

1901.

GOVERNMENT OF BOMBAY.

Technical Education in Primary and Secondary Schools.

REPORT BY

ARTHUR W. THOMSON, D.Sc., C.E.

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No. 8544 OF 1900-1901.

*Poona : Office of the Director of Public
Instruction, 13th March 1901.*

From

THE DIRECTOR OF PUBLIC INSTRUCTION,

Poona ;

To

THE SECRETARY TO GOVERNMENT,

Educational Department, Bombay.

SIR,

With reference to Government Resolution No. 429 of March 16th, 1900, I have the honour to forward a Report from Dr. Thomson, Professor of Engineering, College of Science.

Dr. Thomson has confined his remarks in this Report to Technical schools generally, but has promised to submit a further report with special reference to Textile schools visited by him.

2. The Report shows in its earlier paragraphs the very great importance which is attached to Kindergarten exercises and to Drawing in Primary schools in England. The latter subject is called by Dr. Thomson "the rock foundation for any Technical Education which deserves the name," and he shows how in England a part of the whole school life from the infant class upward is devoted to this subject. He then proceeds to illustrate some of the methods employed, both in Kindergarten and Drawing for the training of hand and eye.

3. In a recent 'Note' which I have compiled for Sir E. Buck, K.C.S.I., on special duty with the Government of India, copies of which have been supplied to Government, I have pointed out what machinery we possess in Primary schools for the development of systematic instruction in Drawing, and how that machinery can be improved if funds are placed at the disposal of the Department. I therefore need not enter upon the same discussion in this letter, and it is sufficient to note here that—

(1) Drawing is now a compulsory subject in all our Training Colleges for our Normal students.

(2) That consequently all our trained masters will in future have had a certain training in Drawing, sufficient to enable them to introduce it in an elementary form in our Primary schools.

(3) That in all Government secondary schools Drawing is now taught from the lowest standard upward.

(4) That Drawing is also taught in many aided schools and will be included in our revised standards which will shortly be placed before Government.

4. As regards Kindergarten exercises the Department may be said to have made a beginning, but I cannot claim that any systematic Kindergarten instruction exists in our Primary schools, nor could it be developed without very largely increased funds. But in some schools and Training Colleges a fair standard of efficiency has been reached, and in many aided schools, both Secondary and Primary, Kindergarten instruction is systematically followed.

5. With reference to Dr. Thomson's remarks on clay modelling, I concur with him in thinking it a useful exercise for small children in the lower standards of Primary schools, but so far it has not been practised outside the Training Colleges, and in the vast majority of our Primary schools, it could not, I think, be efficiently taught at present. The staff of a village, or even town Primary school, is usually inadequate, and there is no special teacher for the infants as there would be if funds allowed.

6. Dr. Thomson has mentioned Brushwork, and given illustrations of it as shown in Macmillan's copy books, but this subject, even in England, is a new one, and has not been as yet accurately defined. Thus Brushwork according to the scheme of Mr. Burns, Acting Principal, School of Art, is somewhat different from Brushwork as depicted in this Report, for Mr. Burns goes to nature for all his models. At the present moment some of the best secondary schools in Bombay are experimenting in Brushwork on Mr. Burns' plan, and it is sufficient to say here that the subject is one which is already attracting attention and which will receive from the Department every possible encouragement. At present the encouragement of a special grant-in-aid is impossible.

7. Dr. Thomson's Report shows that in the large towns of England arrangements have been made or are being made to pass every boy in a Primary school through a course of manual training in woodwork; and he attaches for information the scheme of the Manchester School Board. But Manchester is spending £300,000 on one school alone, or twice the Annual Provincial Grant to education in the Bombay Presidency. At two of our Training Colleges, Hyderabad and Dhárwár, there are manual training workshops for the Normal students, but at Ahmedabad the funds for the workshop and its maintenance are not forthcoming, though a site has been long acquired, and in Poona we have not even got so far as a site. Thus it is almost impossible to gravely consider the development of such a system for our Primary schools, and we must be content to recognize what is better and desirable, but to follow what is worse, till the financial position is very different from what it has been of late. While the majority of the boys of this Presidency obtain no education whatsoever and there are no funds to multiply even the most elementary schools, it is vain to discuss the benefits of a general system of Manual Training in Primary schools. The same remarks apply to paragraphs 15 and 16 of the Report, which also deal with Primary Education in England.

8. Dr. Thomson then proceeds to comment upon Secondary Education in England. This, with large differences, corresponds to some extent to Secondary Education in Bombay, but there is nothing in this Presidency which can be compared in any way to such a school as the Higher Grade school under the Leeds School Board. It is true that our High schools prepare pupils for the University and also for the general work of the world, but the distinctive classification shown in the Leeds Prospectus is almost wholly wanting, nor can the accessories of even our very best schools be compared for a moment with those of the Leeds Higher Grade school. It may be useful to have so high an ideal placed before us, but attempts to reach it must be slow and halting in a country where the want of funds meets us at every turn.

9. Dr. Thomson concludes his Report with suggestions for our Indian schools. I have to some extent anticipated his suggestions for Primary schools, and I have fully anticipated in the Note alluded to in paragraph 3 his proviso that funds are required before substantial development is possible. Thus the suggestions as to Drawing and clay modelling may be accepted generally and subject to the existence of an adequate teaching power. Woodwork must for the present, I think, be confined to special Technical schools, though its development in ordinary schools may be encouraged where possible.

10. The suggestions for the improvement of Secondary schools are obviously sound, and it is at the same time equally obvious that to give effect to them generally will require a much larger expenditure than is at present possible in Government or aided schools. A possible solution of this difficulty might perhaps be found in special fees for Manual Training from which the cost of the workshop and teacher might be defrayed wholly or partially. But, in spite of the cry for special instruction, I doubt if this suggestion would be enthusiastically received in the Bombay Presidency at the present time.

11. **Technical Schools.**—Dr. Thomson points out that the schools which exist in this Presidency have no exactly corresponding schools in Great Britain, where instruction in work connected with distinct trades is given largely in special evening courses or classes. Dr. Thomson, I believe, rightly expresses the opinion that we can never expect much from evening classes in India. Certainly

our experience of the ordinary night schools shows that the Indian adult or wage-earning youth will not attend an evening class, but prefers, in a relaxing climate, an early rest after labour. But I may note here that Mr. Burns has lately suggested the possibility of morning trade classes in connection with the School of Art, and this might, with funds, be tried in Bombay. For the rest, Dr. Thomson's recommendation is that existing technical or industrial schools should be enlarged in scope as funds permit, and that they should be worked if possible in connection with local industries. This recommendation is similar to that made by me in the 'Note' with reference to our technical schools and the proposed craft schools. Dr. Thomson's final recommendation that the Public Works Department and other officers in Government service, Railway officials, and Managers of mills and large workshops should recognise as far as possible, the trained outturn of our special schools, is one that I submit to the favourable consideration of Government. If publicity is given to this report, it will be easy for Government to bring the matter to the notice of officials and the public generally.

12. Finally, I am of opinion that it would be well to print Dr. Thomson's Report and to lay it on the Editor's table. It will at least serve to show the public what is being done in England in certain directions, and what ideals the people of this Presidency may set before themselves. It is acknowledged that we are very far behind England in respect of the special instruction described in this Report, but it is not the less useful that the managers of schools should learn at what to aim in future developments, and it is to be hoped that hereafter Government may be in a position to assist those developments by that material aid which is so requisite for their ultimate success.

I have the honour to be,
 Sir,
 Your most obedient servant,
 E. GILES,
 Director of Public Instruction.

Accompaniment to Director of Public Instruction's letter No. 8544,
dated 13th March 1901, bearing Register No. 566.

1901.

GOVERNMENT OF BOMBAY.

Technical Education in Primary and Secondary Schools.

Report on a visit to some of the more important educational centres in England and Scotland; and suggestions based thereon by
ARTHUR W. THOMSON, D.Sc. (Glas.); C.E., M.Inst.Eng.Scot.;
Professor of Engineering, College of Science, Poona;
Inspector of Technical Education, Bombay Presidency.

In the beginning of last year Government was pleased to grant me furlough for about six months; and during a portion of that time, September and October 1900, I visited the following educational centres:—London, Manchester, Birmingham, Bristol, Bradford, Leeds, Sheffield, Huddersfield, Oldham, Ashton-under-Lyne, and Trowbridge; Edinburgh, Glasgow, Paisley, Dundee, and Dunfermline.

The short time at my disposal prevented me from seeing many other places of perhaps much greater importance than some of those visited, but enough was done to allow me to form a fair idea of the educational work which is being carried on in Great Britain.

2. The object of my visit was to see whether any of the Technical Subjects or Methods of Instruction adopted in Great Britain could with advantage be introduced into our Indian schools.

3. Great earnestness and activity in the matter of Technical Education were manifest in every town which I visited; and it was at once evident that much progress had been made in the last ten years. In the large cities enormous sums have lately been and are being spent on new buildings, &c.; for instance, Manchester is spending £300,000 on her new Technical school, which will be opened in the course of a few months; and in many of the important towns handsome buildings have recently been erected, some by local authorities, some by private munificence.

4. It will not be necessary for me to describe in detail the different schools which I visited, nor to give statistics; only such details as are in my opinion required for the purpose of illustrating this report will be given.

5. In the English Act of 1839, Technical Instruction means—

“Instruction in the principles of Science and Art applicable to industries, and in the application of special branches of Science and Art to special industries or employments; it shall not include teaching the practice of any trade or industry or employment. . . . The expression ‘Manual Instruction’ shall mean Instruction in the use of tools, processes of Agriculture, and modelling in clay, wood, or other materials.”

Under this Act, Trade Instruction or Workshop Training in the actual practice of any trade may be given only so long as that practice deals with principles and methods of work, and does not include teaching continued for the purpose of gaining manual dexterity in the practice of that trade.

6. The subject will best be considered under the heads—

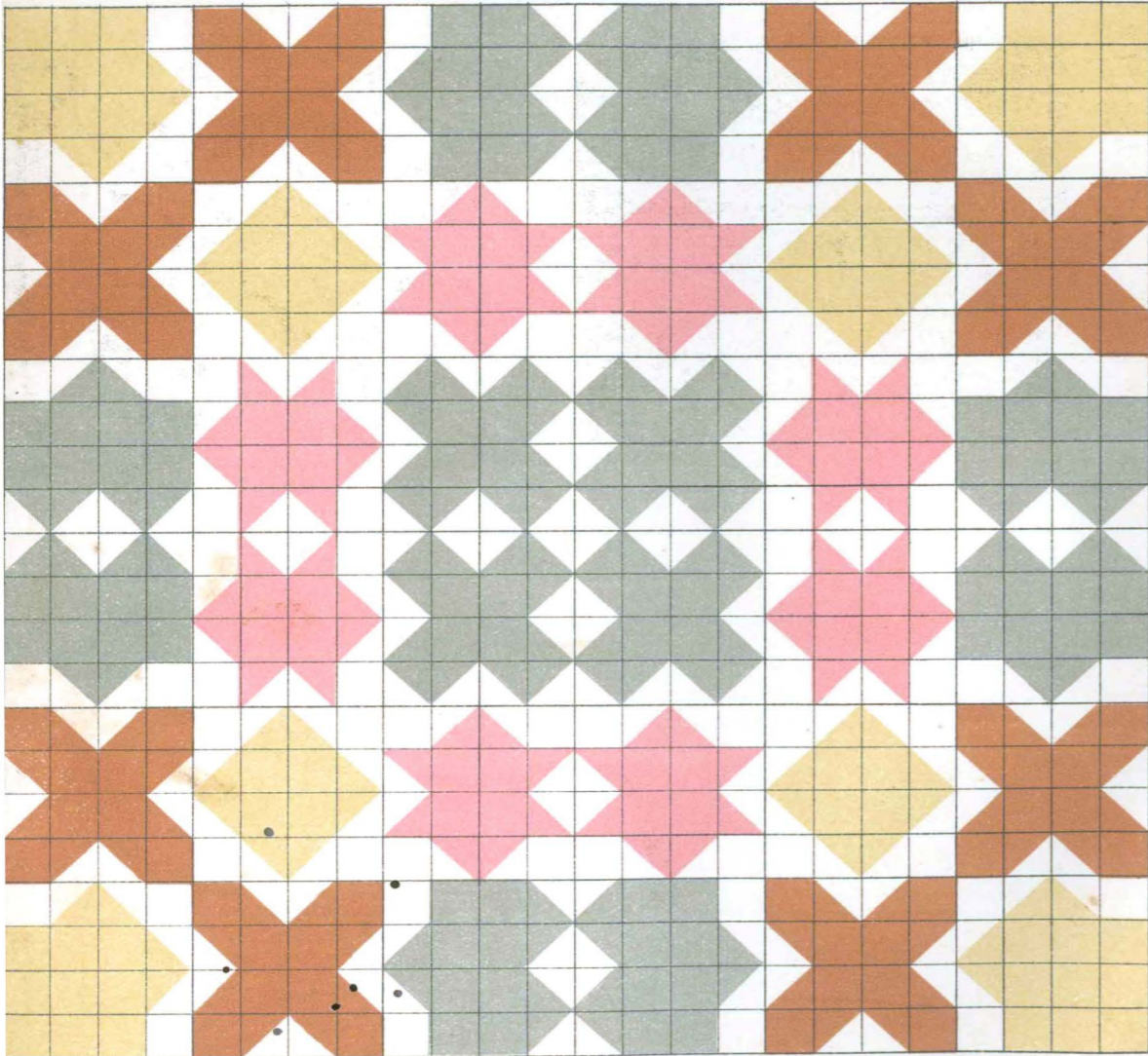
(a) Primary Education.

(b) Secondary Education.

(c) Recommendations for our Indian schools.

JOHN EDWARD NOWLAND.

Standard I.

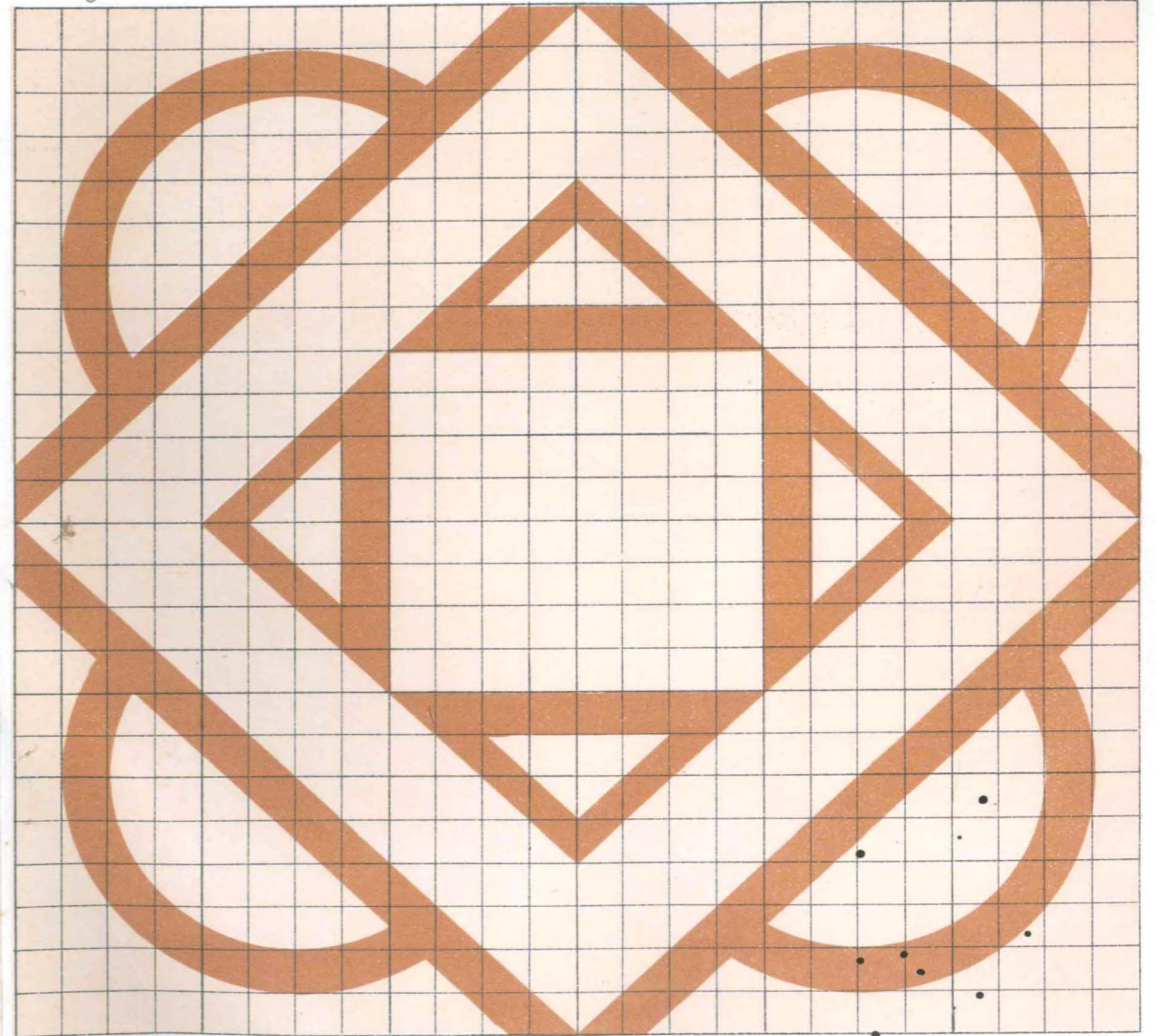


LITTLE HOLBACK BOARD SCHOOL. LEEDS.

LIZZIE COKILL.
Age 9 Years.

ROUNDHAY RD GIRLS, LEEDS.
Std. III.

M.A.E. DRIVER.



Drawn & Litho: Govt. Photodup. Office, Paona 1901.

7.

Primary Education.

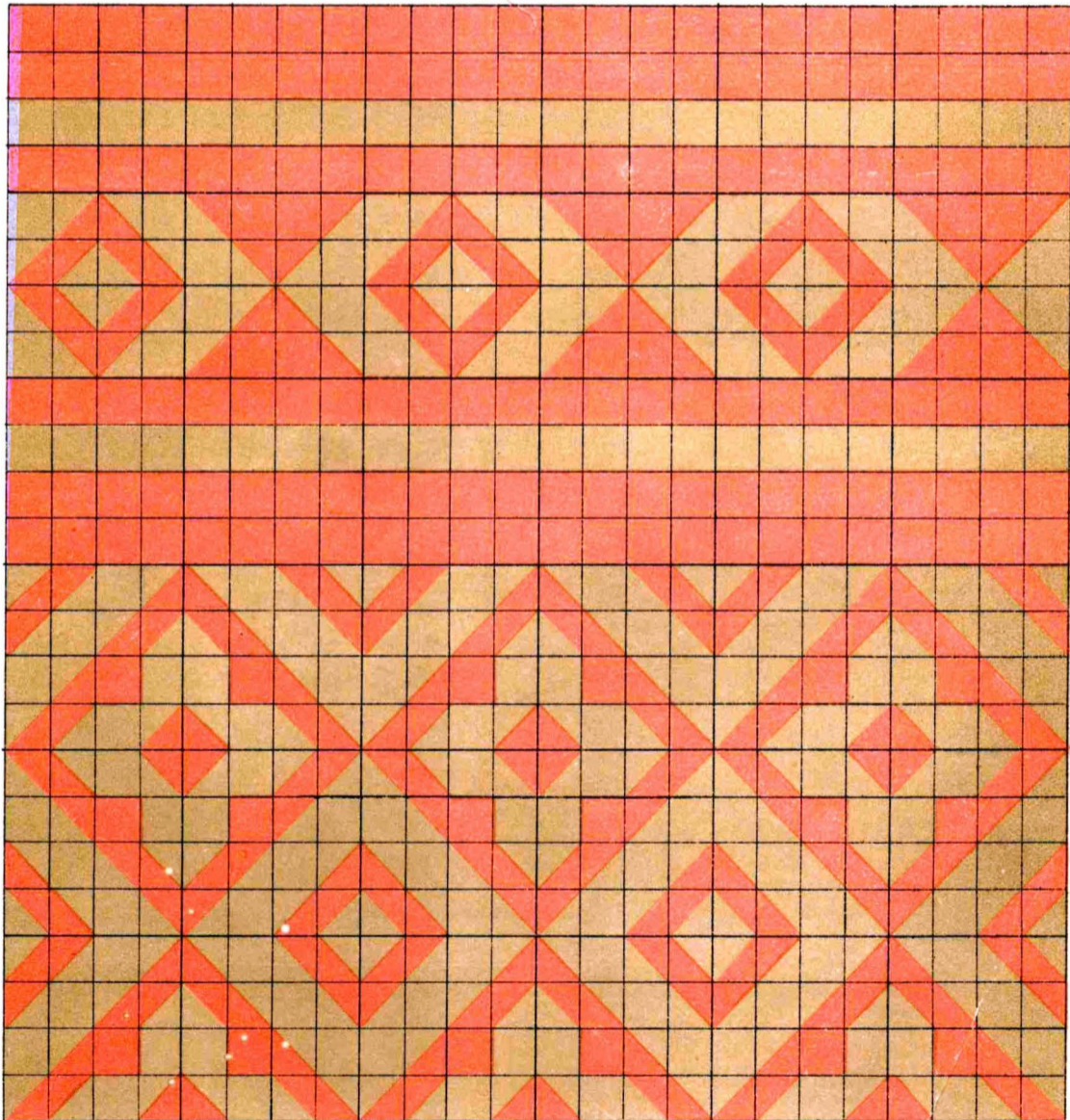
- | | |
|-------------------|---------------------|
| 1 Kindergarten. | 5 Woodwork. |
| 2 Drawing. | 6 Metalwork. |
| 3 Clay Modelling. | 7 Domestic Economy. |
| 4 Brushwork. | |

1.—KINDERGARTEN.

8. In the Infant classes the Kindergarten system is now firmly established, and with excellent results. The children whom I saw at work at Brick-building, Paper-cutting, Drawing, and Musical Drill appeared to be very happy in their infant studies.

In Paper-cutting the designs often show much taste in colour and form, and accuracy in mounting; good specimens of this work adorn the walls of some of the school rooms, and in this way there is obtained a healthy stimulus to the children to produce their best work. In many of the schools this work of a more advanced type is done in the standards. Three specimens made by children attending schools under the Leeds School Board are given to show what is done in this subject.

CHARLES CRAVEN ST. IV.
CHAPELTOWN (LEEDS) BOARD SCHOOL.



7.

Primary Education.

- 1 Kindergarten.
- 2 Drawing.
- 3 Clay Modelling.
- 4 Brushwork.

- 5 Woodwork.
- 6 Metalwork.
- 7 Domestic Economy

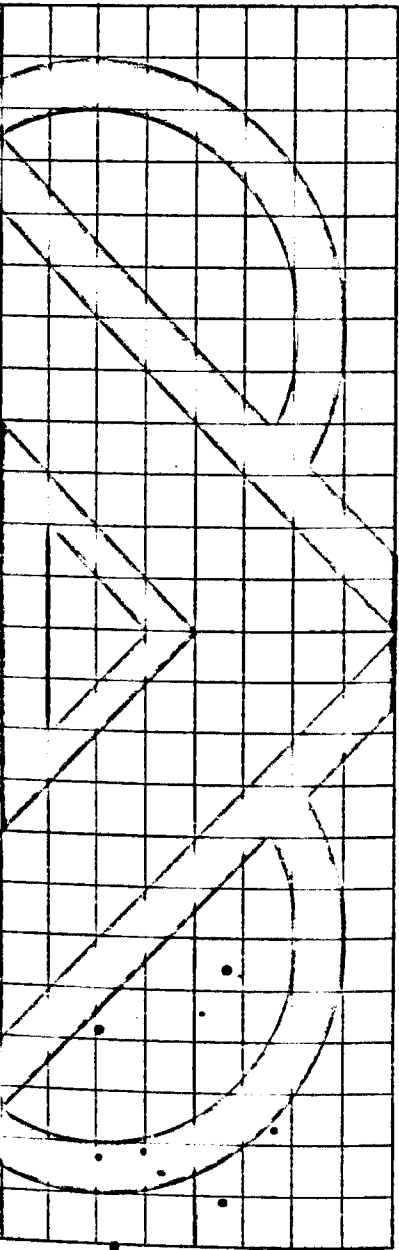
1.—KINDERGARTEN.

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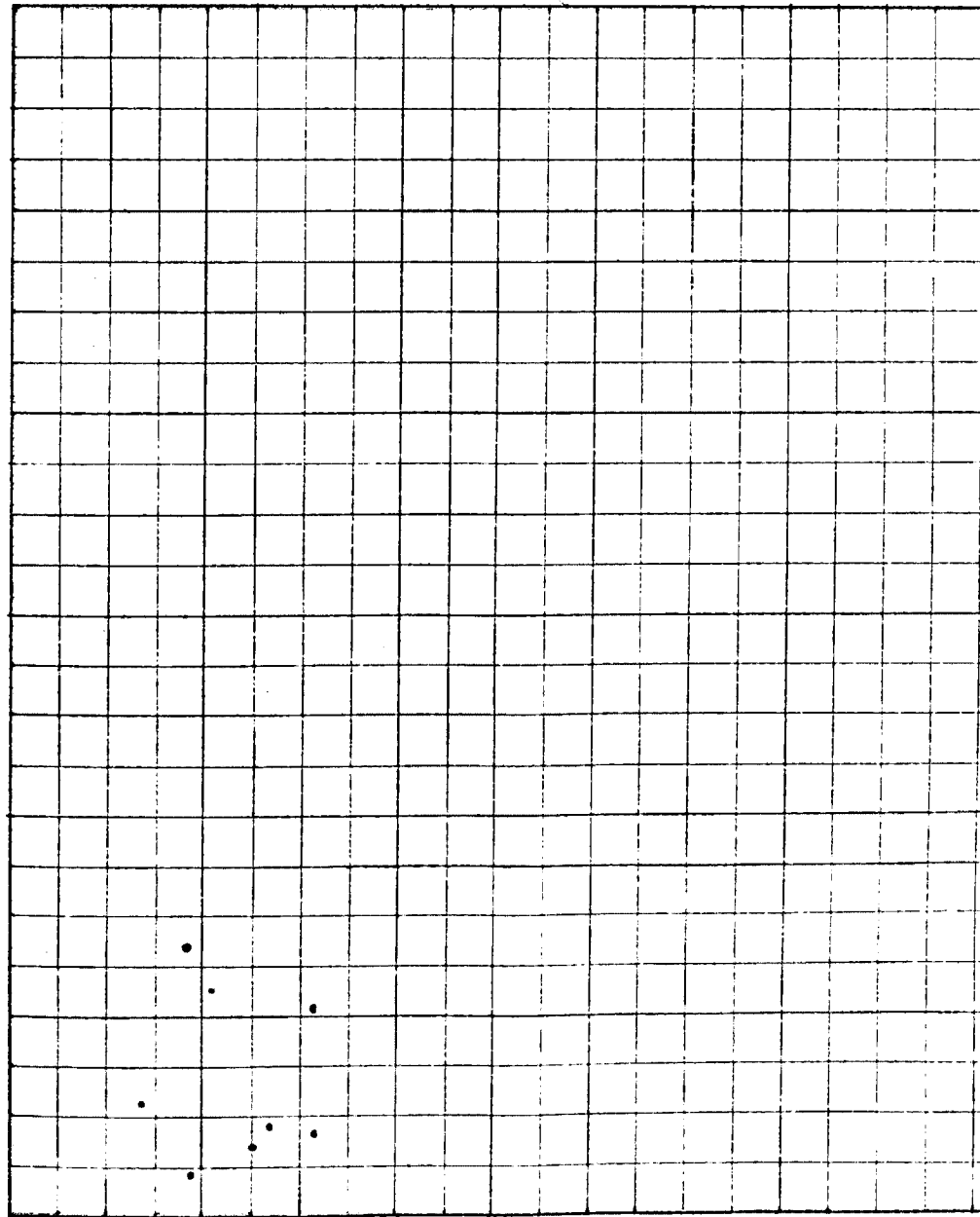
In Paper-cutting the designs often show much taste in colouring and accuracy in mounting; good specimens of this work adorn the walls of the school rooms, and in this way there is obtained a healthy competition among the children to produce their best work. In many of the schools a more advanced type is done in the standards. Three specimens of this kind of work, done by children attending schools under the Leeds School Board are given below. What is done in this subject.

S.

M.A.E. DRIVER.



CHARLES CRAVEN ST. IV. CHAPELTOWN (LEEDS) BOARD SCHOOL.



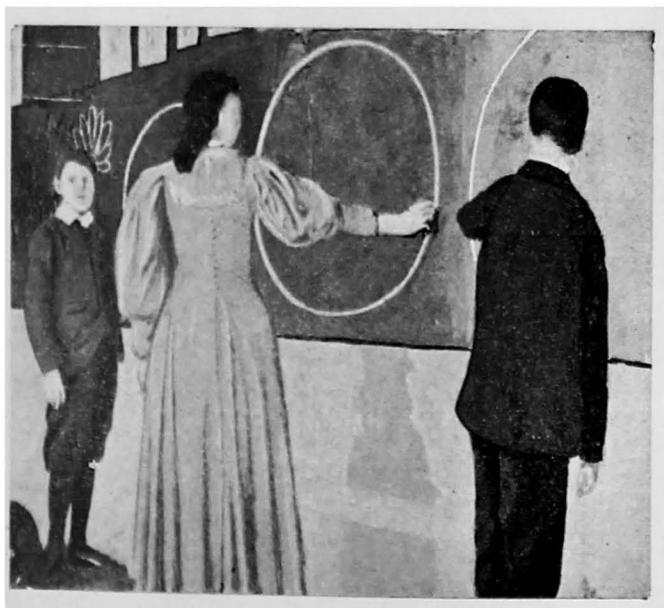
Primary Education.

2.—DRAWING.

9. Drawing is the rock foundation for any technical education which deserves the name. It forms part of the work in the Infant classes and in all the Standards; and from two hours to four hours per week during the whole school life of a child are given to this subject.

Some of the teachers whom I met expressed strong objections to the usual method of teaching Drawing from printed diagrams; and were much in favour of having most of the work done from a copy on the blackboard, from the objects themselves, or from plaster casts.

Long blackboards, on which a dozen or more pupils can, at one time, draw with chalk are in use in many of the class rooms. During these lessons *drawing from the shoulder* is practised, and the two hands are made to work together simultaneously and so as to form symmetrical patterns. I am glad to be able to illustrate the methods by diagrams given in "The School World" of January 1899, in an article entitled "Bimanual Training in Schools" by Mr. H. B. Bare.



3.—CLAY MODELLING.

10. Exercises in this subject are given in some of the schools which I visited. The material used is ordinary pipe clay, and the work consists in constructing simple geometrical figures—cube, prism, sphere, cylinder; and such objects as the common fruits and vegetables.

This subject is suitable for young children—say Standards I and II; and it appears to me to give excellent training at a very small cost for material which is used over and over again.

4.—BRUSHWORK.

11. This subject was introduced a few years ago into some of the schools, and it appears to be making good progress. The work is very attractive, the materials used are not expensive; and as a training in colour and form, more particularly in forms which repeat themselves, this subject is certainly in the front rank.

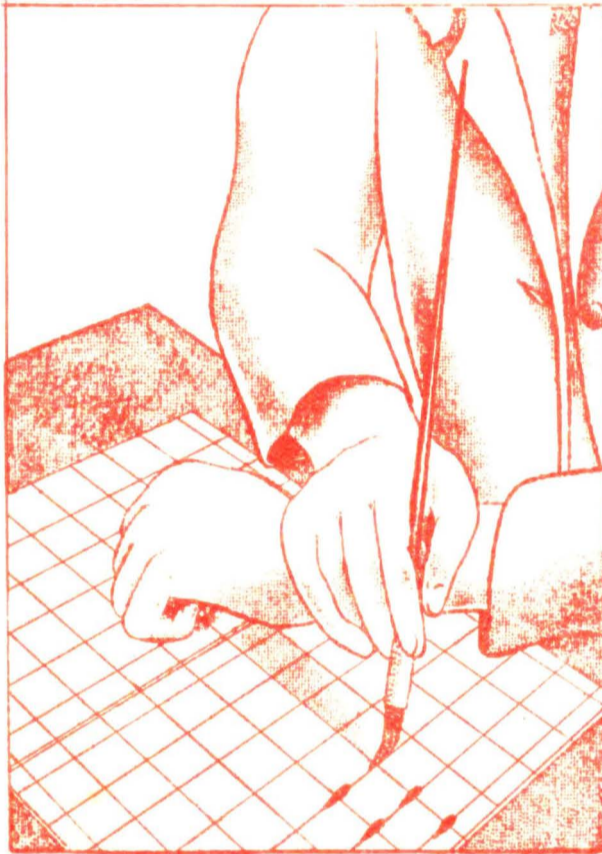
Messrs. Macmillan and Co. have recently published a series of Brushwork Copy Books, six in number, and costing about fourpence each.

In order to illustrate the subject, I have selected a few examples from these copy books and they appear on the following pages.

Primary Education.

12.—EXAMPLES SELECTED FROM MACMILLAN'S
BRUSHWORK COPY BOOKS.

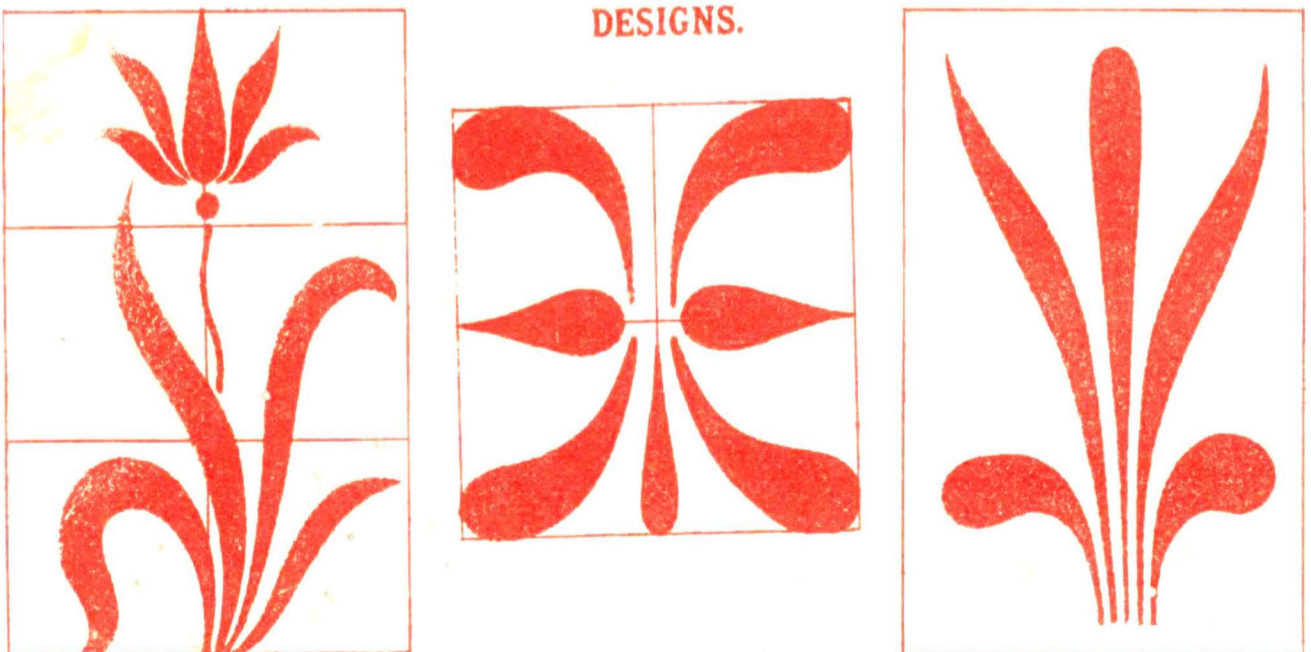
HOW TO HOLD THE BRUSH.



ELEMENTS.



DESIGNS.



Primary Education.
SIMPLE LEAVES.



OAK.



MAIDEN-HAIR FERN.



MARGUERITE.

BORDERS



VERTICAL BORDER.



12

A PANEL.

Primary Education.

5.—WOODWORK.

13. In this portion of the work of the schools which I visited, I was specially interested; as a good deal has already been done in this subject in the Technical schools, and a beginning has been made in a few of the ordinary Day schools in the Presidency of Bombay.

I was both surprised and pleased to find that woodwork now forms a most important part of the ordinary work of the Primary schools of Great Britain. In the cities London, Manchester, Leeds, Edinburgh, Glasgow, and others, arrangements have been completed or are nearly completed so that EVERY BOY ATTENDING THE BOARD SCHOOLS SHALL TAKE CARPENTRY, one lesson of two hours per week for three years, that is to say in Standards IV, V, VI. A workshop is attached to each large school; for smaller schools, one workshop is used as a centre for the schools in the district. Eighteen pupils go to form a Carpentry class under one teacher; for larger classes, two or more teachers are provided. With classes restricted to eighteen, each boy attending for two hours per week, a teacher is able to take three hundred (300) pupils on his list.

All the work is done in school hours; each working bench in the workshop is provided with a vice and a complete set of tools used by the pupils in turn; and the teacher is required to keep the eighteen or twenty sets of tools under his charge in good order.

The set of exercises which forms the Course of Instruction varies slightly in the different centres. The scheme in use in the schools under the Manchester School Board is given on the next page.

14. The teachers of this subject are of two kinds—Day School teachers who have taken Manual Training in Wood as a special subject; and selected men who have worked as tradesmen and who know Drawing and are otherwise suited for teaching posts. I made inquiry as to which class was found to be the better; and so far as I could judge, opinions seemed to be about equally divided. In the small schools where the whole time of the Carpentry Master is not required for this subject, the trained teacher will probably be preferred; but where the teacher of Carpentry has his time fully occupied, the trained artisan will probably find employment.

6.—METAL-WORK.

15. In a few centres a beginning has been made in this subject, which forms a continuation as it were of the course in woodwork. Only pupils who have completed the carpentry course are allowed to join; and the processes of working iron and other metals—cutting, chipping, filing, scraping, welding, soldering, drilling, &c.,—or some of them, are practised by the pupils in a set of graduated exercises.

7.—DOMESTIC ECONOMY.

16. Subjects falling under this head are taken by the girls, while carpentry or some other form of manual training is taken by the boys.

The subjects are—Sewing, plain and fancy; dress making; cookery; laundry work; lessons in health.

In one large Board School which I visited, arrangements are made daily by which any food, brought by the children from their homes for their midday meal, is heated and prepared free of charge; and plain cooked dinners, made by the pupils attending the cookery classes, may be had at reasonable rates by any of the pupils who desire to have them.

Primary Education.

MANCHESTER SCHOOL BOARD.

HAND, EYE, AND MANUAL TRAINING.

WOODWORK, DRAWING, Etc.

FOR ELEMENTARY SCHOOLS.

Course of work and time schedule for First year scholars.

| Work Period. | No. | Model or Exercise. | Finished Dimensions. | Material. | No. | Drawing. | Theory of Tools and Materials. |
|------------------------|-----|-----------------------------|---|----------------------|-----|--|--|
| First Quarter's Work. | 1 | Planing Exercise | 9" x 1" x 1 $\frac{3}{8}$ " | Scotch Fir | 1 | Elements of Parallel or Orthographic Projection, and Isometric Projection and Drawing. | Tool positions of Planing Saw, Chisel, Gauge, T-square, and Elementary uses. |
| | 2 | Sawing | 8 $\frac{1}{2}$ " x 1" x 1 $\frac{3}{8}$ " | Do. | 2 | | |
| | 3 | Door Button on Base | 2 $\frac{1}{2}$ " x 5" x 1" base 4 $\frac{1}{2}$ " x 5" x 2 $\frac{3}{8}$ " | Yellow Pine | 3 | | |
| Second Quarter's Work. | 4 | Half-Lap Cross Joint | 4 $\frac{1}{2}$ " x 1" x 1 $\frac{3}{8}$ " | Do. | 4 | Orthographic and Isometric Projections. Plan and Elevation. | Construction and uses of the above, and of tools now brought into use. |
| | 5 | Octagonal Prism | 8" x 1 $\frac{3}{8}$ " | Do. | 5 | | |
| Third Quarter's Work. | 6 | Oblique Sawing and Planing. | 8 $\frac{1}{2}$ " x 1" x 1 $\frac{3}{8}$ " | White Spruce | 6 | Orthographic Projection. | Growth of trees, structure of wood, and woods in common use. The Pines and Firs. |
| | * 7 | Hexagonal Mat | 5 $\frac{1}{2}$ " x 3" | Basswood | 7 | Plan and Elevation | |
| | 8 | Dovetail Tee Joint | 4 $\frac{1}{2}$ " x 1" x 1 $\frac{3}{8}$ " | Yellow Pine | 8 | Orthographic and Isometric Projections. | |
| Previous to Gov. Exam. | 9 | Pan Stand | 6" x 1 $\frac{1}{2}$ " x 1" | Walnut or Pine | 9 | Plan, Elevation, and Working Drawing of Joint. | Basswood, Walnut. Recapitulation previous to Government Examination. |
| | 10 | Mortising Exercise | 9" x 1 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Yellow Pine | 10 | Plan, Elevation and Isometric Drawing. | |
| | 11 | Bridle Joint | 4 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Basswood | 11 | Orthographic and Isometric Projections. | |
| | 12 | Modifications, 4, 6, 11. | Various for Tests | Y. Pine or W. Spruce | 12 | Various for Test of Principles. | |

Second year scholars.

| | | | | | | | |
|------------------------|-----|------------------------------|---|----------------------|----|--|--|
| First Quarter's Work. | 1 | Mortise Joint | 4 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Yellow Pine | 1 | Orthographic and Isometric Projections. Working Drawing. | Advanced Tool positions. Boring Bit, Spokesheave, Gauge, Hammer, Bow Saw. |
| | 2 | Desk Tray | 10" x 2" x 2 $\frac{1}{2}$ " | Satin Walnut | 2 | | |
| Second Quarter's Work. | 3 | Halved and Dovetailed Cross. | 5" x 3" x 1 $\frac{1}{2}$ " | Scotch Fir | 3 | Orthographic and Isometric Projections. Plan, Elevation and Section. | Nails and Screws. Hard woods, varieties and uses. Sharpening saws and other tools. |
| | 4 | Oblique Sawing and Inlay. | 10" x 3" x 1 $\frac{3}{8}$ " | Spruce and S. Walnut | 4 | | |
| | 5 | Dovetail Joint at 60° | 4 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Yellow Pine | 5 | | |
| Third Quarter's Work. | * 6 | Pen Tray and Inkstand. | 10" x 2 $\frac{1}{2}$ " x 5" x 2" | Satin Walnut | 6 | Orthographic and Isometric Projections. Working Drawing. | Glue. The Beech, Oak, Ash, Mahogany, Sycamore. |
| | 7 | Bridle and Mortise Joint. | 4 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Do. | 7 | | |
| | 8 | Tea-Pot Stand | 6" x 6" x 4" | Basswood and Walnut | 8 | | |
| Previous to Gov. Exam. | 9 | Housing and Grooving. | 5" x 2 $\frac{1}{2}$ " x 2" | Yellow Pine | 9 | Orthographic and Isometric Projections. Working Drawing. | Recapitulation previous to Government Examination. |
| | 10 | "Home Pets" Feeding Trough. | 12" x 2 $\frac{1}{2}$ " x 1" x 4" | Scotch Fir | 10 | | |
| | 11 | Simple End Dovetail | 4 $\frac{1}{2}$ " x 1" x 1 $\frac{3}{8}$ " | Satin Walnut | 11 | | |
| | 12 | Fern Basket | 8" x 8" x 4" x 1" Sq. | Basswood | 12 | Working Drawing. | |

Third year scholars.

| | | | | | | |
|------|-----------------------------|---|----------------------------------|----|------------------------------|--|
| 1 | Simple 3-Pin Dovetail. | 4 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Yellow Pine | 1 | Isometric (Joint apart). | Preservation of hard and soft Woods—chief methods in use. Chief natural timber destroyers. |
| 2 | Knife Box | 12" x 8" x 2 $\frac{1}{2}$ " x 1" | Scotch Fir | 2 | Working Drawing. | |
| 3 | Tenoned and Rabbeted Frame. | 8" x 6" x 1" x 1 $\frac{1}{2}$ " | Yellow Pine | 3 | Isometric (Joint apart). | |
| 4 | Bow-Saw Exercise | 12" x 3" x 1" | Do. | 4 | Working Drawing | |
| 5 | Wall Bracket | 12" x 6" x 1" | Do. | 5 | Isometric Drawing. | |
| 6 | Stop Dovetailing | 4 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " | Yellow Pine and Walnut | 6 | Isometric (Joint apart). | |
| 7 | Edge Jointing | 12" x 4" x 1" | Any White Wood and Satin Walnut. | 7 | Working Drawings | |
| 8 | Table Mat | 12" x 7" x 1" | Do. | 8 | | |
| * 9 | Dovetailed Box | 12" x 7" x 4" x 1" | Scotch Fir | 9 | Isometric (with lid off). | |
| * 10 | Shallow Tray | 11" x 6" x 1" x 1" | Satin Walnut | 10 | Isometric and Joint Details. | |
| * 11 | Inlaid Card Tray | 6" x 6" x 1" x 1" | S. Walnut and Sycamore. | 11 | Working Drawing. | |

NOTE.—Exercises or Models marked * are optional, all others must be taken in numerical order.

SECONDARY EDUCATION.

17. During my tour I visited a number of the largest and most important Higher Grade schools in the educational centres mentioned at the beginning of this report. Most of these schools are under the management of the School Boards; a few are under corporate bodies; and a few are under private control.

In every one of these schools the importance now given to science teaching, to practical work in the laboratories physical and chemical, and to workshop instruction is very great indeed.

18. I will describe in detail one of the very best of these schools; and from this description a very good idea of what is aimed at in all and attained to in many of the secondary schools of Great Britain will be obtained.

19. The Leeds Higher Grade School is under the School Board; the accommodation is for over 2,000 pupils and 1,800 are in actual attendance; and manual instruction in the workshop forms part of the compulsory course for boys in every standard. A portion of the printed prospectus for 1900-1901 is given; as, with its letter-press and five very fine illustrations, it will give a clearer idea of what is done than could be obtained in any other way.

PROSPECTUS.

In this school accommodation was provided at first for about 2,639 scholars, but the provision of Laboratories and Lecture Theatres has considerably diminished the number of school places. At the end of last school year, the tenth in the history of the new building, the number of pupils on the roll was 1,761. The utmost attention has been bestowed on the lighting, warming, ventilation, and sanitary arrangements of the building; the fittings are of the most approved designs calculated to ensure the comfort of the pupils, and to secure the best educational results. The Chemical Laboratory is one of the largest and best equipped in the Kingdom; the Physical Laboratory is fitted and furnished for enabling pupils practically to perform what the Demonstrator has shown in the Lecture Theatre. Commodious Play-grounds are provided for recreation; and pupils coming from a distance can have their luncheons, warm if desired, in comfortable dining-rooms.

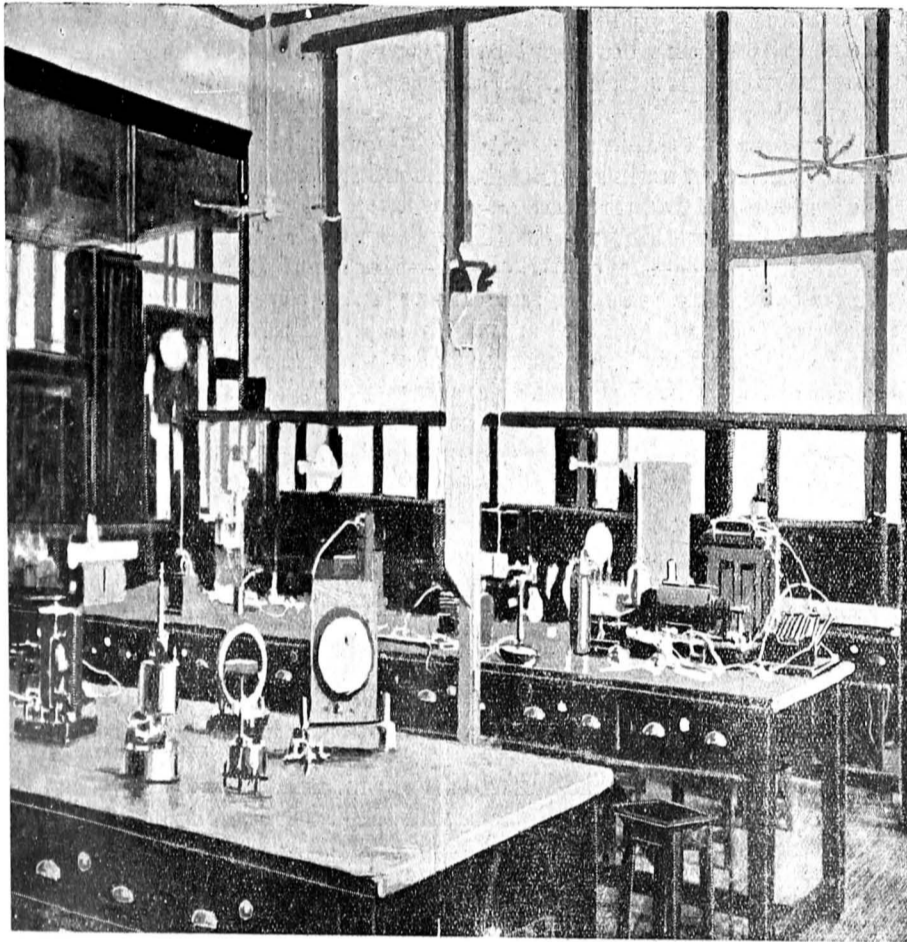
The Gymnasium has been fitted with a great variety of apparatus, affording every gradation of exercise for young people of both sexes; and the greatest care is taken to prevent overstrain or accident, all the exercises being conducted under the personal supervision of a thoroughly qualified instructor and in the presence and with the assistance of the teacher of the class. The Board, anxious to avail themselves of every opportunity for benefiting the scholars, have taken advantage of the circular on Manual Instruction, issued by the Science and Art Department, and have erected and equipped a commodious workshop, in which the training of hand and eye will lead to that union so much to be desired in all industrial occupations—the union of drawing and practical handiwork. The interest displayed by every boy in this practical workmanship will lead to that accurate perception of form and correct execution of hand which all manual and technical occupations require. It is the aim of the Board to carry on in this school under the most healthful conditions the education of children to the fullest extent, from Elementary to Secondary subjects, and yet without undue pressure. In order to give a practical training also to girls, Cookery and Needlework have always received attention in the Elementary Section; and arrangements have been made to secure efficient instruction for the pupils of the Higher Section in Cookery, and in the Cutting-out of Garments. A large Laboratory for Elementary work in Practical Physics has been fitted up in order to give fuller opportunities of progressive instruction in this important subject. Laboratories for advanced Chemistry and Physics have been erected, with every appliance for higher studies.

On a basis of elementary education it is intended to superadd a system of higher education which, at a moderate charge, will train pupils for industrial, manufacturing, and professional pursuits. This system of instruction will have its beginnings in the elementary school, but will be practically carried out in a three years' course beyond the standards. It will embrace such courses as—

- I.—The CLASSICAL (or Professional), in which Latin, Mathematics, Science, and Drawing form the chief subjects.
- II.—The MODERN (or Mercantile), in which French or German, Commercial Geography, Mathematics, Science, and Drawing will receive most attention.
- III.—The SCIENCE (or Technical), in which Mathematics, Science, and Drawing form the leading subjects.

Each course is detailed in the Prospectus, and will in addition contain all the subjects of a sound general education in English. The new regulations of the Science and Art Department with regard to Organised Science Schools aim at providing a thorough and progressive

Secondary Education—Prospectus of Leeds Higher Grade School.



PHYSICAL LABORATORY.



CHEMICAL LABORATORY.

Secondary Education — Prospectus of Leeds Higher Grade School.

course of education in Science, combined with Literary or Commercial Instruction. It is intended that pupils who have attended the full course shall be prepared for the Matriculation Examination of the London University, and the Preliminary Examination for Arts, Law, and Medicine of the Victoria University (Yorkshire College); as well as for the Preliminary Examinations of the Law Society, Pharmaceutical Society, Veterinary Colleges, and for the Oxford and Cambridge Senior Local Examinations. The record of the successes of present and former pupils at University and other examinations, abundantly proves that the curriculum of this school not only enables boys and girls to pass creditably the Entrance Examinations to the Universities, but gives such a training as enables them to take in their University course a distinguished position. The work of the Higher Section will be found to embrace all the subjects for thoroughly preparing those who desire to become pupil teachers at the end of the First or Second Year's apprenticeship; and such a preparatory course, giving instruction in Languages, Science and Art, as well as in English subjects, should enable such students to pass well the Pupil Teacher's examinations, and to take an honourable position in the examinations for admission to Training Colleges. Such courses of instruction are already in operation; and the Text-Books used in the various classes are selected from those prescribed for such work.

I.—Elementary Section.

The work in this section is conducted in accordance with the requirements of the standard of the Education Code, and embraces all the branches of a good English Elementary Education, with the addition of French, Latin, Drawing, Elementary Mathematics, and Science Lessons. Hand-and-Eye Training is given to all pupils below Standard V; Manual Instruction to all Boys above Standard IV; and Girls receive instruction in Needlework and Cookery.

Junior Division.

(Standards II, III, IV.)

SUBJECTS.—Scripture, English, Writing, Dictation, Arithmetic, Elementary Geography, History, Grammar, Object Lessons, Gymnastics, Hand-and-Eye Training, Drawing, Music; Needlework for Girls.

Middle Division.

(Standards V, VI.)

SUBJECTS.—Scripture, English, Writing, Dictation, Arithmetic, Grammar, Composition, Geography, History, Elementary Mathematics, Elementary Latin, Science Lessons, French Drawing, Gymnastics, Manual Instruction, Music; Needlework, Cookery, and Domestic Science for Girls.

Senior Division.

(Standard VII.)

SUBJECTS.—Scripture, English, Writing, Dictation, Arithmetic, Grammar, Composition, Geography, History, Elementary Mathematics, Elementary Latin, French, Drawing, Gymnastics, Manual Instruction, Music, Science Lessons; Needlework, Cookery, and Domestic Science for Girls.

II.—Higher Section.

This section is intended for scholars beyond the standards of the Education Code; and the full courses of study occupy four years, and are arranged with a view to the future occupation of the pupil. The elementary course is intended to give in two years a sound basis of scientific and general education; in the advanced the pupil is expected to specialise his work in certain lines. The selection of the course should, therefore, be a matter for consideration between parents and the Principal.

SUBJECTS OF STUDY FOR BOYS.

ELEMENTARY COURSE.—FIRST YEAR.

ENGLISH.—A period of English History and Literature; and the study of an English Classic.

LATIN.—Latin Grammar and Elementary Composition; Easy Translation.

MATHEMATICS.—Arithmetic; Algebra; Euclid.

FRENCH.—Thorough Revision of Grammar; Daudet, *Le Petit Chose en Province*; Musset, *Monsieur Le Vent et Madame La Pluie*.

SCIENCE.—Inorganic Chemistry (Theoretical and Practical); Physics (Theoretical and Practical).

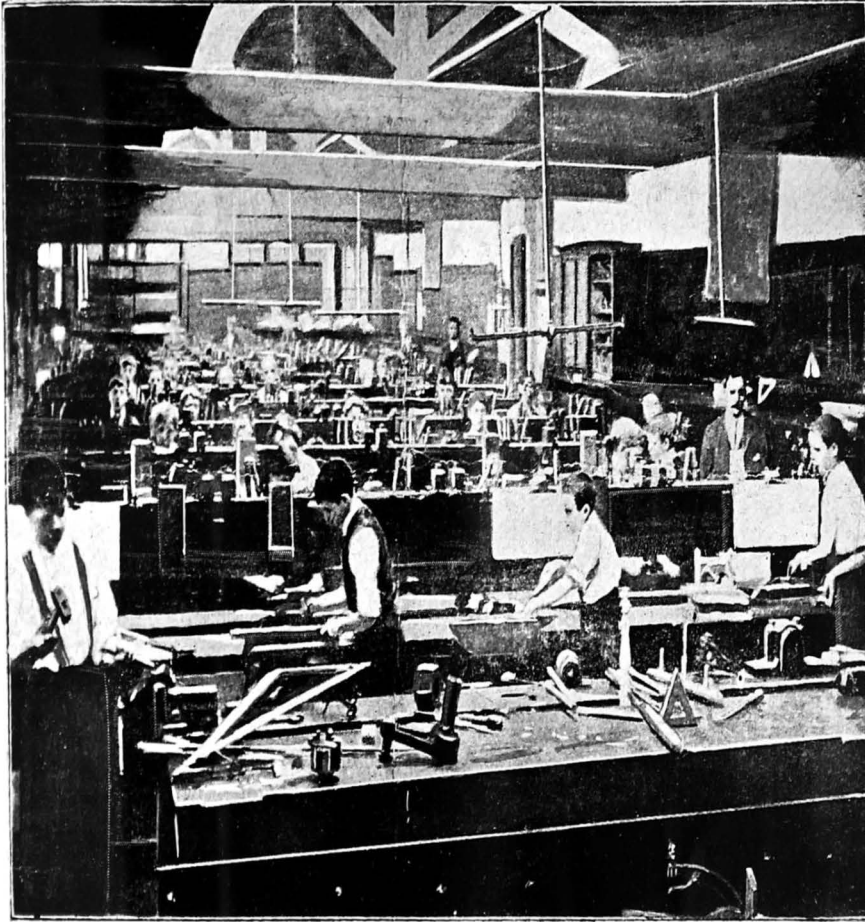
DRAWING.—Practical Plane and Solid Geometry; Freehand.

COMMERCIAL.—Shorthand; Geography (British Islands and British North America; Book-keeping.

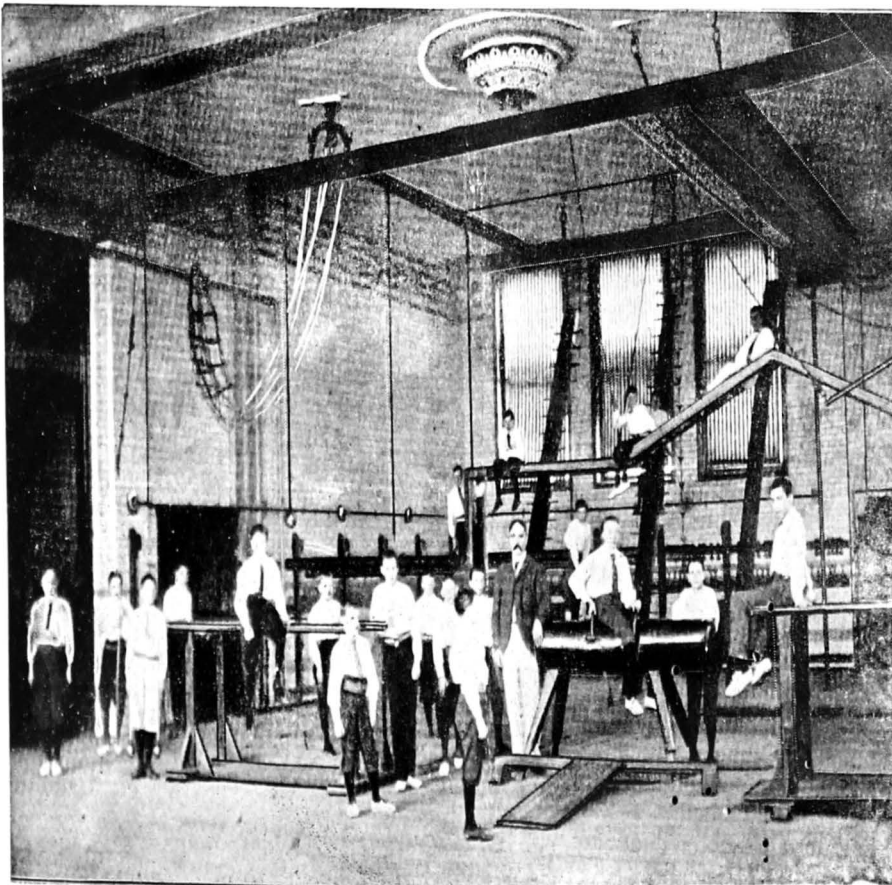
• MANUAL INSTRUCTION in the Workshop.

• GYMNASTICS.

Secondary Education—Prospectus of Leeds Higher Grade School.



MANUAL WORKSHOP



GYMNASIUM

Secondary Education—Prospectus of Leeds Higher Grade School.

ELEMENTARY COURSE.—SECOND YEAR.

ENGLISH.—A period of English History ; a period of English Literature with the study of an English Classic.

LATIN.—Latin Grammar and Composition ; *Via Nova* ; *Gradatim*.

MATHEMATICS.—Algebra ; Euclid ; Plane Trigonometry.

FRENCH.—Grammar ; Repetition of Easy Poems ; Daudet, *Tartarin de Tarascon* ; Labiche et Joly, *La Grammaire*.

GERMAN.—Grammar, Easy Translation.

SCIENCE.—Practical Plane and Solid Geometry ; Inorganic Chemistry (Theoretical and Practical) ; Physics (Theoretical and Practical).

DRAWING.—Freehand ; Linear Perspective ; Model ; Elementary Shading.

COMMERCIAL.—Business Methods ; Shorthand ; Geography (Europe and British India).

MANUAL INSTRUCTION in the Workshop.

GYMNASTICS.

ADVANCED COURSE.—THIRD YEAR.

ENGLISH.—Modern English History and Literature ; History of the English Language.

LATIN.—Latin Grammar and Composition : Cæsar, *de Bello Gallico*, Book IV ; Vergil, *Æneid*, Book IV.

MATHEMATICS.—Algebra ; Euclid ; Plane Trigonometry.

FRENCH.—Conversation and Commercial Correspondence ; Molière, *Les Précieuses Ridicules* ; Souvestre, *Un Philosophe sous les Toits*.

GERMAN.—Grammar ; Conversation.

SCIENCE.—Electricity and Magnetism (Theoretical and Experimental) ; Inorganic Chemistry (Theoretical and Practical) ; Practical Plane and Solid Geometry ; Machine Construction.

ART.—Mechanical Drawing ; Shading from Objects and Casts ; Painting in Water-Colours and Oil.

COMMERCIAL.—Geography (British Empire) ; Shorthand.

MANUAL INSTRUCTION in the Workshop.

GYMNASTICS.

ADVANCED COURSE.—FOURTH YEAR.

ENGLISH.—History of the English Language ; Modern Literature and History.

LATIN.—Latin Grammar and Composition ; Sallust, *Catiline* ; Vergil, *Æneid*, Book II.

MATHEMATICS.—Algebra ; Euclid ; Trigonometry ; Co-ordinate Geometry.

FRENCH.—Grammar ; Conversation ; Madame de Witt, *Derrière les Haies* ; Labiche et Joly, *La Grammaire*.

GERMAN.—Grammar ; Conversation ; Goethe, *Götz von Berlichingen*.

SCIENCE.—Practical Plane and Solid Geometry ; Heat (Theoretical and Experimental) ; Organic and Inorganic Chemistry (Theoretical and Practical).

ART.—Mechanical Drawing ; Shading from Objects and Casts ; Painting in Water-Colours and Oils.

MANUAL INSTRUCTION in the Workshop.

GYMNASTICS.

SUBJECTS OF STUDY FOR GIRLS.

ELEMENTARY COURSE.—FIRST YEAR.

ENGLISH.—A period of English History and Literature ; and the study of an English Classic.

LATIN.—Latin Grammar and Elementary Composition ; Easy Translation.

MATHEMATICS.—Arithmetic ; Algebra ; Euclid.

FRENCH.—Thorough, revision of Grammar ; Conversation ; Bruno, *Les Deux Petits Patriotes* ; Laboulaye, *Pif Paf*.

SCIENCE.—Inorganic Chemistry (Theoretical and Practical) ; Physics (Practical and Theoretical).

DRAWING.—Practical Plane and Solid Geometry ; Freehand.

GEOGRAPHY.—British Islands and British North America.

COOKERY ; NEEDLEWORK, and CUTTING-OUT ; DRESSMAKING.

CALISTHENICS.

Secondary Education—Prospectus of Leeds Higher Grade School.

ELEMENTARY COURSE.—SECOND YEAR.

ENGLISH.—A period of English History ; a period of English Literature ; with the study of an English Classic.

LATIN.—Latin Grammar and Composition ; *Via Nova ; Gradatim*.

MATHEMATICS.—Arithmetic ; Algebra ; Euclid ; Plane Trigonometry.

FRENCH.—Grammar ; Repetition of Easy Poems ; Dumas, *Histoires d' Animaux* ; Labiche et Joly, *La Grammaire*.

GERMAN.—Grammar ; Easy Translation.

SCIENCE.—Inorganic Chemistry (Theoretical and Practical) ; Physics (Practical and Theoretical) ; Practical Plane and Solid Geometry.

DRAWING.—Freehand ; Linear Perspective ; Model ; Elementary Shading.

GEOGRAPHY.—Europe and British India.

COOKERY ; NEEDLEWORK, and CUTTING-OUT ; DRESSMAKING.

CALISTHENICS.

ADVANCED COURSE.—THIRD YEAR.

ENGLISH.—Modern English History and Literature ; History of the English Language.

LATIN.—Latin Grammar and Composition ; Cæsar, *de bello Gallico*, Bk. IV ; Vergil, *Aeneid*, IV.

MATHEMATICS.—Algebra ; Euclid ; Plane Trigonometry.

FRENCH.—Conversation and Composition ; Molière, *Les Precieuses Ridicules* ; Souvestre, *Un Philosophe sous les Toits*.

GERMAN.—Grammar ; Conversation.

SCIENCE.—Electricity and Magnetism (Theoretical and Experimental) ; Inorganic Chemistry (Theoretical and Practical) ; Practical Physics.

ART.—Shading from Objects and Casts ; Painting in Water-Colours and Oil.

COMMERCIAL GEOGRAPHY.—British Empire.

COOKERY ; NEEDLEWORK, and CUTTING-OUT ; DRESSMAKING.

CALISTHENICS.



COOKERY ROOM.

Secondary Schools—Prospectus of Leeds Higher Grade School.

ADVANCED COURSE.—FOURTH YEAR.

ENGLISH.—Modern English History and Literature ; History of the English Language.

LATIN.—Latin Grammar and Composition ; Sallust, *Catiline* ; Vergil, *Æneid*, Book II.

MATHEMATICS.—Algebra ; Euclid ; Plane Trigonometry.

FRENCH.—Conversation and Composition ; Madame de Witt, *Derrière les Haies* ; Labiche et Joly, *La Grammaire*.

GERMAN.—Grammar ; Conversation ; Goethe, *Götz von Berlichingen*.

SCIENCE.—Organic and Inorganic Chemistry (Theoretical and Practical) ; Heat (Theoretical and Experimental).

ART.—Shading from Objects and Casts ; Painting in Water-Colours and Oil.

COOKERY ; NEEDLEWORK, and CUTTING-OUT ; DRESSMAKING.

CALISTHENICS.

The Course is that laid down by the Science and Art Department for Schools of Science, and provides a thorough and progressive course of education in Science, combined with literary and commercial instruction suited to the educational needs of students.

RECOMMENDATIONS AND SUGGESTIONS FOR OUR INDIAN SCHOOLS.

20. On account of present straitened financial circumstances, it may not be possible for Government to give immediate effect to some of the recommendations I now make, even if these are thoroughly approved. Such additions to our teaching efforts as I am about to propose will entail additional expenditure on Government, but I feel certain that the money thus spent will be well spent ; and that the effects on our pupils who are privileged to receive the practical education which I recommend will be highly beneficial.

PRIMARY SCHOOLS.

21. For our ordinary town and village schools, the Technical subjects—Drawing, Clay Modelling, and Woodwork are, I think, the most suitable.

22. *Drawing*.—Drawing on slates should begin in the infant class and continue in Standard I ; simple Freehand Drawing should begin in Standard II ; and Freehand Drawing, Model Drawing, and Geometry should have a place in the remaining Standards of the Primary School Course ; at least two hours per week should be given to this the most important of all the technical subjects ; and every pupil should be encouraged to go forward to the Sir Jamshedji Jijibhai School of Art examinations.

In many of the existing school-houses, the amount of space is so small that drawing desks cannot be introduced ; in such cases the work might be done—but not so well done—on small drawing boards resting on the knees of the children.

For the purpose of Bi-manual Training, a long blackboard should be placed in every room of the school, and lessons in this subject should be regularly given whenever teachers are available.

23. *Clay Modelling*.—This subject appears to me to be one that would be suitable for many of our schools.

Clay such as is used by potters and brickmakers would answer well ; it is inexpensive and is easily obtained.

The lessons should begin in Standard I, and be continued in Standards II and III ; the work should be done as far as possible from drawings previously made, and should consist of simple geometrical figures, and representations of common fruits and vegetables ; in some cases, vases and such forms as are easily made on the potter's wheel might be introduced with much advantage.

Recommendations and suggestions for Indian Schools.

24. *Woodwork*.—For some years I have endeavoured to induce the managers of some of the technical schools in the Presidency of Bombay to allow pupils from neighbouring schools to attend special classes in Carpentry in the technical schools; I have also spoken to the pupils who were in a position to take advantage of these classes. The managers of the schools have given the necessary facilities, but up to the present time the number of pupils in these classes has been small. I should like to see such classes as these successful; and this desired end will probably be attained by the Department impressing on the teachers the great importance of this subject, giving some special prizes, and bearing a portion of the expense to which the managers of the schools will be put if the classes are successful.

Each pupil should attend these special classes twice a week during ordinary school hours; each lesson should be $1\frac{1}{2}$ hours, and the course should be for three years; pupils from Vernacular Standards IV, V, VI, if possible with a year's practice in Drawing before entering the workshop, would be found, I think, to make good progress.

In the meantime, the course of lessons in "Manual Training for Indian Schools" will be available; but if there were many such classes, probably a somewhat simpler course would be preferable.

25. For some years a Carpentry Class has been attached to the Training Colleges for Vernacular Masters in Dhárwár and Hyderabad Sind. I strongly urge the necessity of having similar classes in Poona and in Ahmedabad.

A few of the trained teachers who have done good work in Drawing and Carpentry should be given an opportunity of showing whether they can carry on successful classes in these subjects. For this purpose a small workshop with carpenters' benches and tools for a class of about twenty-four pupils at one time, will be required wherever this experiment is to be given a fair trial.

26. In some of the important schools in the Presidency, the managers have already introduced Kindergarten and other subjects. I hope they may be induced to go still further in this direction.

SECONDARY SCHOOLS.

27. I have visited many of the High schools in the Presidency of Bombay, and I have always been much pleased with the good educational work which is done in these institutions.

28. In paragraph 17 I have already referred to the great importance now attached, in Great Britain, to Science teaching, to Laboratory work, to Manual Training in Wood, and to Drawing. Our efforts for the improvement of our High School Course should be in the direction of making the studies more and more practical. This can be done by making Drawing a compulsory subject in all High schools—it now is so in Government High schools; by supplying more models, apparatus, and specimens of finished products, in other words by attaching a small museum to every school; by extending the physical and chemical laboratories; and by the introduction of Woodwork as a compulsory subject of the ordinary course—it now forms one of the optional subjects of the Bombay University School Final Examination.

29. For the introduction of Manual Training in Wood into our schools, a special class of teachers should be trained. The qualifications which I think these men should have are as follow—a good general education and knowledge of English; the highest qualifications required at present for our teachers of Drawing; and a three-years' practical course of training in the Workshop of the College of Science, Poona.

Recommendations and suggestions for Indian Schools.

TECHNICAL SCHOOLS.

30. There are about a dozen Technical schools in the Presidency of Bombay which I inspect annually, and about a dozen in Sind which I visit occasionally. In these schools about three hours a day are allowed for the ordinary Vernacular School Course as far as Standard V, one hour a day is allowed for Drawing, and three hours a day are allowed for practical training in the Workshop.

The object of these schools is to turn out intelligent workmen, and the course usually extends over three years. Carpentry is taught in nearly all these schools; and in about one-half of them, such subjects as Wood Carving, Wood Turning, Inlaying in Wood, and some branches of metal work form part of the practical course.

31. Such schools as our Indian Technical or Industrial schools are not common in Great Britain; corresponding work is there done in night schools to which apprentices and others who are engaged at their trades during the day come on certain nights every week, in order to learn the principles and practice of their own trade. The number of distinct trade subjects and courses taught in some of the large institutions in England is very great.

In order to give an idea of what is being done, I give, at the end of the report, a few pages extracted from the Calendar for 1900-01 of the Northampton Institute, London, which contain a list of special courses carried on in the evenings.

32. I fear that evening classes in trade subjects would, as a rule, be unsuccessful in India on account of the difficulty of getting pupils to attend regularly; if this difficulty can be overcome by the employment of energetic masters, and by allowing premiums to pupils who are regular and attentive, much good might, I think, be done.

33. The Technical schools in the Presidency of Bombay are regularly inspected by me; and the courses of work are very much on the lines recommended by me in my annual reports. The only recommendation with respect to these schools which I now wish to make is that—in some of the schools the course of practical work should be enlarged so as to include some or all of the subjects mentioned in paragraph 30; and that local industries should be carefully considered and as far as possible helped when framing a course of practical instruction.

34. Technical Education will be much assisted if officers in the Public Works and some other Departments of Government, officers in Railway service, and proprietors and managers of mills and other works are prepared to reserve some appointments suitable for lads who have successfully passed through the Technical school course; and I would suggest that Government may be pleased to bring this matter to the notice of these officers.

35. A special certificate signed by the Superintendent and President of the school, and by the Educational Inspector of the Division should be given to pupils who successfully pass through a prescribed course.

36. In conclusion, I wish to thank Mr. Alan S. Cole of the Education Department, London; Sir Philip Magnus of the City and Guilds, London; the Principals and Professors of the Colleges, and the Head Masters and other officers of the schools which I visited, for the uniform courtesy and kindness which they showed me, and for the ready manner in which they helped me to get the information I was in search of.

ARTHUR W. THOMSON, D.Sc., C.E.,
Prof. Engineering.

*College of Science,
Poona, 9th February 1901.*

APPENDIX.

Extract from the Calendar, 1900-01, of the Northampton Institute, St. John Street Road, London, E.C.

EVENING COURSES AND CLASSES.

In the Evening Courses and Classes the fundamental principle of adapting the work of the Institute to the special requirements of the surrounding district is carried out with much greater detail than is possible in Day Courses. This district, as is well known, is thronged with small workshops engaged in a great variety of trades, amongst which Watch and Clockmaking stand out as the most prominent, though by no means the only important trades. Mechanical and Electrical Engineering Workshops (including in the latter Electroplating and Electrotyping) and Art Metal Workers in great variety also abound.

As many of the workshops are small, the need of an all-round training for the workmen in the principles and practice of the different sections of their trade is more urgent than in large workshops where the work of production is subdivided very minutely. It is hoped, therefore, that both the employers and the workmen will co-operate with the Governing Body in their endeavour to meet the educational necessities of the district and to provide sound technical education adapted to the different classes of workers.

Outline of Works.

The greater part of the work in this section consists of Evening Classes in the different branches of the trades and industries referred to above, but there are included certain classes held during the afternoon, which are on the same basis as the Evening Classes. These are classes for Post-Office Telegraphists, Afternoon Classes in Horology for apprentices and improvers, and a Ladies' Class in Domestic Economy and a Tracing Class.

The Session 1900-1901, except for the Domestic Economy Day School, will begin for this section in the week commencing 24th September 1900, and will continue until the week ending 1st June 1901.

The Educational Work of the Institute is for convenience divided into the following departments:—

- | | |
|---|--|
| (i) Mechanical Engineering and Metal Trades. | (v) Horology. |
| (ii) Artistic Crafts. | (vi) Miscellaneous Trades. |
| (iii) Applied Physics and Electrical Engineering. | (vii) Domestic Economy and Women's Trades. |
| (iv) Electro-Chemistry. | |

Such a division enables the work to be more systematically dealt with, but it is not intended to suggest that every trade will find all its requirements met within the limits of a single department. Thus, for instance, many art metal workers will probably find it advantageous to attend courses not only in the Artistic Crafts Department, but also in the Metal Trades Department.

Towards the close of the Session, Institute Examinations, written and practical, will be held in all the classes carried on during the winter, and on the results of these examinations, combined with the records of the whole of the work of each student in class-room, laboratory, workshop, or studio, **Course or Class Certificates** will be awarded to all students who show themselves worthy of them. The Certificates will be evidence of good and steady work throughout the Session, and will not be obtainable merely by cramming and passing an examination. Only those students who have attended during the whole Session will be eligible to receive them.

In addition to the Institute Examinations, several of the courses are suitable for students preparing for the Technological Examinations of the City and Guilds of London Institute, and all students taking such courses will be expected to present themselves for these external examinations. There is also a special course for Opticians which covers the ground required for the examinations of the Spectacle Makers' Company; and to meet the requirements of Post-Office Telegraphists, arrangements have been made for holding examinations in Magnetism and Electricity and in Mathematics, under the Board of Education. Arrangements will also be made, if necessary, for the examination of students in the qualifying subjects required for the full Technological Certificate of the City and Guilds of London Institute.

Special Courses of Instruction.

The modern constructive and artistic crafts employ in their processes so many methods derived from widely different sources and use the principles developed in so many branches of natural science, that scarcely a single trade can be found which does not demand from an intelligent craftsman or journeyman, if he is to understand his daily work, a clear knowledge of fundamental principles drawn from more than one science. Fortunately, in many cases, the principles referred to are not very abstruse, and can be easily grasped by a man of ordinary intelligence who is willing to devote the necessary time to the study. For the guidance of such, the following table has been compiled to enable the workmen engaged in the various trades specified in the second column to ascertain readily the Institute classes which they should attend, in addition to those more immediately dealing with their particular trades. The courses have been arranged specially for the benefit of artisans, apprentices, and others engaged in the Clerkenwell trades.

It has been assumed that an earnest student will be willing to devote three, or, in some cases, four nights a week to study during the winter months, and the table will show him how to make the best use of his time. Every student is *strongly* recommended to take up one of these complete courses, and as an inducement to do so, specially reduced fees (as shown in columns 5 and 6), have been arranged for each course.

Northampton Institute, London.

TABLE OF SPECIAL COURSES.

ADAPTED TO VARIOUS CLASSES OF STUDENTS.

Each course represents the amount of work which a fairly diligent Student would be able to get through in one Session, and every Student is strongly recommended to take up one of these systematic courses.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | Fees. | | REMARKS. |
|----------------|--|--|--|------------------------|--------------|----------|
| | | | | Members or Associates. | Non-Members. | |
| 1 | ENGINEERING FOREMEN, CHARGEMEN, AND LEADING HANDS. | <i>Course A—</i> Workshop Drawing Workshop Calculations Materials of Construction .. | Thursdays ... 7-30—9-45 Fridays ... 8-30—9-45 Mondays ... 7-30—8-30 (from Sept. to Dec.) | 6/6 | 10/- | |
| 2 | Do. ... | <i>Course B—</i> Workshop Drawing Machinery and Machine Design. Mechanical Laboratory ... | Thursdays ... 7-30—9-45 Wednesdays... 7-40—8-40 Fridays ... 7-30—9-45 | 8/6 | 12/6 | |
| 3 | FITTERS AND TURNERS. | <i>Course A—</i> Workshop Practice Workshop Drawing Workshop Calculations Tools and their Construction (Six Lectures only.) | Tuesdays or 7-30—9-45 Thursdays. Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 Mondays ... 8-50—9-50 (24th Sept. to 29th Oct.) | 8/6 | 12/6 | |
| 4 | Do. ... | <i>Course B—</i> Workshop Practice Workshop Drawing Machinery and Machine Design (Lectures). Materials of Construction ... | Tuesdays ... 7-30—9-45 Thursdays ... 7-30—9-45 Wednesdays... 7-40—8-40 Mondays ... 7-30—8-30 (from Sept. to Dec.) | 9/6 | 14/- | |
| 5 | DRAUGHTSMEN ... | <i>Course A—</i> Workshop Drawing (advanced), Workshop Calculations Materials of Construction ... | Thursdays ... 7-30—9-45 Fridays ... 8-30—9-45 Mondays ... 7-30—8-30 | 6/6 | 10/- | |
| 6 | Do. ... | <i>Course B—</i> Practical Machine Design ... Machinery and Machine Design (Lectures). Technical Calculations ... | Thursdays ... 7-30—9-45 Wednesdays... 7-40—8-40 Fridays ... 8-15—9-45 | 8/6 | 12/6 | |
| 7 | Do. ... | <i>Course C—</i> Structural Engineering ... Prime Movers (Steam Engines). Do. (Gas and Oil Engines). Engineering Laboratory ... And if Student wishes, he may attend in the Drawing Office to continue Designing. Dynamo, Engine, and Boiler Trials. | Thursdays ... 8-50—9-50 Tuesdays ... 8-40—9-40 Mondays ... 8-15—9-45 (from 4th February.) Fridays ... 7-30—9-45 Wednesdays... 7-30—9-45 Special evenings to be arranged. | 10/7 | 15/- | |
| 8 | ENGINEER'S APPRENTICES. | <i>Course A—</i> Engineering Workshop Workshop Drawing Workshop Calculations Tools and their Construction (Six Lectures only.) | Tuesdays or 7-30—9-45 Thursdays. Wednesdays . 7-30—9-45 Fridays ... 8-30—9-45 Mondays ... 8-50—9-50 (24th Sept. to 29th Oct.) | 8/6 | 12/6 | |
| 9 | Do. ... | <i>Course B—</i> Mechanics and Mechanism ... Workshop Drawing Technical Calculations ... And Engineering Workshop (if desired, and there is room). | Thursdays ... 7-30—10-0 Mondays or 7-30—9-45 Wednesdays. Fridays ... 8-15—9-45 Time to be arranged with the Head of the Department. | 8/6 | 12/6 | |

Northampton Institute, London—Table of Special Course—continued.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | FEES. | | REMARKS. |
|----------------|---|--|--|------------------------|--------------|----------------------------------|
| | | | | Members or Associates. | Non-Members. | |
| 10 | ENGINEERS' APPRENTICES. | <i>Course C—</i> Practical Machine Design ... Materials of Construction ... Machinery and Machine Design (Lectures). Prime Movers (Steam Engines). Do. (Gas and Oil Engines). Dynamo, Engine, and Boiler Trials. | Thursdays ... 7-30—9-45 Mondays ... 7-30—8-30 Wednesdays... 7-40—8-40 Tuesdays ... 8-40—9-40 Mondays ... 8-45—9-45 (from 4th February.) Special dates to be announced. | 10/- | 15/- | |
| 11 | MECHANICAL ENGINEERS. | <i>Course A—</i> Materials of Construction ... Prime Movers (Steam Engines). Do. (Gas and Oil Engines). Mechanics and Mechanism ... | Mondays ... 7-30—8-30 (from Sept. to Dec.) Tuesdays ... 8-40—9-40 Mondays ... 8-45—9-45 (from 4th February.) Thursdays ... 7-30—10-0 | 10/- | 15/- | Course for City and Guilds Exam. |
| 12 | Do. ... | <i>Course B—</i> Machinery and Machine Design. Practical Machine Design ... Mechanical Laboratory ... Dynamo, Engine, and Boiler Trials. | Wednesdays... 7-40—8-40 Thursdays ... 7-30—9-45 Fridays ... 7-30—9-45 Special dates to be announced. | 10/- | 15/- | Course for City and Guilds Exam. |
| 13 | PATTERN MAKERS ... | Practical Pattern Making ... Workshop Drawing ... Workshop Calculations ... | Mondays ... 7-30—9-45 Wednesdays... 7-30—9-45 Fridays ... 8-30—9-45 | 8/6 | 12/6 | |
| 14 | SMITHS ... | Practical Smithing ... Workshop Drawing ... Materials of Construction ... | Thursdays ... 7-30—9-45 Wednesdays... 7-30—9-45 Mondays ... 7-30—8-30 (from Sept. to Dec.) | 7/6 | 11/- | |
| 15 | CYCLE MAKERS ... | Practical Cycle Making... Machinery and Machine Design (Lectures). Workshop Drawing ... | Mondays ... 7-30—9-45 Wednesdays... 7-40—8-40 Tuesdays ... 7-30—9-45 | 8/6 | 12/6 | |
| 16 | PRESS TOOL MAKERS. | Press Tool Making ... Smithy ... Workshop Drawing ... Tools and their Construction (six Lectures). | Wednesdays... 7-30—9-45 Thursdays ... 7-30—9-45 Mondays ... 7-30—9-45 Mondays ... 8-50—9-50 (21th Sept. to 23th Oct.) | 10/- | 15/- | |
| 17 | METAL PLATE WORKERS. | Practical Metal Plate Work ... Workshop Drawing ... Workshop Calculations ... | Thursdays ... 7-30—9-45 Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 | 8/6 | 12/6 | Course for City and Guilds Exam. |
| 18 | BRASS FINISHERS ... | Brass Finishing .. Decorative Metal Workers' Design. | Fridays ... 7-30—9-45 Mondays ... 7-30—9-45 | 6/6 | 10/- | |
| 19 | BUILDERS AND GENERAL BUILDING STUDENTS. | <i>Course A—</i> Workshop Drawing ... Workshop Calculations ... Buildings, and their Construction. Materials of Construction, with Laboratory. | Thursdays ... 7-30—9-45 Fridays ... 7-15—8-30 Wednesdays... 8-50—9-50 Mondays ... 7-30—9-45 | 8/6 | 12/6 | |
| 20 | Do. ... | <i>Course B—</i> Architectural Drawing ... Mechanical Laboratory ... Buildings (Advanced Lectures). | Fridays ... 7-30—9-45 Mondays ... 7-30—9-45 Thursdays ... 7-20—8-20 | 8/6 | 12/6 | |
| 21 | Do. ... | <i>Course C—</i> Practical Architectural Design. Architectural Ornament ... Structural Engineering ... | Fridays ... 7-30—9-45 Tuesdays ... 7-30—9-45 Thursdays ... 8-50—9-50 | 8/6 | 12/6 | |

Northampton Institute, London—Table of Special Course—continued.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | FEES. | | REMARKS. |
|----------------|-------------------------|---|--|------------------------|--------------|---|
| | | | | Members of Associates. | Non-Members. | |
| 22 | BUILDING SURVEYORS. | <i>Course A—</i> Workshop Drawing Buildings and their Construction. Building Trades (General Course). <i>Or,</i> Workshop Calculations ... | Thursdays ... 7-30—9-45 Wednesdays... 8-50—9-50 Fridays ... 7-30—9-45 Fridays ... 7-15—8-30 | 8/6 | 12/6 | |
| 23 | Do. ... | <i>Course B—</i> Workshop Drawing Buildings (Advanced Lectures). Materials of Construction and Laboratory. | Fridays ... 7-30—9-45 Thursdays ... 7-30—8-30 Mondays ... 7-30—9-45 | 8/6 | 12/6 | |
| 24 | Do. ... | <i>Course C—</i> Practical Architectural Design... Structural Engineering Architectural Ornament ... | Fridays ... 7-30—9-45 Thursdays ... 8-50—9-50 Tuesdays ... 7-30—9-45 | 8/6 | 12/6 | |
| 25 | ARCHITECTS' PUPILS. | <i>Course A—</i> Buildings and their Construction. Drawing Materials of Construction and Laboratory. Workshop Calculations ... | Wednesdays .. 8-50—9-50 Thursdays ... 7-30—9-45 Mondays ... 7-30—9-45 Fridays ... 7-15—8-30 | 10/- | 15/- | |
| 26 | Do. ... | <i>Course B—</i> Buildings (Advanced Lectures). Practical Architectural Design. Architectural Ornament ... | Thursdays ... 7-30—8-30 Fridays ... 7-30—9-45 Tuesdays ... 9-30—9-45 | 8/6 | 12/6 | |
| 27 | Do. ... | <i>Course C—</i> Structural Engineering Practical Architectural Design. Architectural Ornament ... | Thursdays ... 8-50—9-50 Fridays ... 7-30—9-45 Tuesdays ... 7-30—9-45 | 10/- | 15/- | |
| 28 | CARPENTERS AND JOINERS. | <i>Course A—</i> Workshop Practice Workshop Drawing Special Series of Seven Lectures to Wood-workers. Ornamental Design for Wood-workers. | Tuesdays or 7-30—9-45 Thursdays, Fridays ... 7-30—9-45 Wednesdays... 8-50—9-50 (From 7th Nov.) Wednesdays... 7-30—9-45 | 8/6 | 12/6 | Course for City and Guilds Exam. (Preliminary). |
| 29 | Do. ... | <i>Course B—</i> Workshop Practice Workshop Drawing Buildings and their Construction. | Fridays ... 7-30—9-45 Thursdays ... 7-30—9-45 Wednesdays... 8-50—9-50 | 8/6 | 12/6 | Course for City and Guilds Exam. (Ordinary). |
| 30 | Do. ... | <i>Course C—</i> Workshop Practice Buildings (Advanced Lectures). Workshop Drawing | Wednesdays... 7-30—9-45 Thursdays ... 7-30—8-30 Fridays ... 7-30—9-45 | 8/6 | 12/6 | Course for City and Guilds Exam. (Honours). |
| 31 | PLUMBERS ... | Practical Plumbing Workshop Drawing Science for Plumbers Special Lectures for Plumbers... Workshop Calculations | Tuesdays ... 7-30—9-45 Thursdays ... 7-30—9-45 (24th Sept. to 21st Jan.) Mondays ... 7-30—9-45 (28th Jan. to 29th April.) Wednesdays... 8-50—9-50 (9th Jan. to 6th Mar.) Fridays ... 7-15—8-30 (Sept. to Dec.) | 8/6 | 12/6 | Course for City and Guilds Exam. |
| 32 | BRICKLAYERS ... | Brick Cutting Workshop Drawing Lectures on Materials, with Mechanical Laboratory. | Tuesdays ... 7-30—9-45 Thursdays ... 7-30—9-45 Mondays ... 7-30—9-45 (After Christmas.) | 6/6 | 10/- | Course for City and Guilds Exam. |

Northampton Institute, London—Table of Special Course—continued.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | Fees. | | REMARKS. |
|----------------|------------------------------------|---|--|-------------------------|--------------|----------------------------------|
| | | | | Members or Associates.* | Non-Members. | |
| 33 | PLASTERERS ... | Practical Plastering ... Ornamental modelling for Plasterers. Lectures to Plasterers (Three Lectures). | Thursdays ... 7-30—9-45 Mondays ... 7-30—9-45 Wednesdays... 8-50—9-50 (13th March to 27th March.) | 8/6 | 12/6 | Course for City and Guilds Exam. |
| 34 | GOLDSMITHS AND JEWELLERS. | Design and Modelling ... Lectures ... Practical Goldsmiths' Work ... | Mondays ... 7-30—9-45 Tuesdays ... 8-0—9-15 Thursdays ... 7-30—9-45 | 6/6 | 10/- | Course for City and Guilds Exam. |
| 35 | DIAMOND MOUNTERS. | Design for Diamond Mounting... Practical Diamond Mounting ... | Mondays ... 7-30—9-45 Thursdays ... 7-30—9-45 | 6/6 | 10/- | |
| 36 | SILVERSMITHS ... | Design and Modelling for Silversmiths' Work. Practical Silversmith's Work ... | Tuesdays or 7-30—9-45 Thursdays. Mondays and 7-30—9-45 Wednesdays. | 10/0 | 15/- | Course for City and Guilds Exam. |
| 37 | CHASERS AND EMBOSSEERS. | Modelling ... Design for Chasing ... Practical Chasing and Embossing | Mondays ... 7-30—9-45 Tuesdays ... 7-30—9-45 Thursdays ... 7-30—9-45 | 8/6 | 12/6 | Course for City and Guilds Exam. |
| 38 | HERALDIC AND ORNAMENTAL ENGRAVERS. | Heraldic Drawing and Design ... Practical Engraving ... | Wednesdays... 7-30—9-45 Fridays ... 7-30—9-45 | 6/6 | 10/- | Course for City and Guilds Exam. |
| 39 | DECORATIVE METAL WORKERS. | Drawing and Design for Decorative Metal Work. Practical Decorative Metal Work. Practical Brass Finishing ... | Mondays ... 7-30—9-45 Tuesdays ... 7-30—9-45 Fridays ... 7-30—9-45 | 10/- | 15/- | |
| 40 | ORNAMENTAL IRON WORKERS. | Drawing and Design for Ornamental Iron Work. Practical Decorative Iron Work. Practical Iron Work ... | Mondays ... 7-30—9-45 Tuesdays ... 7-30—9-45 Thursdays ... 7-30—9-45 | 10/0 | 15/- | |
| 41 | STONE AND MARBLE CARVERS. | Modelling of Architectural Ornament. Practical Stone and Marble Carving. | Mondays ... 7-30—9-45 Tuesdays ... 7-30—9-45 | 6/6 | 10/- | |
| 42 | WOOD CARVERS ... | Modelling for Wood Carving ... Design for Wood Carving ... Practical Wood Carving ... | Mondays ... 7-30—9-45 Wednesdays... 7-30—9-45 Fridays ... 7-30—9-45 | 8/6 | 12/6 | |
| 43 | PAINTERS AND DECORATORS. | Practical Painting and Decorating. Design for Decorators ... | Tuesdays and 7-30—9-45 Thursdays. Fridays ... 7-30—9-45 | 8/6 | 12/6 | For City and Guilds Exam. |
| 44 | SIGN-WRITERS AND GRAINERS. | Practical Sign-Writing and Graining. Drawing and Designing ... | Tuesdays and 7-30—9-45 Thursdays. Fridays ... 7-30—9-45 | 8/6 | 12/6 | For City and Guilds Exam. |
| 45 | ELECTRICAL ENGINEERS. | <i>Course A—</i> Applied Electricity A ... Electrical Testing ... Engineering Workshop ... Practical Calculations ... | Wednesdays... 8-45—9-45 Fridays ... 7-0—8-30 Tuesdays ... 7-30—9-45 Fridays ... 8-30—9-45 | 10/- | 115/- | Course for City and Guilds Exam. |
| 46 | Do. | <i>Course B—</i> Electrical Engineering A ... Prime Movers ... Electrical Testing ... Engineering Drawing ... Technical Calculations ... | Tuesdays ... 7-15—8-15 Tuesdays ... 8-40—9-40 Wednesdays ... 7-0—9-45 Fridays ... 7-0—8-30 Fridays ... 8-30—9-45 | 8/6 | 12/6 | Course for City and Guilds Exam. |

Northampton Institute, London—Table of Special Course—continued.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | FEES. | | REMARKS. |
|----------------|---|--|--|------------------------|--------------|----------------------------------|
| | | | | Members of Associates. | Non-Members. | |
| 47 | ELECTRICAL ENGINEERS. | <i>Course C—</i> Electrical Engineering B ... Dynamo Alternator and Transformer Design. Electrical Engineering Laboratory. Advanced Calculations ... | Wednesdays... 8-40—9-40 Wednesdays ... 7-0—8-40 Tuesdays ... 7-0—9-45 Fridays ... 8-30—9-45 | 10/- | 15/- | Course for City and Guilds Exam. |
| 48 | ELECTRIC WIREMEN. | Applied Electricity A ... Wiring Exercises and Design ... Electrical Testing ... Workshop Wiring Practice ... Practical Calculations ... | Wednesdays ... 8-45—9-45 Wednesdays... 7-30—8-45 Fridays ... 7-0—8-30 Tuesdays ... 7-30—9-45 Fridays ... 8-30—9-45 | 10/- | 15/- | Course for City and Guilds Exam. |
| 49 | CENTRAL STATION WIREMEN AND CABLE JOINTERS. | Applied Electricity A ... Wiring Exercises and Design ... Electrical Testing ... Workshop Wiring Practice ... Practical Calculations ... | Wednesdays... 8-45—9-45 Wednesdays... 7-30—8-45 Fridays ... 7-0—8-30 Tuesdays ... 7-30—9-45 Fridays ... 8-30—9-45 | 10/- | 15/- | Course for City and Guilds Exam. |
| 50 | ELECTRIC FITTERS. | Applied Electricity A ... Electric Bell Wiring, Electrical Testing. | Wednesdays... 8-45—9-45 Tuesdays ... 7-30—9-45 | 6/6 | 10/- | |
| 51 | POST OFFICE TELEGRAPHISTS. | <i>Course A—</i> Telegraphy and Telephony. (Ordinary Grade). Magnetism and Electricity (Elementary Stage). Mathematics ... Electrical Laboratory (Part Session.) | Various (see page) ... Do. do. ... Do. do. ... Times to be arranged ... | 6/6 | 10/- | |
| 52 | Do. | <i>Course B—</i> Telegraphy (Honours) ... Magnetism and Electricity (Advanced). Electrical Laboratory ... Drawing Office Work ... Mathematics ... | Wednesdays... 7-0—8-0 Wednesdays... 5-30—6-45 Tuesdays ... 7-0—9-45 Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 | 6/6 | 10/- | |
| 53 | Do. | <i>Course B₂—</i> Telephony (Honours) ... Magnetism and Electricity (Advanced). Electrical Laboratory ... Drawing Office work ... Mathematics ... | Wednesdays... 7-0—8-0 Wednesdays... 5-30—6-45 Tuesdays ... 7-0—9-45 Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 | 6/6 | 10/- | |
| 54 | Do. | <i>Course C—</i> Lecture and Tutorial ... Laboratory ... | Fridays ... 6-0—7-30 Tuesdays ... 6-0—8-30 | 25/0 | 30/- | |
| 55 | TELEGRAPHISTS | <i>Course A₁—</i> Applied Electricity AA... Electrical Testing ... Workshop Wiring ... Practical Calculations ... | Fridays .. 7-20—8-20 Wednesdays... 7-0—9-45 Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 | 8/8 | 12/6 | |
| 56 | Do. | <i>Course A₂—</i> Applied Electricity AA... Electrical Testing ... Practical Calculations ... | Fridays ... 7-20—8-20 Wednesdays 7-0—9-45 Fridays ... 8-30—9-45 | 6/6 | 10/- | |
| 57 | Do. | <i>Course B—</i> Telegraphy and Telephony A ... Electrical Testing ... Technical Calculations ... | Mondays ... 7-15—8-15 Mondays ... 8-15—9-45 Fridays ... 8-30—9-45 | 7/6 | 11/- | Course for City and Guilds Exam. |
| 58 | Do. | <i>Course C—</i> Telegraphy (Honours) ... Electrical Testing ... Workshop Drawing ... Advanced Calculations (if required). | Wednesdays... 7-0—8-0 Tuesdays ... 7-0—9-45 Mondays ... 7-30—9-45 Fridays ... 8-30—9-45 | 10/0 | 15/- | Course for City and Guilds Exam. |

Northampton Institute, London—Table of Special Course—continued.

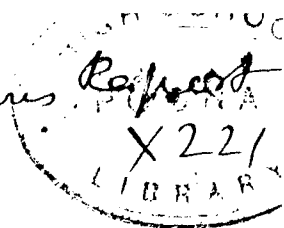
| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | FEES. | | REMARKS. |
|----------------|---|--|---|------------------------|--------------|----------------------------------|
| | | | | Members or Associates. | Non-Members. | |
| 59 | TELEPHONISTS .. | <i>Course A₁</i> — Same as No. 55 (which see) ... | | 8/6 | 12/6 | |
| 60 | Do. ... | <i>Course A₂</i> — Applied Electricity AA ... Electrical Testing .. Practical Calculations ... | Fridays ... 7:20—8:20 Wednesdays... 7:0—9:45 Fridays ... 8:30—9:45 | 6/6 | 10/- | |
| 61 | Do. ... | <i>Course B</i> — Telegraphy and Telephony A. Electrical Testing ... Technical Calculations ... | Mondays ... 7:15—8:15 Do. ... 8:15—9:45 Fridays ... 8:30—9:45 | 7/6 | 11/- | Course for City and Guilds Exam. |
| 62 | Do. ... | <i>Course C</i> — Telephony B ... Electrical Testing ... Workshop Drawing ... Advanced Calculations (if required). | Wednesdays... 7:0—8:0 Tuesdays ... 7:0—9:45 Mondays ... 7:30—9:45 Fridays ... 8:30—9:45 | 10/- | 15/- | Do. |
| 63 | ELECTRICAL INSTRUMENT MAKERS. | <i>Course A</i> — Applied Electricity A... Instrument Testing ... Instrument Workshop Practical Calculations | Wednesdays... 8:45—9:45 Fridays ... 7:0—8:30 Thursdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 8/6 | 12/6 | |
| 64 | Do. ... | <i>Course B</i> — Workshop Drawing ... Instrument Workshop Technical Calculations | Tuesdays ... 7:30—9:45 Mondays ... 7:30—9:45 Fridays ... 8:30—9:45 | 6/6 | 10/- | |
| 65 | Do. ... | <i>Course C</i> — Electrical Instruments Electrical Laboratory ... Instrument Design ... Advanced Calculations | Wednesdays .. 7:0—8:0 Tuesdays ... 7:0—9:45 Wednesdays... 8:45—9:45 Fridays ... 8:30—9:45 | 10/- | 15/- | Course for City and Guilds Exam. |
| 66 | TELEGRAPH INSTRUMENT MAKERS. | <i>Course A</i> — Applied Electricity AA Instrument Testing ... Instrument Workshop Practical Calculations | Fridays ... 7:20—8:20 Wednesdays . 7:0—9:45 Tuesdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 8/6 | 12/6 | |
| 67 | Do. ... | <i>Course B</i> — Electrical Instruments Workshop Demonstrations Instrument Workshop Technical Calculations | Wednesdays... 7:0—8:0 Do. ... 8:30—9:45 Tuesdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 10/- | 15/- | |
| 68 | OPTICAL, MATHEMATICAL, AND SURVEYING INSTRUMENT MAKERS. | <i>Course A</i> — Workshop Drawing ... Instrument Workshop Practical Calculations | Tuesdays ... 7:30—9:45 Thursdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 7/6 | 11/- | |
| 69 | Do. ... | <i>Course B</i> — Applied Optics ... Optical Instruments (part only). Optical Testing ... Instrument Workshop | Mondays ... 7:30—8:30 Do. ... 8:45—9:45 Tuesdays ... 7:0—9:45 Wednesdays... 7:30—9:45 | 10/- | 15/- | |
| 70 | Do. ... | <i>Course C</i> — Optical and Scientific Instruments. Optical Laboratory and Workshop. Technical Calculations | Mondays ... 8:45—9:45 Tuesdays ... 7:0—9:45 Fridays ... 8:30—9:45 | 8/6 | 12/6 | |
| 71 | OPTICAL GLASS WORKERS, (a) | Applied Optics ... Optical Laboratory and Workshop. Practical Calculations .. | Mondays ... 7:30—8:30 Tuesdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 8/6 | 12/6 | |
| 72 | (b) | Optical Instruments ... Optical Laboratory and Workshop. Technical Calculations ... | Mondays ... 8:45—9:45 Tuesdays ... 7:30—9:45 Fridays ... 8:30—9:45 | 10/- | 15/- | |

Northampton Institute, London—Table of Special Course—continued.

| No. of Course. | For | Complete Course Recommended. | Evenings and Times. | FEE. | | REMARKS. |
|----------------|--|--|---|------------------------|--------------|--|
| | | | | Members or Associates. | Non-Members. | |
| 73 | OPTICIANS ... | Applied Optics ... Visual Optics ... Optical Laboratory ... Practical Calculations... Optical Workshop (if desired). | Mondays ... 7:30—8:30 Tuesdays ... 7:0—8:30 Do. ... 8:30—9:45 Fridays ... 8:30—9:45 Wednesdays . 7:30—9:45 | 10/- | 15/- | Course for Spectacle Makers' Exam. |
| 74 | ELECTRO-PLATERS, NICKEL-PLATERS, COPPER DEPOSITERS, &c. | <i>Preliminary Course—</i> Electro-Chemistry (Prel.) ... Practical Work ... Calculations ... | Fridays ... 7:30—8:30 Tuesdays ... 7:15—9:45 Fridays ... 8:30—9:45 | 6/- | 9/- | Course for City and Guilds Exam. |
| 75 | Do. | <i>Course A—</i> Electro-Chemistry A ... Practical Work ... Practical Calculations ... Applied Electricity A ... | Mondays ... 8:45—9:45 Do. ... 7:15—8:45 Fridays ... 8:30—9:45 Wednesdays . 8:45—9:45 (part Session only) | 7/6 | 11/- | |
| 76 | Do. | <i>Course B—</i> Electro-Chemistry B ... Practical Work ... Practical Calculations ... Electrical Engineering A (part Session only). | Tuesdays ... 8:45—9:45 Do. ... 7:15—8:45 Fridays ... 7:15—8:30 Do. ... 8:30—9:45 Tuesdays ... 7:15—8:15 (part Session only) | 10/- | 15/- | |
| 77 | ELECTROTYPES AND STEREOTYPES. | Practical Work ... Workshop ... | Thursdays (alternate). 7:30—8:45 Mondays or 7:30—9:45 Wednesdays. | 6/6 | 10/- | |
| 78 | METALLURGY ... | <i>Course A—</i> Lectures ... Practical Metallurgical Chemistry. Practical Metallurgy ... | Mondays ... 9:0—10:0 Do. ... 7:0—9:0 Tuesdays ... 7:30—9:45 | 10/- | 15/- | |
| 79 | Do. | <i>Course B—</i> Lectures ... Practical Metallurgical Chemistry. Practical Metallurgy ... | Wednesdays . 9:0—10:0 Do. ... 7:0—9:0 Tuesdays ... 7:30—9:45 | 10/- | 15/- | |
| 80 | CLOCKMAKERS (and SMALL GEARERS). | <i>First Year's Course—</i> Workshop Drawing ... Mechanics (Ten Lectures) ... Physics (part } Lectures ... course only.) } Laboratory . Practical Clockmaking ... | Tuesdays ... 7:30—9:45 Thursdays ... 7:3—9:45 (27th sept. to 29th Nov.) Fridays ... 7:30—8:30 Mondays ... 8:30—9:45 (from 1st February.) Wednesdays . 7:30—9:45 | 10/- | 15/- | Courses for City and Guilds and British Horological Exams. |
| 81 | Do. | <i>Second Year's Course—</i> Technical Drawing ... Theory of Clockmaking ... Practical Clockmaking ... | { Thursdays ... 6:0—9:30 at the British Horological Institute Mondays ... 7:30—9:45 | | | |
| 82 | WATCHMAKERS ... | <i>First Year's Course—</i> Same as No. 80 (which see) | | 10/- | 15/- | Courses for City and Guilds and British Horological Exams. |
| 83 | Do. | <i>Second Year's Course—</i> Technical Drawing ... Theory of Watchmaking ... Practical Springing and Timing. | { Thursdays... 6:0—9:30 at the British Horological Institute. Wednesdays... 7:30—9:45 | | | |

Supplement to the previous Report

TEXTILE EDUCATION.



Report on a visit to some of the more important centres of Textile Education in Great Britain, and suggestions based thereon by Arthur W. Thomson, D.Sc. (Glas.), C.E., M.Inst.Eng. Scot., Professor of Engineering, College of Science, Poona, Inspector of Technical Education, Bombay Presidency.

In the beginning of last year, Government was pleased to grant me furlough for six months ; and during a portion of that time, September and October 1900, I visited the following centres of Textile Education :—Manchester, Leeds, Bradford, Sheffield, Huddersfield, Oldham, Ashton-under-Lyne and Trowbridge ; Glasgow, Dundee and Dunfermline.

2. *Object of visit.*—The object of my visit was to see the methods of textile instruction in Great Britain, with special reference to the establishment of the Ranchhodlal Chotalal Technical School about to be erected in Ahmedabad.

In December 1900 I visited Ahmedabad along with the Director of Public Instruction ; and with several members of the provisional committee of the school we inspected the proposed site of the school and had a meeting at which rules and some preliminary matters relating to the school were considered.

3. *Textile Classes in Great Britain.*—In Manchester, Leeds, Bradford, Huddersfield and Glasgow day and evening classes in textile subjects are carried on ; in the other centres visited—Sheffield, Oldham, Ashton-under-Lyne, Trowbridge, Dundee and Dunfermline—there are evening classes only.

The number of students in the day classes is very small ; in the five centres mentioned above, the highest number on roll is 52, the lowest 7 and the average is about 35.

The number of students in the evening classes varies from 200 in Oldham to 53 in Trowbridge, and the average number for the eleven centres visited is about one hundred.

I propose now to describe shortly the work which is being done in the Yorkshire College, Leeds, and in the technical schools of Manchester, Trowbridge and Oldham. From this description a general idea may be formed of what is being done for textile education in England and Scotland under varying conditions.

4. *The Yorkshire College, Leeds.*—In this College there are full courses in science, art, law, medicine and technology.

The Textile Industries Department is the most fully developed and handsomely equipped Institution of the kind in Great Britain. The Cloth-workers Company, London, erected the buildings and provided the equipment costing together about £60,000 and they give an annual donation of £3,000 to carry on the work. The class-rooms, looms, &c., are all lighted by electricity, and the machinery is driven by electric motors and everything is of a most advanced type.

The full textile course extends over three years and includes the following subjects :— Spinning and Weaving, Testing of Yarn and Cloth, Textile Designing, Cloth Finishing and Dyeing ; and lectures on the construction of hand and power

looms for various purposes and of spinning machinery ; about half the time is devoted to lectures and drawing and half to spinning and weaving practice and dyeing.

The annual fee for students taking the full course is £30, and the number of students attending is about 40, of whom 20 are in the first year. Specialised courses of study are arranged to suit the requirements of individual students.

The College grants a certificate of proficiency in Textile Design and Cloth manufacture to students who pass through the complete course and certain prescribed examinations.

Evening classes are held for students who are engaged during the day. The course usually takes three years ; the fee is about £2 per annum ; the number of students is about 40, of whom 20 are in the first year. Pupils are prepared for the City and Guilds of London Examinations given later on in paragraph 7 of this report.

This will serve, and probably does serve, as an excellent model for the Textile Department of the Victoria Jubilee Technical Institute, Bombay ; but it is much in advance of anything we require or can hope for in Ahmedabad for a very long time.

The calendar of the College contains much useful information and the prospectus of the Textile Department is beautifully illustrated. One copy of each accompanies this report, and I would suggest that they may be sent to the Ranchhodlal Chotalal Technical School and kept there for reference.

5. *Manchester Textile School.*—In Manchester textile day and evening classes are carried on by the City Municipality.

The textile classes are held in a separate building, but it is intended to take these and many other classes in technical subjects held in various places throughout the City to the new Technical School which will be finished this year, 1901, and on which a sum of not less than £300,000 is being spent for building and equipment.

The accommodation in the old building comprises class rooms, &c., and two large rooms for practical instruction, *viz.*, a cotton spinning machinery room 76' x 33' containing about 30 different machines presented by Messrs. Dobson and Barlow, Bolton, and a cotton weaving machinery room 64' x 60' containing 28 hand-looms and 25 power-looms of different kinds. Two gas engines supply the motive power ; the rooms and machines are lighted by electricity.

The day course is for two years ; the students are engaged for seven hours a day, half the time being devoted to lectures and drawing and half to practical training on the various machines. There are 35 day students on the roll and the annual fee is £16.

For students who are engaged during the day, evening classes are arranged ; the course is for three years, and about 100 pupils attend classes three evenings per week ; the fees are nominal.

6. *Trowbridge Textile Classes.*—The Wiltshire County Council carries on day and evening classes in a large number of technical subjects in many of the towns under its control.

Classes in textile subjects are held in Trowbridge and two other smaller towns in Wiltshire. The classes are held in the evenings—two nights per week in each centre, and the teacher of spinning and weaving visits the three schools in rotation.

The fees are nominal ; about fifty students attend the textile classes in Trowbridge ; courses of instruction are arranged on the lines described in the

following paragraph, and pupils are prepared for examinations held by the Science and Art Department and the City and Guilds of London Institute.

7. *Oldham Technical School.*—The Technical School, Oldham, is on what may be called a medium scale; it is not so elegantly fitted up as the Yorkshire College, Leeds. It is not so large and important as the Manchester Technical School; it is on a much larger scale than the Trowbridge School and it may be taken as a very good specimen of what is being done for technical education and for Textile Education in the more important towns in England and Scotland where textile manufactures are carried on.

About 60 years ago science and art classes were started in connection with the Oldham Lyceum, and about 20 years ago a large and elegant building for these classes was presented to the town by the sons of the late Mr. John Platt, M. P. About five years ago the Technical Education Committee of the Municipality found that the number of pupils attending the school had greatly increased, and resolved to erect an additional building for practical instruction in the subjects, Cotton Spinning and Weaving, Engineering, Plumbing and Sanitary Work and Carpentry; the ceremony of opening the new building took place in June 1897.

This new building covers an area of about 150' × 100'. There are four floors; the walls are of brick with stone dressings; the windows are very large and the cost, excluding site and equipment, was £12,000. On the ground floor are a carpenters' shop 40' × 30', a plumbers' shop 40' × 30', offices, heating and ventilating chambers and boiler house. On the first floor are the mechanical engineering workshop 91' × 40', fitted with fitters' benches, vices, lathes and few other machine tools; the mechanical laboratory 40' × 30'; two class rooms and smithy. On the second floor are the cotton spinning room 92' × 41' and three class rooms; the machinery is excellent and is capable of illustrating all the usual processes in the manufacture of cotton yarn. On the third floor is the weaving room 93' × 42' splendidly lighted from the roof by north exposure windows; the machinery consists of six power-loom and sixteen hand-loom of various types and some other machines. The machinery for cotton manufacture was all presented by Messrs. Platt Brothers, Oldham.

The motive power for the Engineering, Cotton Spinning and Cotton Weaving Departments is supplied by three gas engines of 13, 25 and 10 brake horse power, one engine on each floor. The whole building and all the machines are lighted by electricity.

The number of students attending the evening classes is as follows:—

| | | | |
|----------------------------|-----|----------------------|----|
| Cotton Spinning | 176 | Plumbers work | 52 |
| Cotton Weaving | 40 | Carpentry | 47 |
| Mechanical Engineering ... | 84 | | |

There are no day classes in these subjects. Drawing and Design are taught in day *and* evening classes.

For the two schools, the current expenses for the year 1898-99 amounted to about £5,000, of which sum £1,400 was for interest and sinking fund; the fees amounted to £700 and the number of individual students was 1,688.

Arrangements have been made for courses of study in—

| | |
|-------------------------------|----------------|
| (a) Cotton Spinning, | (e) Chemistry, |
| (b) Cotton Weaving, | (f) Physics, |
| (c) Mechanical Engineering, | (g) Mechanics, |
| (d) Electric Light and Power, | (h) Carpentry, |

and three others of less importance.

The subjects which form these courses are those given in the Science and Art Directory and in the City and Guilds of London Syllabus; and certificates are given by the Board of Education and by the City and Guilds Institute to such students as pass required tests.

The Cotton Spinning course includes the following subjects:—

Cotton Spinning; Machine Drawing and Design; Theoretical Mechanics; Applied Mechanics; and Freehand Drawing and Design.

The Cotton Weaving course includes all the subjects of the Cotton Spinning course, with Cotton Weaving in place of Cotton Spinning.

The Mechanical Engineering course includes the following subjects:—

Mechanical Engineering; Lectures and Workshop Practice; Plane and Solid Geometry; Machine Drawing; Mathematics; Theoretical Mechanics; Applied Mechanics; and Steam.

Recommendations and Suggestions for the Ranchhodlal Chotalal Technical School, Ahmedabad.

8. *Gifts of Machinery.*—Many of the spinning machines and power-looms in the schools which I visited were presented by the makers to show their interest in textile education and also as an advertisement of their machines.

I had some correspondence with Messrs. Dobson and Barlow, Bolton, and with their Bombay Agents, Messrs. Paul and Dadina, and from what I learned from them I think that this firm may probably be willing to assist the Ahmedabad School under certain conditions.

I would suggest that the Committee of the School may communicate with Messrs. Paul and Dadina, Bombay, on this subject; and perhaps also with some of the other makers of cotton working machinery who have business connections with Ahmedabad.

9. *Medium of Instruction.*—The medium of instruction should be entirely vernacular—Gujarati.

The translation of some selected handbooks on technical and technological subjects would be of much advantage to the School.

10. *Work to be educational.*—The practical work done in the School should be entirely of an educational kind; orders from the public should not be accepted; sometimes it will happen that practical exercises done by the pupils have some market value—these may be sold, but the sale of such articles is not to be the object of their manufacture. Many of the simple models and appliances required for the School may, with advantage, be made by the pupils themselves.

11. *Standard of admission to School.*—If pupils who have already passed the fifth or higher vernacular standard come forward in sufficient numbers—say about thirty or forty each year—boys of a lower standard should not be admitted. As far as possible a new class should be formed every year on some convenient date, say 1st November, so that the pupils may be kept together in their studies.

12. *Length of course.*—Experience gained in connection with the Parekh School of Art, Surat, leads me to expect that there will be considerable difficulty in retaining pupils for a course of even three years' duration.

If entrants are qualified as required by the preceding paragraph, I would suggest that the length of each course should be made two years.

13. *Courses.*—Arrangements should be made for starting two courses—

- (a) Cotton Spinning and Weaving.
- (b) Mechanical Engineering.

After the School has been open for some time, it will be seen whether and in what directions extensions are desirable.

14. *Time—How to be spent.*—Taking the number of working hours as forty per week, the time should be spent somewhat as follows:—

| FIRST AND SECOND YEARS. | | | | | | Hours per week. |
|---|-----|-----|-----|-----|-----|--------------------|
| <i>English.</i> —Reading, writing, and dictation | ... | ... | ... | ... | | 5 |
| <i>Mathematics.</i> —Arithmetic and mensuration | ... | ... | ... | ... | | 5 |
| <i>Drawing.</i> —First Grade Art subjects, machine drawing; carpentry drawing | ... | ... | ... | ... | ... | 6 |
| <i>Lectures.</i> —Mechanics, physics, steam | ... | ... | ... | ... | | 4 |
| <i>Practical. Carpentry</i> | ... | ... | ... | ... | | 3 |
| <i>Workshop. Practice...</i> | ... | ... | ... | ... | | 16 |
| <i>Physical. Drill</i> | ... | ... | ... | ... | | 1 |
| Total number of hours per week for all pupils. | | | | | | 40 |

15. *Practical Course.*—For pupils taking the textile course, workshop practice should include—

First year.—Lectures on cotton technology and spinning machinery; taking machines to pieces and replacing parts; practice with spinning machines.

Second year.—Lectures on cotton technology and weaving machinery; taking machines to pieces and replacing parts; practice on hand-loom and on power-loom.

For pupils taking the course in mechanical engineering, workshop practice should include—

First year.—Lectures on materials and workshop methods; practical carpentry; chipping, filing and scraping in iron; and lead work.

Second year.—Tending of engine and indicator diagrams; practical carpentry; pattern-making; smithery; brass casting; wood and metal turning and metal fitting.

16. *Courses for boys of low educational standard.*—The courses prescribed in paragraphs 14 and 15 are arranged, as has been stated, on the expectation of getting, in sufficient numbers, pupils who have already passed Vernacular Standard V or higher before joining the Technical School.

If, however, properly qualified pupils in sufficient numbers do not come forward, a three years' course beginning with boys who have passed Vernacular Standard II should be arranged, but I propose to leave this for future consideration.

17. *Certificates and Scholarships.*—An examination in Gujarati reading and writing, arithmetic and drawing should be held every year, to determine first year scholarship-holders; some of the scholarships might be reserved for backward classes.

Marks for class work and practical work done during the first year and for examinations held at the end of the year should determine—

- (a) Whether a pupil passes into the second year of the course; and
- (b) Scholarships to be held during the second year.

The final examinations should be held at the end of the second year of the course; pupils who have been regular in attendance and diligent in their work for at least two years should be allowed to appear, and candidates who pass the examination successfully should receive the school certificate in—

- (a) Cotton Technology ; or
- (b) Mechanical Engineering as the case may be.

18. *Special Classes.*—Special classes in drawing and carpentry should be held in the School at times convenient for pupils and teachers.

These classes are intended for pupils who attend other schools, or who are engaged during the day in some other way, and who wish to appear for the examinations of the Sir Jamshedji Jejeebhoy School of Art, Bombay, or for the examination in manual training—subjects (drawing and carpentry)—held under the Bombay Education Department.

19. *Evening Classes.*—I have not had much experience of night classes in India ; the little I have had leads me to think that they are not likely to be successful in Ahmedabad. They are intended for young men who work in mills or as mechanics during the day and who wish to improve themselves by further study ; the working hours in India are usually long and the climate is exhausting.

If, however, the local committee can induce a sufficient number of pupils, say 12 or 15 in a class, to join and attend regularly, there is every reason to hope that the results will be successful.

Classes in drawing and practical carpentry, and lectures and practical classes in cotton technology and in mechanical engineering should be started and should be continued if found to be sufficiently attended.

The educational test for admission will, I think, have to be much lower than that for day students, see paragraph 11 ; probably Vernacular Standard II will suffice.

A certificate should be given to each pupil who attends the evening classes regularly for two years or more ; the classes he takes and the progress made should appear on this certificate.

Some of the scholarships might be reserved for students attending the evening classes.

20. *School Buildings.*—I have already supplied a sketch of a two-storied building which I consider suitable for the School. Two sheds well lighted from the roof by large windows with a northern exposure will be required later on—one for the cotton spinning and weaving machines, the other for the mechanical engineering workshop and smithy.

21. *Equipment*—The spinning and weaving machinery should be of the newest and most efficient kind and should be able to show all the processes through which cotton has to pass as it changes from the raw material to the finished fabric.

Details may be left to the founders of the School, to the donors of the machines and to other local experts who will form the Committee of the School.

The School furniture should be of the best kind obtainable. About forty dual desks—80 places—of approved pattern suitable for drawing and other class work ; twenty carpenters' tables each with two vices similar to those in use in the College of Science, Poona—40 places ; five fitters' tables each with four fitters' vices—20 places ; two portable forges ; forty sets of carpenters' tools—one set for each place at the carpenters' tables ; several general tools for wood

and iron work; two sets of smiths' tools; grindstone and certain models and diagrams will all be required soon after the School is opened. An oil engine of about ten brake horse power for driving the machinery; four turning lathes for wood; four turning lathes for iron, two of which should have screw cutting arrangements and some other machine tools will be required later on.

This does not pretend to be an exhaustive list of the requirements, which will depend on the number of students attending the School and on the funds available.

22. *School Staff.*—This subject was considered at the meeting referred to in paragraph 2 and does not require further consideration.

23. *Finally*, I wish to express the hope that the Ranchhodlal Chotalal Technical School may be of great use to the people of Ahmedabad and that there will be no lack of good students desirous of taking advantage of the opportunities offered to them.

It is very sad to think that the large hearted donor who founded the School in memory of his father should have died at its very inception; let us hope, however, that the members of his family may have the great pleasure of guiding the affairs of the School, and of seeing it prosper more and more as time goes on.

I wish to thank the officers in all the Technical Schools which I visited while travelling in Great Britain for their uniform kindness in showing me everything I wished to see and in giving me whatever information I wanted.

ARTHUR W. THOMSON, D.Sc., C.E.,

Professor of Engineering.

College of Science, Poona, 6th June 1901.