	..	..	1937	..	14 6 0	.96	N.G.	..
H	..	..	..	1929	N.G.	15 10 0	to .96	..	..	1937	N.G.	15 10 0	1.07	N.G.	..
I	..	..	..	..	..	19 8 0	1.20	N.G.	..	1937	..	19 8 0	1.39	N.G.	..
J	..	..	..	1930	6	14 11 0	.90	90	117.500	1937	10	15 9 0	1.06	95	155.625
K	..	..	..	1934	16	15 0 0	.92	N.G.	240.000	1937	16	16 0 0	1.03	N.G.	240.000
Total columns 3 and 7				..	88	..	..	..	1498.068	..	97	..	..	..	1,398.546

Result of 7÷3 (average per person reported) 17.02
 Result of 7×16 (to give annas)÷260 to give annas per hour .. 1.047

× by 16 to give annas ÷ 234 = annas per hour .. 16.07
 Decrease 4.36 per cent. (annas per hour) .. 1.099
 Increase

Category no. 80. Excepers (Departmental). N.G.=Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total columns nos. 3 and 5 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	13	12 12 0	'75	99	157'625	1937	19	11 10 7	'80	86	221'567
B .. .. .	..	Not working	..	..	..	..	1937	14	13 12 0	'94	N.G.	192'500
C	1933	6	14 11 5	'91	N.G.	88'281	1937	7	14 15 7	1'02	N.G.	104'313
D	1934	3	15 10 0	'96	90	40'875	1937	12	14 0 0	'96	95	168'000
E	1929	9	14 12 0	'31	97.8	132'750	1937	9	14 12 0	1'01	98	132'750
F .. .. .	..	Not working	..	..	..	..	1937	1	9 12 0	'87	N.G.	9'750
G	1929	..	10 0 0 to 11 4 0	'62 '69	..	..	1937	..	10 0 0 to 11 4 0	'68 '77	..	..
H	1929	N.G.	12 8 0	'77	N.G.	..	1937	N.G.	12 8 0	'85	N.G.	..
I	1929	37	12 2 6 to 12 6 8	'75 '82	N.G.	449'781 Boys 160'687 Wearing	1937	31 12	12 12 9 to 13 8 0	'87 '92	N.G.	366'708 Boys 162'000 Wearing
J	1930	4	13 12 0	'84	75	55'000	1937	4	13 11 0	'98	85	54'750
K	1934	18	11 0 0	'68	N.G.	193'800	1937	19	13 14 0	'95	N.G.	263'625
Total columns 3 and 7 ..	..	102	..	..	..	1,288'999	..	128	..	..	..	1,705'458

(136)

Result of 7-9 (average per person reported) 13'64 x by 16 to give annas = 234 = annas per hour .. 13'33
 Result of 7x16 (to give annas) ÷ 260 to give annas per hour 778 Decrease
 Increase 17'22 per cent. (annas per hour) '912

Category no. 31. Sweepers (Compound). N. G. = Information not given

1	2	3	4	5	6	7	2	3	4	5	6	7
Name of mill	1929 year or nearest	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total column nos. 3 and 4 multiplied	Year	Number employed	Average earnings	Annas earning per hour	Per cent. attendance	Total column nos. 3 and 4 multiplied
			Rs. a. p.			Rs.			Rs. a. p.			Rs.
A	1930	20	14 1 3	87	99	281'562	1937	19	15 4 1	91	97	251'848
B	..	..	..	..	..	..	1937	5	13 12 0	94	N.G.	55'000
C	1935	3	14 12 10	91	N.G.	44'306	1937	5	14 4 10	98	N.G.	77'500
D	1931	7	11 25 0	74	90	88'562	1937	9	13 11 6	94	90	128'468
E	1929	25	11 1 3	68	95	277'784	1937	31	12 0 0	82	98	972'000
F	..	Not working	..	..	..	..	1937	Not working	..	..	..	..
G	1929	..	8 12 0	54	..	..	1937	..	8 12 0	66	..	..
H	1929	N.G.	10 0 0 14 5 0	62 88	N.G.	..	1937	N.G.	10 0 0 14 0 0	68 98	N.G.	..
I	..	..	..	..	..	..	1937	..	..	..	..	..
J	1930	15	10 1 0	62	79	150'287	..	21	10 14 0	1 72	85	228'975
K	1934	32	13 12 4	85	N.G.	302'958	193	25	12 10 7	97	N.G.	291'213
Total Columns 3 and 4	..	92	..	..	..	1,121'169	..	112	..	..	..	1,393'404

Result of 7÷3 (average per person reported) .. 12'40
 Result of 7×16 (to give annas) ÷ 230 to give annas per hour .. 763

× by 16 to give annas ÷ 234 = annas per hour .. 12'44
 Decrease 11'54 per cent. (annas per hour)
 Increase .. 951

APPENDIX V

Terms of Reference—Our terms of reference include consideration of not only the rates of pay which shall be paid for time and piece-workers in any efficiency scheme which has been or may be introduced by individual mills, but also conditions which should be provided for the various occupations prior to the introduction of any efficiency scheme. Taking these two factors into consideration, we have the following recommendations to make regarding the main occupations in the mills :

Blow Room

Efficiency scheme recommended—We consider that, with very few exceptions, mills should be able to introduce a system of one man per two machines in the case of Exhaust and Lap Machines, Breaker Scutchers, Intermediate Scutchers and Finishing Scutchers. No additional expenditure on equipment would be required before introducing the system recommended, nor would it be essential to make any changes in the cotton used as far as this process is concerned, though it needs to be pointed out that the type of cotton used will necessarily affect the possibilities of introducing schemes in most subsequent processes.

Wages—Where two machines per man are being worked, we recommend that the wage paid should be on a time-work basis and should be consolidated; the minimum rate recommended is Rs.28-7 per month of 26 working days.

Card room—The possibility of increasing the allotment of cards per Stripper and Grinder depends to a very large extent on the quantity of cotton put through the card during the day. With conditions varying so greatly between mill and mill owing to the difference in the average count being spun it is not possible for us to recommend any general system for adoption other than a minimum which should be achievable in any mill. The minimum allotment of cards per Grinder and Stripper and should, in our opinion, be that laid down in the Association's Standardization Scheme, namely, one Grinder and one Stripper per 20/24 cards where patent strippers are not in use.

As regards other occupations in the Card Room, the minimum number of cards allotted to each operative should be as under :

- | | | |
|----------------------------|-----|------------------------------|
| (1) Fly Gatherer | ... | One man for 40/50 cards. |
| (2) Lap Carrier | ... | One man for 27/30 cards. |
| (3) Card Tenter or Can Boy | ... | One man to each preparation. |
| (4) Sweeper | ... | One to 40/50 cards. |

If greater numbers of cards than those specified above are allotted to each operative, the wages paid should be somewhat higher than those specified in the schedule recently adopted by the Association for unrationalized occupations.

Drawing Frames—Efficiency scheme recommended—We consider that a system of two men per three heads of Drawing irrespective of the number of deliveries, could be introduced in all mills for 12s. and over. No further expenditure on equipment would be necessary. As regards cotton, see note under Blow Room.

Wages—The wages recommended for this system of work should be on a piece-work basis, and payment should be made at the rate of 20 per cent. higher than the rate paid per operative on the 3 head system.

It has been brought to our notice that the system of estimating the wages payable to Drawing Frame Tenters varies in different mills, and we are of the opinion that, if and when standardization of wages is attempted in the future, the system of payment of drawing tenters should be made uniform.

Slubbing Department—We do not advocate any change in the present system of one man per machine.

Intermediate Frames—We recommend the continuance of the system of one frame per man. In certain cases where conditions are exceptional, it would be possible to introduce a system of two frames per man with a back tenter, but the saving in such a system is, in our opinion, too small to justify our advocating its general adoption.

ROVING DEPARTMENT

Efficiency scheme recommended—We consider that where rovings are being made for counts 12s. and over, a system of one man per two rovers is possible in all mills without any additional expenditure on equipment. The cotton used should, however, be sufficiently good to reduce sliver breakages to a minimum, as otherwise the possibility of introducing the efficiency system in the spinning department will be affected adversely.

Wages—We recommend that the wages paid for the system of work recommended should be on a piece-work basis with wages for two frames equivalent to two-thirds of the calculated wage, with 35 per cent. Dear Food Allowance for a 10-hour day, and two-thirds of the calculated wage with 40 per cent. Dear Food Allowance, when the 54-hour week is introduced.

Complement of Doffer boys—Though not essentially an efficiency scheme recommendation, we consider it desirable that the attention of all mills should be drawn to the necessity of maintaining their complement of Doffer boys, according to the scales recommended in the original Standardization Scheme of the Association framed in the year 1930, namely—

- 1 per 130 roving spindles when hank roving is $2\frac{1}{2}$ and under;
- 1 per 160 roving spindles when the hank roving is between $2\frac{1}{2}$ and $3\frac{1}{2}$;
- 1 per 240 roving spindles when the hank roving is between $3\frac{1}{2}$ and 4;
- 1 per 300 spindles when the hank roving is between 4 and $4\frac{1}{2}$;
- 1 per 400 spindles when the hank roving is $4\frac{1}{2}$ and over.

Wages to be paid as specified in the recent schedule for unrationalized occupations.

RING SPINNING

Efficiency scheme recommended—In our opinion, it should eventually be possible for practically all mills to introduce a system of two sides per man in the spinning department in all counts above 20s. In certain cases where spinning is exceptionally good, two sides per man is possible on counts 12s. and over. At the same time, we wish to make it clear that it is not possible for us to recommend the compulsory adoption of the two-sides system unless adequate safeguards are introduced which ensure that the spinning qualities of the yarn reach a minimum standard. The only real test of spinning quality is the breakage test. Details as to the number of breakages which take place in mills which have successfully introduced the two-sides system have been supplied to us, and after a study of these particulars, we have reached the conclusion that the introduction of the two-sides system should not ordinarily be attempted by mills unless upon introduction the number of breakages which an operative working on two sides would have to piece up does not exceed 2 per minute. Generally speaking, we consider that where a change over to the two sides system is introduced, better cotton will be necessary.

Wages—The wages to be paid where two or more sides per man are being worked, should, in our opinion, be consolidated and on a time-work basis with a minimum equivalent to $33\frac{1}{2}$ per cent, higher than the minimum

wage laid down in the recent schedule adopted by the Association for single side, that is—

	Warp		Weft	
	Wages per month on single side	Wages per month on double side	Wages per month on single side	Wages per month on double side
	Rs. a.	Rs. a.	Rs. a.	Rs. a.
Up to and including 800 spindles	20 5	27 1	21 2	28 3
301—360	21 2	28 6	21 2½	29 4
361—420	21 15	29 4	22 12	29 5
Over 420 spindles	22 12	30 5	23 9	31 7

WEAVING

Efficiency scheme recommended—We have given very careful consideration to the possibility of making recommendations for the adoption of efficiency systems in weaving, but our final conclusion is that the decision to adopt a 3 or 4-loom system depending as it does on so many different factors, must be left to the discretion of individual mills. The main points to be considered are—

(a) Quality of warp yarn being supplied to the weaver.

(b) In our opinion, no matter what class of goods are being woven, it would be difficult to work an efficiency system in the weaving department unless the number of warp breakages per loom per hour is reduced to a minimum. For a 4-loom system, warp breakages should not, in our opinion, exceed two per loom per hour, and on 3-loom system, 3 per loom per hour.

(c) The next factor to be taken into consideration is the layout of the machinery in the shed. Before any system can be successfully introduced, the layout must be arranged to suit the system; for instance a 3-loom system would be difficult to operate in a shed in which looms are arranged in lines of 4. The starting handles should also be arranged in groups; for example, in a 3-loom system, the starting handle for all the three looms worked by the same man should be in close proximity.

(d) The class of work must be taken into consideration when a decision is being taken on the question of introducing a 3-loom or 4-loom system, for example, in a mill which is producing practically nothing but *dhoties*, the number of shuttle changes which have to be made per hour must be taken into consideration. If complicated headings are the rule, it would be found that in certain instances, the number of shuttle changes on a 4-loom system would be excessive, and might greatly reduce loom efficiency.

(e) A further consideration is the average count of weft being used. If the average count is low, the amount of shuttle changing involved in a 3 or 4-loom system might rule out the possibility of its adoption.

Speaking generally, we would like to lay down that wherever a 4-loom system is found possible after a scientific study by the management concerned, extra help should be given in the way of weft carriers and cloth carriers at the expense of the management.

We would also point out that the introduction of a 3 or 4-loom system is facilitated where coarse weft is being used, by supplying re-wound weft or using longer pirns. Re-wound weft would not, however, always be necessary even in moderately coarse counts if the length of yarn on the pirn is considerably greater than the normal owing to the use of large diameter rings on the spinning frame.

Wages—Subject to the conditions provided being satisfactory for the introduction of an efficiency system in weaving we recommend that the wages paid should be on a piece-work basis with Dear Food Allowances as laid down in the Association's schedule, with additional payment to the weaver equivalent to 50 per cent. of the wages earned on the additional loom, that is to say, where a 3-loom system is worked, wages should be five-sixths of the calculated wage, and on a 4-loom system three-fourths of the calculated wage.

General Observations—We wish to make it clear that our recommendations should not be construed as the last word in standardization. In the peculiar circumstances of the industry we feel that it would hardly be possible for us to do more than prescribe minimum wages, and in any event, standardization in rationalized occupations would be somewhat inconsistent as long as there is no uniformity in the wages paid in unrationalized occupations.