CHAPTER LXII: PART-TIME OR HALF-TIME CO-OPERATIVE INDUSTRIAL SCHOOLS.

SECTION 1: INTRODUCTORY.

While evening continuation classes have been regarded as distinctly beneficial to adult pupils, their advantages for young boys have been questioned. It has been often contended that for boys between 14 and 18, study for two or three hours at night is too great a strain after a long working day.

The co-operative industrial school affords, through combination, what the apprenticeship school furnishes by the efforts of employers alone. It is founded on a co-operative agreement between a school and one or more employers by which apprentices or other young employees are excused from work part of the time in order to attend school, the latter undertaking to give them instruction wholly, or to a considerable extent, related to their shop work. Boys who could not afford to remain in an ordinary school may thus secure a good trade education while earning sufficient for at least partial self-support; and employers who could not maintain an apprenticeship school of their own are enabled to develop well trained mechanics within their establishments. These schools being independent units, and very closely adjusted to the needs of their particular localities, naturally show much variety of arrangement. Some operate under the half-time plan, by which pupils alternate school and shop work, generally week about; others provide short periods of instruction every week, or at some special time during the year.

Origin of Co-operative Schools.

The term Co-operative Schools originated from the work of Professor Schneider in the University of Cincinnati; and Fitchburg, Massachusetts, was the first to apply the system to the High Schools. Different methods are outlined in the summaries of schools of this type which follow. These schools have been established in few places as yet, and the United States Commissioner of Labor reports that they seem to be regarded with indifference except where they have been tried; but wherever tried, they seem to have been successful and to have won general favor. While they differ materially in their operations, one group is quite distinct—the co-operative half-time schools, in which the pupil is in the school half the time and in the employer's shop half the time. The other co-operative schools, for convenience termed part-time schools, provide only short periods of instruction each day or week, or provide instruction for only a few weeks in the year; all, however, under a co-operative arrangement.

This system is not feasible in the elementary schools because of the youth of the pupils.

How Schools are Classified.

The Massachusetts State Education Office has three classifications for so-called "part-time" schools:—(1) Full-time and full-responsibility, where the school authorities assume responsibility both for the shop training and the school training of the boy (as Newton Independent Industrial); (2) Part-time and full-responsibility (as at Beverly and Worcester); (3) Part-time with part-responsibility, where the school assumes responsibility for the boy's arithmetic, drawing, grammar and English, but does not have anything to do with his shop work. Where the school does not go near the shop, the State Office would classify it as part-responsibility. A school where for a comparatively long period, say a week or a month, a boy has shop experience followed by school experience, is called a part-time school, as distinguished from others like the Newton School, where the shop experience and school experience are much more intimate and there is not a long rigid division of school and work shop.

A plan of co-ordination between the shop work and the school work generally prevails in the half-time or part-time schools.

The difference between a school such as that at Worcester and the half-time School at Beverly inheres in this: that the shop work at Worcester is all done in school workshops, whereas at Beverly, while the shop work is under school control, it is done in a part of the commercial factory. In the case of the half-time school at Fitchburg the arrangement is still different. There the boys do their shop work and receive their shop experience in several workshops of the city, free from school control, although the teacher from the school visits the workshops and thereby prepares himself to co-ordinate the school work with what the pupils were doing in the shops during the previous week.

Each of the three plans has its defects and its merits, and seems to fit in with the local conditions of the place where it exists. A report in sufficient detail on the different types of schools has been made in order to enable authorities in Canada to judge for themselves.

Objections to Co-Operative Schools.

Some foremen at first objected to the co-operative plan because of the bother caused by releasing the boys for a part of the time from the shop, necessitating readjustment of the shop schedule; but as the schools prove their worth this objection is being withdrawn, and the superintendents and foremen are becoming advocates of the plan. Objection is still made to the co-operative plan, from the outside, on the grounds that it may in some instances place the school too much under the domination of the employer, and that the continued co-operation of the employer on which the system depends may be withdrawn at any time, thus closing the school. In theory both these objections seem valid, but in practice no trouble has been experienced along either line.

These schools are looked upon as being in a sense experiment stations where, in addition to the valuable training given to the pupils, standards in industrial

and agricultural education are being evolved. Guided largely by the experience of the existing schools, certain theories and principles have been established, which, it is believed, will have an important bearing on the future development of industrial education.

Dr. Balliet thinks the half-time plan is one form of industrial education that is going to be very effective. "It would be better for some children in the upper elementary schools to work half a day and go to school half a day if it could be done. But the half-time plan is only one type which meets a certain problem. It cannot be made universal at all. One thing to be borne in mind in studying this problem is that no one type of industrial school is all we want. We want a good many types, determined by different conditions and circumstances, and differences of communities. In some industries the half-time school is the best; in others it would not work at all."

SECTION 2: THE CO-OPERATIVE SYSTEM OF EDUCATION.

(ACCORDING TO DR. HERMAN SCHNEIDER).

Professor Herman Schneider, head of the Engineering Department of the University of Cincinnati, is regarded as the originator of this system of organized education; and the following brief account is given practically in his own words:

The first active steps towards a solution of the problem of co-operation in industrial education were taken at Cincinnati in 1906 in a conference of the authorities of the Engineering College of the University with the local branch of the National Metal Trades Association. This resulted in a plan whereby engineering students, properly prepared, obtain their practical experience in the manufacturing shops and their knowledge of theory at the University. The students are divided into two sections—one studying at the University while the other is working at the shop, thus alternating theory and practice week by week.

The course was started in September 1906 as an experiment, and was so successful that the attention of the National Metal Trades Association was drawn to it in a paper in 1908. The delegates from Fitchburg, Mass., decided to adopt a similar scheme for training mechanics in connection with the public school system; hence the "Fitchburg plan." The evident economy and efficiency of the system caused widespread imitation of this method of "hitching the shop and the school abreast."

Prof. Schneider thinks that perhaps the best statement of the fundamental idea is this: "The practice of engineering cannot be learned in a University; it can be learned only where engineering is practised, namely, in the shop or field. The theory underlying the practice may be obtained outside of the University, but can be best obtained in an organized system of instruction under skilled teachers."

It should not require much argument, he adds, to show that the practice and the theory underlying it should be taught simultaneously, if possible. "As a matter of fact, the whole argument for the co-operative course, together with

the investigation which led to it, would make a long and involved statement, and while it might prove more conclusive than any simple expression, we have always felt that the demonstration of the scheme, together with a statement of the results achieved year by year, would be more effective. While we still believe the actual demonstration to be better than the argument, we find that many erroneous impressions prevail concerning the work.

Alternate Week Arrangement Merely a Detail.

"Curiously enough, many people think that the basic idea in the co-operative system is the alternate-week arrangement. The plan by which theory and practice are combined and co-ordinated is merely a detail, and the alternate-week scheme which we use is the one which happens to fit our local conditions the best. Even in our own school we are devising different systems of co-operation.

"For instance, after four years of experiment, we decided to operate the co-operative courses in electrical, mechanical and metallurgical engineering on the alternate-week plan 11 months in the year, reducing the length of the courses from six years to five years.

"In civil engineering we have the alternate-week scheme eight months in the year, and for the summer months we have made an arrangement with the Union Pacific Railroad Company whereby our students obtain field work in railroading, together with instruction given by the railroad company. In chemical engineering there will be a marked departure, according to our present plans, from both of these details of operation.

"It must be evident that for different localities, different means of getting theory and practice together will be used, and also in different courses the ratio of theory to practice may vary.

The Scientific Spirit is Not Killed.

"Our critics have always felt that the amount of work given would tend to kill the scientific spirit, and to instil a too practical one. A recent occurrence worth mentioning in this connection was a meeting of all the co-operative students with the faculty to discuss the five-year, 11-month plan of operation. At this meeting the students who have been with us three or four years strongly expressed the hope that the course would be made six years long, 11 months of the year. None of the students wanted a six-year course, nine months of the year.

"When the vote was finally taken, it was found that all the men who had had three or four years of the work wanted a six-year course, 11 months of the year, while the younger men were unanimously in favor of a five-year course, 11 months of the year. The reason given for their attitude by the older co-operative students was that they wanted to take up in the University, advanced scientific work of a post-graduate grade, together with certain academic subjects such as psychology and logic, and that they desired also to take a more comprehensive group of technical subjects than is usually given in an engineering course. That

is to say, they have become so impressed in the shop with the broader aspects of engineering that they desire to touch not only the technical subjects of their own courses but also many of the technical subjects of other engineering courses.

Teaching How to Tackle a Problem.

"We are more and more convinced that the best thing a University can teach an engineering student is how to tackle a problem, and to this end most of our summer work is devised. All of the summer work in the University is to be constructive, following the analytical work of the previous year's theory. For example, the student's first problem will be something like this: 'There is a barrel of rock salt; you are supposed to have a certain knowledge of theoretical chemistry after your year's work. Here is the laboratory; here, also, are the necessary industrial implements; over there is the library. Now go and make four pounds of table salt. At five o'clock each day let us have a written report on what you have accomplished.'

"Following this and other simple problems, the work becomes more complex, leading into boiler compounds and metallurgy. The student will be compelled to rely almost entirely on his own resources, except for critical suggestions following errors, and by the time he has reached his third summer it is hoped that he will be able to use the laboratory, the library and his theoretical knowledge to make a logical and effective attack on a new piece of constructive work. In his last year he will have several problems which will involve theoretical considerations that he has never met, except perhaps in the fundamentals of physics."

Value of the Co-Ordinator.

The great moving force, according to Prof. Schneider, is the co-ordinator for each class of students in the shops—a college graduate who is acquainted with shop work, and who must be a man commanding a good salary. He spends every morning at the University, in class-room or laboratory, and every afternoon at the shops. It is his work to make a direct weekly co-ordination of the work of the shop with the work of the school. During the afternoons he will supervise the student apprentices at the shop. He will know what they are turning out, their speeds, feeds and cuts, the angle of the tool, how the batch of work is ticketed, how the work is set up, the power drive, in fact everything important in connection with the operation. The next week those working apprentices are in their classes at the University, and all the points observed during their week in the shop will be taken up and explained. Prof. Schneider says the plan is revolutionizing the teaching in his department. Instead of students listlessly sitting at a lecture in engineering, they are alive with question after question. A card system is also in use on which is marked the operation which calls for an explanation of the theory.

How the System Works.

This is the co-operative plan. It works well in Cincinnati, which is a manufacturing city, and the alternate week system allows the application of the plan

to many smaller manufacturing centres within a radius of 50 miles of Cincinnati, as students can reach these places at week-ends as easily as they can reach the city itself.

A most important feature of the scheme is that the wages paid go a long way towards supporting the needy student in his college course. It is intensely practical. Students are paid for their services while at the shops on the following scale, each period being approximately 990 hours:—First period, 10c per hour; second, 11c; third, 12c; and so on, increasing one cent per hour for each successive period for ten periods.

The city of Cincinnati is so enamoured of the Schneider scheme that it is just finishing a building costing $300,000 and a power plant costing $150,000 for the University. The educational impulse given the city of Cincinnati by the University is shown by the late erection of one of the most comprehensive and even magnificent High Schools in the United States.

The term of operation of Prof. Schneider's plan in Cincinnati University was originally six years, but it is found that it can be shortened to five on account of the new methods of instruction forced on professors and instructors, and it is suggested that it may be reduced to four years. There is a class for each year, and a shop co-ordinator for each class. There are two shifts of students. There are at present nearly 300 Engineering students, with a large waiting list.

The examination for entrance is severe, not only knowledge and preparation being taken into account, but the personal aptitude of the student. The outside shops are glad to have the students. The course runs over ten months in the year, giving five months each to class-room and shop work. Attention is also being paid to the social condition and recreation of the students.

Successful After Three Years' Test.

Last year the Union Pacific Railway took the output of the University Engineering class and placed them for the two months vacation on sections along their railway route.

No doubt those who have not seen the working of this system will object that a scheme which brings two sets of students into any work on alternate weeks is not practicable and will demoralize a factory. The answer to this, in Prof. Schneider's own words, is that three years' co-operation at Cincinnati and shorter periods of observation elsewhere have demonstrated that the criticism is untenable.

Prof. Schneider in developing his system has adhered to the principle that the University and its funds should be used for the development of brains, not machinery; hence his University has "scrapped" its practice shops. and uses instead the highly organized, well-equipped commercial shops of the city. He says that if one-third the money saved by the co-operative plan were put into salaries for the teaching force, engineers who are deterred by poor pay would be attracted to college, and Universities would then be centres of real learning

and research. If a student is to devote 33 months of his life to study under skilled instructors and 33 years to practical work he must be taught in college only those things he cannot learn outside.

Effect of Plan on Teaching Methods.

The effect upon the pedagogic work has been remarkable, and Prof. Schneider thinks this is the most important development of the co-operative course. In every subject the teacher was required to produce his syllabus and answer the question "Why do we teach it?" It was thus discovered that broad fundamental principles were being taught over and over, not as basic principles but as special rules for special machines. Thus a number of courses, *e.g.*, in hydraulic machinery, were found to be merely compilations of what the student has already had in other subjects, with much descriptive matter from machine catalogues; also that many so-called "technical courses" were merely descriptions of practical work which the student would learn more accurately in the shop, and therefore entirely out of place in the co-operative system. By teaching such things the student failed to grasp once and for all the big fact that these principles were broad underlying laws, not ingeniously devised formulas for special cases.

The drawing teachers, in reply to the question, stated that many of the students would become designers, and hence must be able to draw. But it is well known that the real designer in a progressive shop spends very little time at the drawing board. If he is an alert man he is in the shop watching the performance of tools and machines; he frequently consults the salesmen to hear objections to his particular machine and get suggestions for its improvement; he does extensive experimental work, following recent developments at home and abroad; and when he comes to do any designing he sits at a roll-top desk, makes his computations and free-hand sketches, and turns these over to follow-up men who can be obtained for about $75 a month. In other words, the drafting-room is becoming to the designer what the typewriting room is to the management. For these reasons Prof. Schneider holds that it is much more important for the future designer, after he has learned the necessary elements of drawing, to spend the afternoons of his college days in the laboratory, the library, and in consultation with his professor in research problems, leading to computations and free-hand sketches which can readily be interpreted by an inexpensive follow-up man, than it is for him to spend all this time laboring to become an expert draftsman. Hence, except where drawing instruments are absolutely necessary for certain classes of work, as in kinematics, the long periods of drawing have been eliminated from the course, but the student is given definite problems based upon the fundamental principles of physics and required to devote many hours to the laboratory and the library, where he works out his results in the form in which they would go to the drafting-room. In other words, the student is taught first that essential requisite of the engineer—how to tackle a problem in the laboratory and in the library.

Plan of Teaching Reorganized.

For these reasons the teaching system has been reorganized as follows: The first three years of the course are devoted to mathematics and the fundamental sciences, together with the cultural subjects. Physics is the backbone of the whole course, for there is not one principle used in engineering which is not to be found in physics. The teaching of physics has been modified in accordance with the same principle. When a student studies the principles of heat, for instance, he is told how they will be applied in his work in thermodynamics. The professor of thermodynamics starts him where the professor of physics has left off, and these principles are not to be taught him again as though he had never had them. On the basis of his work in physics he will at once start on his problems in thermodynamics. After the first three years we cease lecturing to our students and demand of them original work based upon fundamental principles, which work, of course, is guided by the professor, but more after the method of the post-graduate seminar.

Besides the natural sciences there is another science just as important for the engineer, namely, the science of management. This embraces all the problems of shop economics, and these are introduced in the later years, after the student has had three years of experience in the various departments of the shop. Coupled with these sciences, there is a six-year course in the economic, social, political, and industrial development of the human race, and two years of general economics. There are also courses in the modern languages, sociology, sanitation and English literature. About 25 per cent of University time as distinguished from shop time is devoted to these so-called cultural subjects.

In Close Touch With Industries.

Prof. Schneider, who spends every afternoon in the industries investigating the commercial production manufactured in Cincinnati, believes that developments of his system indicate a radical change in much of the future instruction in engineering colleges. It has been shown, for instance, that just as much business science is needed for building a piano as for building a dynamo, and just as many men are employed in one trade as the other, requiring a similar time for mastering the work; yet if a college of engineering were to announce a course in piano building, a howl of derision would probably arise throughout the educational world.

There are many other industries which are considered by engineers as minor industries, but which have a basis in science. If the investigator is fair, however, he will discover that a broad and thorough training is just as essential for their successful operation as for the building of a machine tool. Since our colleges are endowed for the benefit of the public, and not to make life's pathway easier for the individual of average calibre whose father can afford to send him to school, it should be obvious that to meet the requirements of the industrial community the college of engineering must broaden into a College of Industrial Science. If

we pursue this investigation a little further we will find that the first three years of work would be the same for the apprentices in the piano factory as for the apprentices in the machine tool or electrical works.

INSTITUTE OF INDUSTRIAL RESEARCH.

After receiving a broad training in the fundamental sciences, the mathematics and the humanities, the students would enter upon their last three years with one backbone course of specialized study, together with the collateral branches applying to these particular fields of endeavor. The most promising development has been brought forcibly to us by manufacturers in these so-called minor, and supposed non-engineering, industries, who have proven to us the great dearth of well-trained men for their work. It is a function of the College of Industrial Science to prepare these men also.

Another suggested development is that there will grow up by the side of the College of Industrial Science, an Institute of Industrial Research, which will have about the same relation to the college that the research department of the Westinghouse Company bears to its production department. It is well known to educators that a good research man is often a poor teacher, and that a good teacher is frequently a poor research man. Yet we are always trying to make a good teacher do research work; often, too, a good research man is held down to a miserable salary because his teaching is not as efficient as it should be.

If a number of Universities develop Research Institutes, the next natural step would be a bureau under national direction as in Germany. A foundation of this kind would bring to the college of Industrial Science, without cost, the best research brains obtainable, in exchange for which the colleges would furnish the laboratories. The co-operative system operates in times of industrial depression or prosperity to the satisfaction of the manufacturers, the students, and the University; a logical combination of theory and practice, closely co-ordinated, has been worked out; a great waste of the funds provided for education has been eliminated by abolishing the imitation practice shops; the substitution of work in real shops at fair pay has made the college course possible to many more young men, and hence has permitted a selection of the raw material for making engineers; and the close contact with industrial life in an industrial centre has widened the field of usefulness of the science college and has forecasted an Institute for Industrial Research on elastic and economical lines.

SECTION 3: THE FITCHBURG PLAN OF INDUSTRIAL EDUCATION, HIGH SCHOOL, FITCHBURG, MASS.

The "Fitchburg Plan" is the direct result of the seed sown by Prof. Schneider of Cincinnati at the Convention of the National Metal Trades Association in New York in 1908, when he outlined the system of co-operation whereby the Cincinnati shops take charge of the practical training of students while the University teaches the theory.

Fitchburg manufacturers, who were present, felt that this method could be adapted to High School students who wished to learn a trade and continue their education at the same time, and they offered the use of their shops for the practical instruction of apprentices, if the school board would provide the necessary collateral instruction. The result was an arrangement with the leading local manufacturers of saws and knives, steam engines, grinding machinery, steam pumps and pumping machinery, manufacturers of lathes, planers, railroad tools, tinsmithing, pipe engineering, etc. Textile work was added in September, 1911, a slight change being made in the course by substituting Principles of Cotton Machinery and Textile Chemistry for Mechanism of Machines and Chemistry in the ordinary course. The textile industry in New England employs probably 50% more men receiving from $1,300 to $10,000 a year than any other industry in that section.

By this plan shops far superior to any trade school that can be conceived of were given to the City for the training of mechanics, while the City is not called upon to spend a single dollar for their equipment, nor is the State required to contribute to their maintenance. It is a strong feature to have industrial pupils in the High School; it makes the High School really democratic. This Industrial Course is for the ordinary Grammar School graduate and for boys who have not obtained this standing but who have "gone over" the course.

The Course, and How It Works.

The course outlined is of four years' duration, as is the regular High School course. The first year is spent wholly in school; the next three years the boys alternate weekly between shop and school, and are thus "steadied down" from the age of 15 to 18. In a boy's growing time he is made stronger by this plan, as it is a sequence of short vacations or changes, and also ensures that he will come under male teachers.

The manufacturers take the boys in pairs, so that by alternating they have one of the pair always at work, and likewise the school is provided with one of the pair.

Every Saturday morning the boy who has been at school that week goes to the shop in order to get hold of the job on which his mate is working, and be ready to take it up Monday morning, when the shop boy returns to school for a week.

Shop work consists of instruction in all operations necessary to the particular trade.

Earnings for Shop Work.

Students, in the second year and after, get 20 weeks in school and 30 in shop yearly. They receive pay for their shop work as follows:—

	Per hour	Per week	Per year
Second year	10 cts.	$5.50	$165 00
Third year	11 "	6.05	181.50
Fourth year	12½ "	6.87	206 25
Total for three years (each student)			552 75

The 60 boys (20 in each class) thus earn in three years a total of $11,055.

Above rates are higher than the former apprentices had been receiving, the manufacturers having of their own accord raised the prices. Hence a boy has strong inducements to continue in school, for he can thus earn more than he could by going out and taking ordinary jobs in stores or offices; at the same time he has an opportunity to contribute to his support when his parents could not have kept him at school, and thus is enabled to continue his education.

In one shop the firm offers prizes for suggestions, and a boy won $30 in one year in this way.

When there is a vacation week in school, work is provided in the shops so that the boy does not have to loaf around the street with his hands in his pockets looking for mischief. These periods are paid for in addition to the amount above indicated as his yearly wage.

"Trying out" Boys—Selection of Courses.

Every candidate is given a trial period of two months after the close of his first year at the High School. If he likes the work and shows aptitude for the trade he takes the course; otherwise he drops out and, if he chooses, takes up some other course in the High School. Thus the boy has opportunity to "find himself." The wage scale becomes operative the first day of July, when the boys enter upon a trial period of two months. Division into pairs is made at the opening of the fall term in September.

What should be taught in such a course as this? Since the school time is only 20 weeks a year, it is evident that only such subjects should be included as are of practical value to the student in the pursuit of his livelihood, of course looking to his advancement in that pursuit. The point insisted upon by manufacturers was that this course be such as would make the boys better mechanics and also capable of advancing to their highest possibilities. Better a little done well than a smattering of a large variety of subjects. The regular courses of High School study were discarded, precedent was ignored, and such subjects were selected as would fit the students to become intelligent mechanics. The courses, and the reasons for the selection of studies are as follows:—

Schedule of Studies.

First Year—*All School Work:*	
English and Current Events	* 5
Arithmetic, Tables and Simple Shop Problems	5
Algebra	5
Freehand and Mechanical Drawing and Bench Work	8
Second Year—*School and Shop Work*:	
English	* 5
Shop Mathematics, Algebra and Geometry	5
Physics	4
Civics	2
Mechanism of Machines	5
Freehand and Mechanical Drawing	6
Third Year—*School and Shop Work:*	
English	* 5
Shop Mathematics	5
Chemistry	4
Physics	4
Mechanism and Machines	5
First Aid to Injured	6
Freehand and Mechanical Drawing	6
Fourth Year—*School and Shop Work*:	
English	* 5
Commercial Geography and Business Methods	2
Shop Mathematics	4
Mechanism of Machines	4
Physics, Electricity and Heat	4
Chemistry	6
Freehand and Mechanical Drawing	5

* The figures show number of periods per week, each period being 40 minutes.

English.—Throughout the four years, in order that the boy may speak and write intelligently, he is given forms of business papers, shop terms and spelling. Familiarity with shop terms and their significance is an important feature of this work, also current events and industrial history, the daily happenings in the industrial world, the history of the iron industry, factory system and labor problems, new inventions, and reading of mechanical journals to keep in touch with mechanical affairs. The boy gets interested in the history of industry, and learning of its heroes. He "straightens up."

Mathematics.—Beginning with simple propositions in mensuration, fractions, metric system, circular measure. General shop mathematics dealing with problems on cutting speeds and feeds, belting, gearing, strength of materials, general cost figuring.

Algebra.—To give facility in using the formulae so common in trade journals and handbooks, and leading up to simple practical geometric and trigonometric formulae.

Mechanism.—Treats of construction and uses of various machine tools that every shop contains. The names and uses of every part are learned in the school as well as in the shop.

Physics.—Study of laws underlying all mechanics, study of working examples being emphasized.

Chemistry.—Nature and qualities of metals and salts, tests that can ordinarily be applied to fractured metals, hardening and tempering processes.

Commercial Geography.—Study of sources of supply of various industries, preparation and methods of transportation, cost of materials, etc.

First Aid.—Knowledge of how to care for those injured in accidents.

Drawing.—The "sign language" of the mechanic. A large share of the drawing period is given to freehand work, beginning with simple objects, then machine parts. During the last two years the boy draws with instruments to scale. Boys sometimes get into the drafting room at the works.

Civics and American History.—Careful study of city and state government for intelligent and progressive work.

Business Methods.—Study of organization of shop systems, including receiving materials, laying out work, tagging, inspecting, and routing work through shop; also general office systems. The workman sees the dependence of one department on the other, the necessity for the co-operation of all to secure good results. He gets an idea of the great responsibilities of the employer. This will help solve the labor and capital problem.

Better Apprentices Better Students.

Mr. Hunter, who is Director of the High School Studies, and also acts as correlator, adds that this plan gives the manufacturer a better class of apprentices, boys who will make thinking mechanics, able to read a blueprint and go ahead, and not mere workers who require all the foreman's time and attention explaining every little detail of a drawing. Foremen on every hand speak in the highest terms of the work. The boys are three years ahead of the ordinary High School graduate; they are working in the plant where they would have to apply for a position if they wanted work; the men know what they can do, and when they become journeymen (which Mr. Hunter claims they do on graduation) there is no kick about paying them good wages.

The worker is by this plan given an opportunity to continue his education; to get the educational value of work with his hands under competent direction; to be a better citizen as the result of his acquaintance with the civic operations of his community and their relation to the worker; to be a contented and happy workman because he can see beyond his daily task into the great storehouse of the literature and history of his trade that has made possible the rise of the nation, and continue his supremacy as the artisan. Boys taking this course are not looked upon as inferior by the pupils taking the academic courses.

Conditions of Apprenticeship.

The following is a summary of the rules and conditions under which special apprentices, taking the 4 year co-operative industrial course, are received for

instruction at the works of manufacturers as set out in printed form of agreement signed by employer, apprentice and the latter's bondsman. (The boy's relative or guardian signs an agreement consenting to the employment, and to the payment of wages direct to the boy).

The applicant for apprenticeship must have satisfactorily met requirements for entrance to this course at the High School.

The apprentice is to work for the employer continuously, well and faithfully, under such rules and regulations as may prevail, in such capacity and on such work as specified (unless changed by mutual agreement) for the term of approximately 4950 hours (3-year shop term), divided into three periods of approximately 1650 hours each, and with wage scale as follows:—

First period, 10 cents per hour; second period, 11 cts; third period, 12½ cts.

This wage scale begins the first day of July preceding the apprentice's entrance upon the first year of shop work.

The apprentice to report for work every alternate week when High School is in session, and on all working days when School not in session, and to be paid only for actual time at such work, but to have vacation of 2 weeks each year without pay during school vacation.

The employer reserves the right to suspend regular work wholly or in part at any time deemed necessary, and agrees to provide under ordinary conditions other work for the apprentice during such period at the regular rate of pay.

Should the conduct or work of the apprentice not be satisfactory to employer or the High School authority, he may at any time be dismissed or suspended for a time by the employer without previous notice. The first 2 months of the apprentice's shop work are considered a trial time.

Lost time shall be made up before the expiration of each year, at the rate of wages paid during said year, and no year of service shall commence till after all lost time by the apprentice in the preceding year shall have been fully made up.

The apprentice must purchase from time to time such tools as may be required for doing rapid and accurate work.

In case the apprentice violates in any way the terms of the agreement, or these rules and conditions, the bondsman agrees to pay $100.

On the satisfactory fulfilment of contract the School Board of Fitchburg confers on the apprentice at graduation a diploma, bearing the signature of an officer of the Company with which he served his apprenticeship.

The employer agrees to furnish the apprentice, during three years, work and supervision suitable and proper for him to learn the specified trade, during the regular working time of its shop, provided he shows reasonable capacity and ability to do the work given him; also to faithfully instruct the apprentice in said art or trade in their shops during said term.

How the Plan Works.

From observations made by the Commission and statements made by others, who had examined this system, it is not manifest that any special attention or instruction is given by the various foremen or others while the boys are working in the shops.

By weekly visits to the shops, and by inquiries of the boys during their school week, the Director keeps in close touch with their work. If a boy feels that he is not getting just what he ought he makes the fact known, then a talk with proprietors and foremen discovers whether a change should be made. A written report of the work in the shop is also passed in on Monday morning of the school week, and is inspected and filed for reference. This furnishes a good exercise in observation and composition, covering hours worked; kind of work (lathe, planer, chipping, blocking, weaving, etc.); description of work (size, color, kind of metal, etc.); description of machine (sketch of parts; particular features); tools used, facts learned (speeds, feeds, time, etc.); comments.

Every opportunity for questions regarding shop work is encouraged in the school, and these questions are of a most intelligent nature. Many problems are dealt with that the shop has not time to consider, and interchange of ideas

and methods in different shops broadens and helps all the boys. While this course was intended for those who wanted to become mechanics, it forms an excellent foundation for a technical course. With another year at High School studying a foreign language and a few other college-required subjects, a boy is exceptionally well prepared, and can pass off his shop work and a great deal of drawing, so that he gains instead of losing.

Friendly Attitude of Manufacturers.

Alluding to the fear expressed that manufacturers will control the schools, Director Hunter says there is little foundation for it; that the manufacturers have insisted on but one thing—that the course be practical; that a practical shop graduate be the supervisor. They have enough to do to run their own business, and expect that the school authorities know what is wanted. Business men and manufacturers, instead of standing aloof criticising and complaining, have turned in and helped to provide what they want and need. As manufacturers are among the largest taxpayers, Mr. Hunter asks why they should not get what they need.

Mr. McDonald, President of the Fitchburg Iron Manufacturers' Association, says he does not take apprentices any other way now. He added that this plan gives a boy something the mere shop apprentice has not got, and he becomes a faster workman. The boy from the home of the not-too-well-off gets a chance of an education.

Another manufacturer claimed, as a point in this course superior to trade schools, that these boys generally stay to the end, while it is said 80 per cent of boys in trade schools fall out before the end of the course. Also, a boy in this plan has his place, with his feet in it for future employment, while the other boy has to look for a place. Ability to do real work develops responsibility, just as a boy, who knows that what he writes will be printed exactly as he writes it, will be specially careful.

Mr. McNamara, foreman of Fosdick Engine Works, which has 12 boys besides 3 graduates from the school, said their men looked on the boys as a good feature. When boys get through they are not specialists, but machinists—the men that are wanted for the future. The boys work one year and a half on lathes, making pistons and piston-rods and pins for cross-heads. A boy who was working stated to us, "You can keep your interest more by week-about; otherwise you would be more likely to lose your interest in the shop or in the school."

An advantage of week-about as against half-day is that the boy has separate clothes for school and for work; this helps to maintain his dignity. The close contact, between the work in school and the reality (accuracy) in shops, makes the boy's education real and living, and the boy fills his place as a real unit in society. The local authorities, teachers and manufacturers, were much impressed with the system, and they seemed to think that it was meeting the local needs.

QUALITY OF REPORTS WRITTEN BY STUDENTS.

Our Commission inspected the reports made by students from shops, and noted the good hand-writing and clear English, also the freehand drawing used to illustrate their ideas when necessary. Compositions, well-written and illustrated, gave descriptions and sketches of machines, mandrils, taps, micrometers, calipers, gang-planer tools, reamers, saws, grinders, sprinklers, high-speed lathes, etc. Others dealt with the growth, decline and possibilities of the apprentice system; opportunities of a machinist at a local factory in which the boy worked: migration of machinists; automatic machinery; manufacture of shot for special caliber guns; iron industry in America during the Colonial period; wireless telegraphy, etc. There were also series of business letters asking permission to use the name of a firm as reference; permission to open a business account; asking references of firm; reply favorable to men opening business; ordering goods; acknowledging order and containing invoice; concerning damaged goods; remedying damage; letter containing payment; letter acknowledging payment, etc.

The boy who has been in the shop all week must on the following Monday morning bring in a written report on the previous week's work. He must also bring in writing a synopsis relative to some one book, selected from general literature, that he has read during his shop week.

SECTION 4: THE BEVERLY HALF-TIME INDUSTRIAL SCHOOL.

"One of the most important features of the welfare work at the factory is the industrial school for the boys who will one day be the inventors and the trained mechanics of the Company. In conjunction with the State of Massachusetts and the city of Beverly the Company has established the first school of its kind for mechanics in this country. There is nothing else quite like it in the world." Thus speaks the United Shoe Machinery Co. in a pamphlet describing its factory at Beverly, Mass. The Company, which has about 3,000 employees, has invested $25,000 in shop equipment for this educational experiment, sufficient for 25 boys at a time.

The origin of this school is interesting. For several years evening class instruction in mechanical drawing had been given in Beverly. In October 1907 the Massachusetts Commission on Industrial Education, co-operating with the Beverly School Committee, established an Independent Evening Industrial School with courses in machine drawing, architectural drawing and engineering mathematics. In the following year this work was systematised, attendance largely increased, and freehand industrial design, industrial applied science and shop mathematics were added. The State Commission afterwards appointed a local commission to study the needs of Beverly in the matter of Industrial Education. This Commission represented the varied interests of manufacturing, organized labor, agriculture, commerce, industries for women,

and school authorities. After many conferences and full investigation the Commission reported in May, 1909, and in August the school opened with 50 pupils.

What the School Does.

The school aims to give elementary instruction in the machinist trade to any boy who can qualify for entrance; it is hoped other departments will be added as conditions warrant. Candidates must be 14, and must have completed sixth grade elementary school work or equivalent. Many of the pupils have attended High School for a year or two.

The number admitted is at present limited by shop capacity to 50, and there is a waiting list. These 50 are divided into two groups, A and B, who alternate between the Beverly High School and the factory, one week at a time in each place. This was considered the most advantageous division of time. School days are 8 hours, with Saturday holiday and no home lessons; factory hours are 9 for 5 days, and 5 on Saturdays, with discipline the same as for regular employees. Each group is under the general charge of a thoroughly trained and experienced machinist instructor or co-ordinator who teaches his own group at both school and factory (an assistant shop instructor giving all his time instructing in the shop). These 3 give all the purely trade instruction, while 3 regular High School teachers give the academic subjects. By thus learning the needs, aptitudes and peculiarities of each of his 25 boys, the instructor can more closely correlate the school instruction and factory work, while the experience in both places makes the instructor himself broader and more efficient, the shop work keeping him from being too theoretical in his instruction at the school, and his experience and observation there making him a better teacher at the factory.

In the High School building the work of the Industrial School is carried on in one of the laboratories, which has been assigned for its exclusive use. Other laboratories and classrooms are used in afternoons when not occupied by regular High School classes. All the work is carried on in separate classes, with different hours from the regular High School, with a course of study distinctly its own, with a corps of part-time specialists who teach science, business practice and civics to suit the specific needs of the classes.

What the Factory Does.

The boys are given individual instruction in setting up work on the various machine-tools used in the Company's shops, in running machines to the best advantage, and also in bench work. The instructor keeps a record of each machine-tool on which the boy has worked, so that he will not be kept too long on any one machine. It is found that one week is usually sufficient to master an operation. The practice shop uses no so-called raw-materials; pupils work upon machine parts (castings) brought directly from the Company's foundry for certain operations as shown by blue-prints and drawings furnished by the Company. Under the direction of the instructor each boy performs several different opera-

tions upon a casting. This work, as well as machinery manufactured, is inspected by regular factory inspectors and goes into regular stock of the Company. The boys are said to like the factory work better than the school work, because they build something useful and sell it to the Company, thus enjoying in early life the gratification that comes from profitable and expert toil. 8 of the pupils have been passed out into the regular work of the factory, and earn from $13 to $14 per week. The Director of the part-time work has advised these boys to "go slow," and not to arouse hostility on the part of the older workers because of their earnings.

Course of Study.

At the Factory.—Operation of different machine tools on various classes of work, and later specializing on machine tools for which special aptitude is shown. Each pupil makes a freehand mechanical sketch and writes a description in note-book of the various articles manufactured by him.

At the School.—(a) Drawing—mechanical sketching with all necessary dimensions, working drawings, perspective, industrial design, machine design, blue-print reading. (b) Shop Mathematics—arithmetic, algebra, geometry, trigonometry, with shop tables and the use of micrometers and other instruments of precision. (c) Machinists' Literature, current and historical and modern machine shop practice, explanation and records of shop work, shop talks. (d) Science—mechanics, electricity as applied to machinery, chemistry of materials and their manipulation. (e) Arithmetic and business practice; business and social forms and practices; personal, social and civic duties; industrial economics.

The course of study in the school has been modified from time to time, but speaking generally it covers above subjects. As this school is in an experimental stage, the course of study is not definitely formulated beyond the first year's work. In general it is thought that two years will be given to the introductory course. It is probable that one or two years of more advanced work and specialization will be offered at the end of this period. It is planned to have boys ready to enter on regular apprenticeship at close of course, and for the Company to introduce in the near future some scheme of apprenticeship regulation.

Drawing Emphasized.

The drawing at the High School is based on the mechanical sketch (not to scale) with all necessary dimensions marked on. All drawings are from the objects or mental picture; never copied from other drawings. The pupil makes the necessary measurements from the objects, and in the mechanical sketch records all the data necessary for the completion of the regular scale drawing. Great attention is paid to mechanical sketching in other ways. Each pupil keeps a note-book recording the work done at the factory. In this the operation is described, and a mechanical sketch of the article manufactured is made to illustrate the description. In the development of the work in drawing, all the parts of a simple machine are drawn and then an assembled drawing of the whole machine is made. These in some cases are colored to show the different materials used.

How Expenses Are Met.

The expenses of the school are borne jointly by the public school authorities and the Company. The school is eligible for State aid to the extent of a refund

of one-half the maintenance cost incurred by the city. The full salaries of the 3 High School teachers, and one-half those of the 2 shop instructors are paid from the school funds, the other half being paid by the Company, which also furnishes room, equipment, material, and the Director of the system.

The Company keeps a separate account for the practice shop, debiting it with all cost of maintenance, and crediting it with full value of product accepted. The boys are paid one-half the price which would be paid to men for the same work under the factory's efficient piece-work system. The other half of the price goes toward the expenses of the school. Boys earn from 85 c (given as one instance) to over $7 a week. The yearly deficit between the earnings of the practice shop and cost of maintenance ($1,800 the first five months) is made up by the Company. It is hoped the deficit will be reduced as the system is perfected. Should any profits accrue they will belong to the school and be distributed to the pupils in increased wages, or in whatever way is deemed expedient by the Board of Trustees.

Co-Operation of School and Factory.

"Only the union of pedagogy and industrial competency can produce the new type of industrial education that is desired"—this is the key-note of the Beverly movement.

The management of this school is independent of both the factory and the High School, though having access to both and sharing in the facilities both offer in equipment, organization, established standards of discipline, workmanship and general efficiency. The Trustees argue that to be closely associated with a school and with a factory with established standards is of the greatest value and importance in an undertaking of this character, which must necessarily be experimental. The High School system is the net result of the best educational practice; the factory system is the net result of the perfected methods of dealing with actual conditions of successful manufacturing. The Industrial School, to properly fulfil its function, must measure up to both standards; pedagogically it must be a good school, and industrially it must make efficient workmen. In an industrial school maintained wholly in a factory it is difficult to establish and maintain the legitimate standards of the school in equipment, methods, scholarship and general pedagogical efficiency. On the other hand, it has thus far apparently proved next to impossible in an industrial school maintained as a school solely, apart from any manufacturing establishment, to produce workmen having sufficient skill combined with sufficient productive ability to render them industrially efficient and practical. Hence neither party can afford to ignore the other.

Various Views of Beverly Plan.

A Commission from Wisconsin, after investigating the Beverly plan, reported:—

> The remarkable point and the safe point, both from the standpoint of capital and labor and also from the standpoint of true industrial education, is that the arrangement is controlled entirely by a committee composed of five members of the school board, and one or more citizens of Beverly

appointed by the mayor. Every factory has a representative appointed by the mayor upon nomination of the proprietors of the factory. As an additional safeguard, the whole is under the control of the Massachusetts Commission on Education, and state aid is given the city of Beverly to carry on the work. This seems a good combination, but unless the factory is as large as the United Shoe Machinery Company at Beverly, the shop instruction will not be adequate. It is not often that firms are found who will see matters in as broad a way as the United Shoe Machinery Company of Beverly. If such co-operation could be successfully carried out it would provide a means for making the high school a real factor in the life of every community.

The United States Commissioner of Labor in his report on Industrial Education (1910) says:—

It would appear that one of the greatest handicaps of the Beverly school is its complete dependence upon one manufacturing concern. The United Shoe Machinery Co. furnishes such material financial aid that should the company choose to withdraw its co-operation the school might be compelled to discontinue its work.

SECTION 5: THE BEVERLY AND FITCHBURG PLANS COMPARED.

The co-operation between the school and factory and the week-about periods are the same in both cases, but otherwise there are many variations.

The distinguishing feature of the Beverly plan is that the Machinist-Instructors accompany their boys both in school and shop, whereas in Fitchburg the boys are under the academic teachers at High School and are instructed by the foremen in the various shops. The Fitchburg Director, however, acts as Correlator, and endeavors to arrange so that school and shop co-operate in the matter of instruction.

In Beverly this scheme is run with only one shop, whereas in Fitchburg there are various separate workshops. The single factory makes the complete Beverly plan more workable as to instructors and cost; but when the system is extended, if each group of 25 boys must have a special teacher, the Beverly plan will be more expensive than that at Fitchburg. The limit in Beverly to one factory is only temporary, as it is planned to extend it to others, but meantime the danger to the entire scheme is commented on, because of it being dependent wholly upon one business concern.

Different Apprenticeship Features.

The two plans differ radically in the matter of apprenticeship. In Fitchburg there is a written agreement for 3 years' apprenticeship, accompanied by a bond for $100 in case of failure, and this is looked upon by the Fitchburg manufacturers as one of the strong points of the scheme, because it holds down restless boys; whereas in Beverly there is no apprenticeship indenture, and the pupil is free to leave at any time if he thinks it advantageous to do so.

In Fitchburg boys may select a trade from among a large number, whereas in Beverly they can take up only the machinist trade.

In Fitchburg the number of boys is only limited by the number of factories in the city, whereas in Beverly the capacity is limited to 50.

In Fitchburg the work of the shop is the ordinary work of the regular apprentice, whereas in Beverly the shop work is systematized from the instructional standpoint, as well as being closely correlated with the school work.

In Beverly the instructor keeps a record of each machine-tool on which the boy has worked, so that he may not be kept too long on one machine.

School and Shop Instruction.

In both places, however, the school work is specially adapted to meet the needs as they develop in the shop work, and in both cities specialist teachers are engaged in the school.

In Beverly the Assistant Shop Instructor gives all his time to instructing the boys in the shop, and their work is done under the sole direction of the Machinist-Instructor who teaches them at the school.

In Fitchburg the school instructors spend as much time as possible in the shop observing the work of the pupils, and the shop foreman gives as much instruction as is necessary. Pupils may appeal to the Director if kept too long on one job.

The school authorities at Beverly are responsible for the training at the work shop as well as at the school.

In Fitchburg boys are paid by the hour, whereas in Beverly they work by the piece.

In Fitchburg the school instructors are paid entirely by the school, whereas in Beverly the expenses are apportioned.

SECTION 6 : APPRENTICE SYSTEM OF THE GORHAM MANUFACTURING COMPANY, PROVIDENCE, R.I.

This Company has instituted a system of training for its apprentices, in co-operation with the school system of the city. Apprentices spend one week in the shops and the next in the High School. This system of training applies only to the manual arts, and does not attempt to educate the boy beyond his particular trade. The boys are encouraged to attend evening schools for design, etc.

Mr. Lawton, the Superintendent, believes that the movement towards co-ordinating the school system of a city with the apprenticeship systems of the larger industries, in order to make it possible for boys to continue their education in a broader sense than they now do, will rapidly become general. He did not think the plan of allowing the boys to spend alternate periods of 6 months continuously in the shops at practical work and then 6 months continuously in the school was feasible except in a few trades. He said the chief difficulty in educating boys was to provide sufficient variety in the work to keep them keenly interested and enthusiastic the whole time.

SESSIONAL PAPER No. 191d

SECTION 7 : THE TRADE SCHOOL, WORCESTER, MASS.

Information obtained from "Conversation" with MR. E. H. FISH, *Principal.*

The city of Worcester met the entire initial cost of the school, $125,000, and has since given about $2,500. The city put in $33,000 for land, $30,000 for equipment, and the balance for the buildings, including power plant and heating. Although the city contributes to the running of the school, there is an independent Board of Trustees not controlled by the city. The State pays half the cost of the maintenance if the school meets with its approval. The State pays a certain percentage on the condition that all teachers receive their State certificate before being employed. In the present case the State and the city of Worcester each pay half of $24,000, the amount required for maintenance of the Day School. The net expense for the Evening Classes is $5,000 to $6,000. These sums include labor and actual material used. The revenue from the Day and Evening Schools is about $15,000.

Many come in the evenings who are not connected with the Day Classes. The boys work eight hours per day. There is a special apprentice class on Saturday mornings, attended by 40 boys. They take two hours theory and two hours practical work, and also attend one hour weekly in the evening.

STAFF, TERMS OF ADMISSION, ETC.

There are 14 full-time instructors, 3 of whom are for woodwork and 3 for machine work; and in addition there are 4 men who divide their time between shop and school work in what is called instruction work. The school has 4 electrical men outside, and 4 for machine work.

There are 160 day pupils, which is about the number provided for in the equipment, but 180 could be taken. Under the State law, no pupil under 14 may be admitted. This stipulation works hardships sometimes, as in the case of a boy who is head of his grade and wants to come in; it seems a shame to keep him out, but he can come in on his 14th birthday. The age limit for graduation is 25, so that a boy cannot come after 21, and as a matter of fact very few come over 19, as they do not like to be with younger boys.

This school admits a boy in the expectation that he will make good, and only gives a formal examination, which includes questions to be answered, and a talk with the authorities of the school, from which a great deal more is expected than from the examination. It might be called a combined written and oral examination, only that more attention is paid to the impression gained from the boy himself than from the paper examination.

In the evening school there are about 300 pupils. Questioned as to whether as administrator he foumd any embarrassment through the use of the plant for evening classes, Mr. Fish replied, "You are running there across the trouble that the day gang always blames the night gang for any accident that happens, and *vice versa*. It is impossible to place the blame properly, and I don't know but

it is safest to say each set is doing the best it can, and let it go at that." The real embarrassment in the use of the plant amounts to so little, in proportion to the total expense, that it is not worth mentioning. The material damage to the plant itself does not amount to more than $25 or $30 in a season from evening use.

School Trains Better Than Shops.

As to whether men, who got through this school, were as well equipped in every way as those who had served apprenticeship in a shop, Mr. Fish said it was his belief that the school shop could make as good workmen out of them in 3 years (4,500 hours) as the Worcester machine shops make with their regular 3 years' apprenticeship (9,000 hours). Besides shop work the pupils have class-room work, so that the work in the school shops has to be twice as intensive as in the Worcester shops.

The school takes work just as a shop does, and if a man has an order to give for work that is desirable, it is taken, with the stipulation that the boys shall have all the time they want, so as to give each boy practice in what he is fit for, as the school has no object in exploiting the boy. Otherwise the order is refused, the reason being explained, so that the man will come with his order next time.

The school is trying to get in the line of manufacturing a regular article. They would prefer that to general custom work, though the latter brings in about $3,000 revenue in a year, and will no doubt increase. In addition, they are making equipment for themselves.

Should Boys Receive Wages?

The school is free, and the boys get no wages, though Mr. Fish said he thought the payment of some wages would be an economy in running the school. He believed these boys should do enough work to pay their wages and considerable besides, if they could only be paid. Of course there would be the danger that they would be so anxious to make the wages that they would try to get the instructor to give them work at which they could make good pay, but Mr. Fish considered that this might be the lesser evil, though he admitted that it was a danger.

The Labor organizations have always favored the school, and two Labor men were on the original Commission that worked it up, one being still on the Board of Trustees and one on the Board of Instructors. Everything is wide open, and several men who belong to Labor organizations attend the evening classes. The President of the Electrical Workers' Union is one of the under-instructors in electrical work in the evening; so that they can see just what is going on. The school simply says to them, "Here, gentlemen, we are going straight ahead to teach a trade, and mean to make the course long enough so that there will not be any triflers, or any danger of throwing out scabs at the time of a strike;" and there have been no dissensions at all.

Selling Products.

The Labor men do not object to the school selling goods, and the authorities of the school have been pretty careful to maintain market prices. The point is that the boys should know that the machines they build are going to be inspected by someone outside. If the school has an order for 4 lathes and actually sells one, the boy does not know which one is to be sold, and both he and the instructor have to make them all up to the standard, so that selling even one would gain the point.

If there is any range or variety at all it would be better that the boy should have the benefit of it, because it is a help to him and to the instructor, and makes it easier to keep the boys contented. A boy does not like going back to work he has long finished, but at the same time, if he has not advanced sufficiently for the better work, it can be pointed out to him that he now has to do it himself, without help, and thus he would go over the same ground without being discontented. Boys such as these compare notes with their fathers and relations who are doing the same kind of work and getting paid for it.

This is a manufacturing town, and the school deals with the local industries, the largest of which is machine work, the next largest being building trades. There are about 20 trades which ought to come in, and the next will probably be electric industries, foundry work, and so on.

The manufacturers are in sympathy with the work, and back up the school for anything it wants. The one thing that Mr. Fish deplored about industrial education in Massachusetts was that the manufacturers are not really handling industrial education. They have had their chance, and might as well have done it. This school in Worcester is really an industrial school. The others are working through the school committees, which are not elected with any idea of handling industrial education.

Continuation Work.

The school is running a little continuation work, mainly to get the run of it and find out what there is to deal with. The conditions here are somewhat different from those in Munich, so that they have to work out a scheme of their own. There is a class of 45 boys, from 8 different shops, who come on Saturday mornings from 8 to 12. It was found that simple class work does not hold their attention. They come from so many different shops and are in so many different stages of development, that it is quite difficult to arrange a course to suit them all. It was found that, although they were supposed as apprentices to be moved from one machine to another, they were not being moved as they should be, so that they were put at half-time in the school shop. The fellow who is on a lathe at his shop and sees no chance of getting to a milling machine, is put on a milling machine here. He has already acquired dexterity on the lathe, so he does not require practice for dexterity on the milling machine, but is put to a variety of jobs, spiral gears, bevel gears, etc., which he has to cut out on the milling machine, and learn the mathematics of it. The object is to teach them that they must have

mathematics, and by putting them in front of a milling machine, they are ready to go to the class-room for mathematics.

The boys get the time for school on Saturday and their employers pay them, which is equivalent to raising their pay. If this plan becomes general, it will ultimately work out that the pay will be the same for the actual amount of work done, regardless of the number of hours they are in the shop. In addition to these 4 hours on Saturday, these boys are persuaded to come into the evening school, which means another 5 hours per week. There are no means of compelling attendance.

They want to go to the shop and get hold of a handle and turn something. They would sooner come to turn a lathe than to a class; they want to see the wheels go round. They cannot be induced to do abstract work; they have to have the concrete thing in order to handle it at all. Mr. Fish said he had never run across a place where that was so marked as here. It seems to be a condition that has to be met.

Evening Courses.

The courses in the Evening Classes are,—(1) Machine Shop work, divided into planer, lathe and milling machine work, grinder, gear-cutting and some copying work; (2) Woodworking, including cabinet work, pattern making, house work, house framing and estimating. Drawing is partly blue-print reading and partly jig and fixture design. The class in gasoline engine practice is a popular one, a drawing card, though it does not amount to much for a mechanic unless he is able to indulge in an automobile, as some of them do. It is not an automobile course, but one in adjustment and trouble of gasoline engines.

The evening class students are boys of 17 or over, engaged in actual work, and they come to learn some different part of their trade from what they do all day in the shops. These men are the most valuable to their employers, as they can turn to different machines when required. Some of the day teachers teach in the evening, and a good many of the instructors in the shops work in the evening school, which has also outside instructors. The woodworking instructor in the day school has classes in the evening for estimating.

The evening class meets 5 nights a week, and the accommodation (for 200) being insufficient for all at the same time, some attend 3 nights one week and 2 nights the next, and *vice versa*.

Practical Instruction.

The school aims to make the work as practical as possible. In teaching about levers, they take first the pure lever, with examples from machines they are using to show what the levers are. The boys spend a week in the school and a week in the shop. The latter is part of the school building; a good deal of commercial work is done in it.

Mr. Neal, one of the teachers, speaking from his observation, said that the boys when they leave this school, if they have paid any attention to their work, ought to be skilled journeymen workmen. In the machine shop they have

two years of 48 weeks and 8 hours a day actual working on a machine under an instructor, so they ought to know a good deal about these machines, and be able to do everything on them. They get more variety of work in the four years than they would be likely to get in a shop, and use various kinds of machines.

THE "SERIES OF EXPERIENCES."

Referring to the Worcester Trade School, Mr. Chas. R. Allen, Agent of the State Board of Education, said that the series of experiences the boy goes through in the day school might be illustrated thus:—

	A		B		C
Age	14	to	16,	16 to	18

If we draw a horizontal line to represent his progress through the school, he would enter at A. Then through a period of the time to B he would be put into the shop and given individual jobs of a character which he could handle. In the carrying out of those individual jobs he would be required to learn to do the necessary planning, drawing, calculation, stock data reports, etc. When the product turned out is held to be of a commercial grade, a great deal of time is sacrificed from shop-training to bring in this related work on the job, the primary object being to educate the boy rather than give him mechanical technique, although as far as he is trained he is trained to turn out commercial product. After having given him some grasp of how to do these things, he would pass on to B and enter the second phase. In the first phase if he did any drawing he did it at his bench; if he did any arithmetic he did it on a scrap he picked up; if he wrote a report he would sit down in the shop and write it.

After B there is a division of time between class-room and shop. During a portion of his time the boy, in company with others about the same age, meets the teacher in the class-room outside the shop, but the time is devoted simply to working with the teacher on the particular problems involved in the job on which he is working in the shop. If it be the drawing class, he does what drawing is necessary; if it be a report, he is dealing with English, etc. Here the teacher is dealing with each boy on the individual basis, though doubtless while he is in the shop he is dealing with shop phases.

In the third phase, at C, this boy is taken into the class-room, where a deliberate effort is made to organize all the information he has had; that is, he would be given a definite course in mechanical drawing, or arithmetic, or what not, which would not necessarily be related to his mechanical work at the time. In the shop at the same time he is placed on a commercial basis, and is put on work that requires a certain number of repetitions for the purpose of giving him speed. In short, in the first two years you would stop him anywhere along the line to give him further training; in the last two years he is right on the job.

School uses Student Labor to Educate, not to Earn.

Dr. Snedden said that in practice that third stage would be reached by relatively few students; by those who had the most persistence and the capacity to reach out into the region of more abstract thinking—those who would become foremen. In order to prevent possible misapprehension, he added that while the terms commercial work and productive work had been used, his own view was not that money would be made out of that work, but the idea rather was that when a boy put his hand to an exercise he should do the work under commercial conditions, with a commercial aim; otherwise they would get back to Manual Training conditions, which are removed from actual life. The net effect of it all would be that in the shop schools—the printing school or any other—there would not be any output that would disturb the market at all, so there would be no occasion for trades unions or other producers to be afraid that the competition would be at all severe.

The primary aim being education, the authorities simply had to nail their flag to the mast on this particular matter—that when a boy goes into the shop to do a piece of work, that particular work must be got out as a piece of functioning work, as having a place in the commercial world, and not to be thrown upon the scrap-heap. It has been found that a considerable portion of the output would be absorbed in providing for the schools—additions to the machine-shop equipment, and all sorts of things. In fact in many cases they started the work in these schools by remodeling the building.

Schools Help Labor Market.

Mr. Chas. R. Prosser said that the difficulty in the matter of productive work arose when the schools came to sell these things on the market. Most of the schools can find a market for wood and metal in the school itself and in public works; but in such fields as textiles and shoes, hats and dresses, this cannot be done. Two things would probably have to be dealt with pretty strongly. One was the trades unions, who look askance at the saleable products, but who should be shown that most of those pupils would otherwise have been out in the producing industries, and would produce more there than under the limitations which the school has when they work in it. The second point is that experience seems to show that the schools themselves are really creating a market for workmen. Mr. Fish, of the Worcester Trade School, thinks that the boys will contribute about $5,000 worth of labor, which is $1,000 a year for 5 men. But there are 8 men who are trade unionists employed in that shop as teachers; hence to provide 8 men with employment the products of only 5 will be on the market. In the Girls' Trade School the production amounts to $3,000, which would deprive 6 women of work at $10 a week for 50 weeks; but on the other hand that school gave employment to 22 teachers of machine work, millinery and dressmaking, who are being paid more inside the school than they would have been paid outside.

Growth of the School.

The report by Principal Fish shows that on the morning of 10th February, 1910, 52 boys started work in the school; 7 more classes, each averaging 28 members, have been since admitted. Many have fallen by the wayside, for the present registration is 166.

Up to the first of December, 1911, 323 applications had been received for admission; 73 were refused because of apparent non-adaptability to the work or on account of previous bad records for behavior in the public schools. Of the remaining 250 who were admitted, 166 remained. The other 84 left, in almost all cases on their own account, there having been practically no expulsions from the school. Their reasons for leaving may be thus classified:—

To go to work at the trade for which the school was training them, 2; to go to work in skilled trades which the school could not offer, 8; to go to work at unskilled occupations, 7; to go to other schools 5; sickness, 1; discontented through having been set back a class, 2; moved from city, 1; insubordination, 11; lack of necessary effort, 47.

How the Pupils are Lost.

The report adds:—

From this it will be seen that the number who have been drawn to follow the trades for which they were being trained here is negligible. It is particularly significant to note that the two boys who have left for that purpose are with us in the evening classes, and one is also in our continuation class.

The fact that there are only 8 who have found themselves better suited to some other trade than that which they were able to learn here, in the main indicates that the work of the school has been interesting to those who are willing to be interested in anything mechanical.

The first three groups, comprising those whose primary object in leaving was to go to work, with a total of 17, indicate that less than 10% have felt a pressing need of wages, though the figures do not give any indication of the number who are barred from applying for admission to the school by reason of need.

The few who have left to go to other schools are boys who have shown ability which clearly indicated a capacity for higher education, and who are preparing themselves to get it.

By far the largest loss has been through lack of effort. The larger part of these cases are discovered early in their course, but new cases crop up from time to time as boys are led away by other thoughts. There are few cases of inherent laziness both mental and physical; there are cases where boys have felt a longing for more pocket money, but where their parents have tried to keep them in school; in fact it may be said that the largest part of the lack of effort comes from families where the parents are trying to oppose the wishes of their children as to their lifework. No matter how commendable it might be for us to assist these parents to train their children in some particular path, we ought not to thereby neglect those who have a settled aim in coming here, nor to injure the discipline of the school in so doing.

The withdrawals of pupils seem to follow a curve which would tend to show that at the end of the third year from the entrance of any class, we may expect to have lost about 40%, and at the end of 4 years 70% of its numbers.

SECTION 8: THE TECHNICAL HIGH SCHOOL, PROVIDENCE, R.I.

This school now receives factory apprentices (32) on alternate weeks in its vocational co-operative course for machinists and jewelers. Boys who have successfully completed one year's work in the High School are eligible for work in shops alternately. Before the completion of the first half year in the High

School, boys who wish to take this course are placed in a separate division where their work differs somewhat from that of other classes, thus affording some special preparation for the work in the industry without causing loss of time in school should they not succeed in the shop trial. If the trial is satisfactory to all concerned, the boy agrees to work as an apprentice in the shop under the half-time plan for three years, and the employer agrees to give the boy every possible chance to learn the trade. The actual time that the boy is to spend in the shop each year is 26 weeks of 56 hours. The wages will be uniform in all shops and will amount to about $550 for the three years.

The desires of boys and their parents are consulted as far as possible in deciding at which shop a boy shall work. The shop teachers are the foremen and workmen of the shop, and the apprentices are treated the same as any other workers in the shop, except for the alternation with the school.

In addition to the shop work, and of equal importance with it, are the studies in the school, which not only help boys with the trade work but give a general knowledge of the world's history and development such as every well educated man should have, and include, in addition to many of the usual High School studies, special studies designed to help jewelers. In place of the foreign languages of the regular course there are courses especially related to the trade, together with courses in Industrial History. English, Physics, Civics, and Applied Electricity are taken as in the regular courses; while Chemistry, Free-hand Drawing, Design and Modeling are studied for a longer time than in the other courses, and with direct reference to the jewelry trade. There are also series of lectures by practical men on shop subjects.

SECTION 9: THE HIGH SCHOOL INDUSTRIAL COURSES, CINCINNATI, OHIO.

This school in 1910 began industrial courses for boys and girls, which in the third and fourth years are to be co-operative on the half-time plan. In the first two years of this course the boys take all the shop work and drawing that are given in the 4-year Manual Training course. During the first year double time is given for Manual Training, taking Wood-turning, Pattern-making and Cabinet-making. In the second year they have work in the forge, foundry and machine shop. Mathematics and science are applied to their shop work as specifically as possible.

In June of the second year the boys decide what shops or trades they desire to enter as apprentices, the head teacher of the department assisting them to locate. If in the following September they prove worthy, an arrangement is made for them to take week-about in shop and school for the last two years of their course, being paid half-time for their shop work during the last two years and getting their trade in real shops working under ordinary industrial conditions. This course is designed to give the boys in the first two years an opportunity to select a trade intelligently, and to begin it at 16 under the most favorable conditions for becoming intelligent and expert workmen.

The plan is similar for girls, the purpose being vocational training for self-support or the management of a home. During the first year instruction is given in Sewing and Dressmaking, Applied Art, Cooking; second year, Millinery, Dressmaking, Dietetics, Household Arts, Applied Art, Chemistry. Girls are placed in commercial shops for the summer; then in September they continue their school work on the alternate week plan, or at night school, making the school work closely fit their needs.

The new Ohio compulsory-education plan, which went into effect in May, 1910, requires that all children not otherwise employed shall remain in school until 16; also that all who have not reached the eighth grade shall continue their schooling until 16; hence the Board of Education is authorized to establish part-time day schools for those who are at work, and then may require all who have not completed the eighth grade to continue their schooling until 16. Those who are at work may be required to attend school 8 hours weekly between 8 a.m. and 5 p.m. Those not at work may be required to attend until they are 16 regardless of the grade reached.

SECTION 10: THE CINCINNATI CONTINUATION SCHOOL FOR APPRENTICES.

This school, which has met with marked success, having at the end of its first year nearly as many pupils as are in all the regular trade schools of the United States after 30 years' effort, is an original creation, and not copied after any other school. Its basic principle is that the determining factors of a youth's productive power in a shop are (1) his attitude towards his work, his fellows, his employer and himself, and (2) the intelligence he brings to his work.

In 1909 the Cincinnati manufacturers and labor organizations and the school authorities decided to shorten the hours of labor of apprentice boys by one half-day weekly without decreasing their pay, this half-day being spent in a school-room under educational and cultural influences. The plan meant a loss of over $6,000 a year to the machine, pattern, drafting and printing trades, by payment for time of 250 apprentices when not producing; while the loss of production meant to these firms considerably over $25,000 (including overhead expense but excluding loss of profits). The task before the teachers, therefore, was to so develop the boys' mental attitude and so increase their intelligence that they would produce an additional $31,000 worth of work in the shorter week. It has been noted that thus far no loss has been charged up to the shorter week.

The cost of the school, including salaries of 3 teachers, supplies and equipment is about $5,000 a year, entirely borne by the Board of Education. About 18 men lecture to the classes without pay.

Skill and Attitude are Vital.

The apprentice is first taught the difference between knowledge and skill; "the most vital part of his apprenticeship is lost if he completes his time with barrels of knowledge but without the skill to produce a day's work." The ap-

prentice who develops a journeyman's skill gets full scale wages on finishing, instead of waiting a year or two. He is also taught that his attitude to his fellow-workmen determines his progress, because the trade exists only in the men who follow it, and cannot be acquired from books or schools; hence the boy must draw out the experience of the workmen and learn from them. This can only be done when the men are friendly and willing; hence he learns that to get along with his fellow-workmen is the bigger half of learning the trade. The apprentice's attitude to himself is also considered a subject of school concern, in order to preserve the previous development of the boy and make his transition easy from school to shop-work. "Growth into manhood is assured the State by half a day's contact each week with veterans of the struggle who are in a position to render tempered sympathy and strong stimulus." These the boy finds in the continuation school.

Boy's Attitude Towards Manufacturer.

The attitude of the apprentice towards the manufacturer has much to do with his successful development. He must be taught the difference between the production and distribution of wealth. He is apt to think of the "boss" as a non-producer, and class him with mere distributors of wealth, forgetful that "in a manufacturing community the producer of wealth is the man who buys raw material in a foreign market, and after it has been wrought into a finished article sells it again in a foreign market, thereby bringing wealth to the community." The apprentice is more than likely to overlook this phase of the matter. The public school, being concerned primarily with the preservation and development of the State, is the agency best fitted to present these subjects to the boy's mind; and the best time for so doing is when he is learning his trade and is under actual shop environment.

Intelligence Brings Efficiency.

The second element that determines the industrial efficiency of the apprentice—his intelligence in his work—is easier to develop than his attitude, because more tangible. He is taught spelling by use of a special spelling-book for each trade, composed of pictures of shop articles, such as screws, belts, wrenches, etc., with their names and definitions. The mathematical course in this school is the nearest approach yet made to a direct application of mathematics. Instead of a text-book, the instructor gives each pupil a catalogue of a drill press, and after using this as a reading lesson, the boy gets a blue-print of part of a machine. Blue is a shop color, and blue-prints have more attraction for the young mechanic than the finest page ever printed. The boy is taught to read the drawing. But the same catalogue and blue-print contain a lesson in complex fractions—though not in text-book form. The boy is taught to figure the speeds of pulleys, and when he has a 9½" pulley driving on to a 5¼" pulley he has a real complex problem in fractions. The machinist apprentice is taught the machine application along with the principle; so with other trades.

Freehand Sketching, Mechanical Drawing and the reading of drawings are carried out on a scale corresponding to their use in shops, the greatest amount of

time and energy being placed on the making of freehand and mechanical sketches to scale on rectangular and isometric co-ordinate paper. The mechanic must "talk with his pencil," and the apprentices are all taught to do lots of that kind of talking.

Unique Geometry Method.

The unique method of teaching geometry in this school by using cardboard protractor and rubber bands has been commended by mathematicians everywhere. The protractor is simply a copy of a gear wheel with 72 teeth—one at each 5 degrees; the rubber bands are placed in the notches between the teeth and make the various angles and polygons. These bands, by passing one end through the small hole in the center of the protractor, may be made to represent an angle with its vortex at the centre; this, of course, can be measured by counting the degrees on the circumference between the lines; or the bands may be so placed as to bring the vortex of the angle on the circumference; or the bands may be made to intersect either within or without the circle. In every case the method of measuring the angle is made clear. The same protractor is equally valuable in all polygons, and in calculating from them data for shop use.

The Reading Problem.

American history is studied, and in connection therewith, the development of the iron industry, with the story of Washington playing around the fires of his father's furnaces on the opposite side of the Potomac, the story of the great chain across the Hudson; the discovery of iron ore in the Lake Superior region—these are better romances than any dime novel ever printed. The science of iron has proven a delightful and profitable study.

Magazine publishers supply free copies of their publications, one sending enough to supply each apprentice. These are used for reading lessons, then taken home. There is, however, little demand for books—a branch public library having been discontinued after a year—or for school pamphlets, as it appears the apprentices have not the ability to obtain much from the printed page. Their capacity ranges from two or three who could not use the second reader to those who have completed High School.

Apprentices are admitted to the school without a question as to previous training, their acceptance by the shops being the only requirement. New pupils start each week.

The first effort of the school is to hold the apprentice to the trade until he has become immune to the discouragements of the environment and imbued with the possibilities offered.

Methods and Results.

The class work for those in the 11 trades known as the Allied Printing Trades is made applicable to their trade requirement without being exclusively practical. The same general conditions as in the machine trades are met with,

and the corresponding compromises are made. No machine work is done in the school; the boys get that in their shops, and in the Evening School machine shop, which many voluntarily attend.

An effort is made to carry out the following course for the machine trades, but no self-condemnation takes place in the event of failure. The question asked each week at the close of school is, "What has been the *attitude* of the apprentices ?"

This school opened September 1st, 1909, with an enrolment of 198, and the average attendance during the first 4 months was 186 per week and 21 per class, 9 classes weekly. Reports from manufacturers, foremen and students are decidedly favorable to the method of operation of the school and the effect on the boys. In most cases the output of the boys in the shops is greater than when they worked full time. Their attitude toward employer, foreman and machine is wholly changed. In school the boys show commendable progress and a remarkably earnest and serious spirit.

The scheme as originally outlined was as follows:—

SCHEME OF COURSES.

The course shall in general be technical, with as close application as possible to the shop work of the boys. It shall be the aim to develop continuous courses along the following lines:

(1) A period each day for general shop questions, shop practice, economic questions and civic questions. This work may be either individual or class discussions.

(2) Shop Arithmetic and other Mathematics.

(3) Mechanics, beginning with the simple elements of the machine. Mathematics and mechanics to be taught together as far as convenient.

(4) Freehand Drawing, Designing, Drafting.

(5) Practice in Spelling, Writing, Reading in connection with the story of industries.

It shall be the aim to develop a course in each of these subjects that shall proceed connectively to definite ends. A series consisting of all the lessons in each subject shall be carefully preserved by at least one student of each group to form a basis for inspection and for a course of study. It is expected that the course will be of 4 years' duration, corresponding to the 4 years of apprenticeship, but advanced students may complete the course in less time.

The first duty of the instructor shall be to classify the apprentices into groups, according to their general attainments, getting each group as nearly homogeneous as possible in proficiency, so that the general character of the work of the pupils of a group shall be somewhat the same. In the first course noted above (shop questions), individual instruction and much freedom are expected. In the other courses definite results are expected, and necessarily much more uniformity of work, but not to the exclusion of individual instruction where the instructor is able to give it. The progress of the pupil must be looked after individually in all subjects.

Sessions are from 7.30 to 11.30 a.m.; afternoon from 1.30 to 5.30; no Saturday afternoon session.

The school shall continue 48 weeks in the year, 5½ days a week, providing the attendance justifies it. Groups of students should as a rule contain 14 as a minimum and 20 as maximum to one instructor.

The instructor shall be granted two half days a week to visit shops upon pay. He shall report to the employers, upon blanks prepared, the attendance of his sudents each day; shall keep a register of the same for the inspection of the Supervisor of Manual Training; and shall make such reports as are required by the Superintendent.

CLASSIFICATION OF STUDENTS.

The chief difficulty encountered was in the classification of students. Originally the apprentices were classified according to service, those older in service being assigned to the latter part of the week. The objection to this plan was that the shops could not well spare all the boys of a department at the same

time. Hence it became necessary to follow more or less an individual system of instruction, each group containing older and younger boys in the service. This caused an exhausting strain on the energy of the teacher, and a re-classification is going on, based upon a course covering four subjects:—Mathematics, Science, Shop Practice, General Culture.

FIRST YEAR apprentices study Mathematics, Shop Arithmetic, Science, Geographical Relations of the Shop, Civics, and get much Reading, Spelling, Composition.

Shop Practice—Making and Reading of Drawings.

SECOND YEAR apprentices study Mathematics, Objective Geometry, Science, Iron—its manufacture and founding, Blue-prints, Mechanical and Freehand Drawing.

Shop Practice includes shop conventionalities and their necessities, much composition on observed facts in shop life, and reading of lives of the world's improvers: Civics.

THIRD YEAR apprentices study Mathematics, Algebra, Science, Physics.

Shop Practice—Foreman's Question Box, Drawing, Culture, Economic History, Literature, Civics.

FOURTH YEAR apprentices study Applied Mathematics, Trigonometry, Shop Chemistry, Science, Physics.

Shop Practice includes the shop sense of proportion, visiting of industrial plants and discussing observations, especially of economy and waste; Culture, the man as a wage-earner and a voter; Debates.

SCHOOL WORK APPRECIATED BY ALL.

No machine work is done in the school. The boys get that in the shop 5 days a week. Most of the apprentices are scrupulously conscientious about their school work, and appreciate the opportunity. The boy just entering this apprenticeship appreciates it least, but a few weeks of shop life change his attitude towards the school, as with the older boys a few weeks of the school change their attitude towards the shop. The apprentices soon form friendships with the boys of the shops, and all the conversation one hears concerns methods of doing work in various shops.

When the boys return to their shops they are quizzed by the workmen and foremen, and the lessons given in the school are quite generally discussed in the shops. Many of the workmen express a desire to have the advantages of such schooling. To the foremen especially is the school indebted. They have taken keen interest in the experiment. They have seen to it that the cost sheets in the shop have not been affected by the absence of the apprentices and have shown the greatest good will towards the school and the teacher as he makes his visits.

The teacher, a most capable instructor and an experienced shopman, visits shops for two half days a week, consults with foremen, and gathers practical shop problems. The manufacturers themselves have been generous of their time, have gone into the methods of their business, have furnished sets of blue prints and catalogs, and have sought to strengthen the school in every way possible. The number of manufacturing plants now co-operating is 18.

CONTINUATION SCHOOL EXTENSION.

An extension of the Continuation School is contemplated. There are at least 15,000 young people under 20 years of age now at work in commercial and

industrial lines in Cincinnati who would be greatly benefited by having an opportunity to continue their schooling. The evening schools reach about 5,000; hence at least 10,000 others need looking after.

The Women Teachers' Club has a capable committee at work to see what can be done for girls, and a Continuation School for young women in stores and factories is planned. So deep is the interest in the Continuation idea that the General Assembly (Legislature) of the State of Ohio now requires Boards in cities to provide part-time day-schools for those who go to work, and to require employers to permit the attendance of their young employees during certain hours in the week. School Superintendent Dyer says:

> So far from such a law working hardship to employers, I believe the service of the young workmen will be of greater value because of their more serious attitude towards their work and the increased power their educational training will give them. The expense to the city will not be commensurate to the good that will be done, for in part-time schools one teacher can care for at least 150 students, which is four times as many as in ordinary schools.

PART-TIME COURSES ELSEWHERE.

Other schools and institutions, such as the David Ranken, Jr. School of Mechanical Trades, St. Louis, Mo., The State Trade School, Bridgeport, Conn., The Mechanics' Institute, of Rochester, N.Y., and others provide part-time courses in day-time somewhat like the German Continuation Classes given at the Day Middle Technical Schools.

SESSIONAL PAPER No. 191d

CHAPTER LXIII: TRADE-TEACHING SCHOOLS AND SCHOOLS FOR APPRENTICES.

SECTION I: FROM MR. A. D. DEAN.

Information obtained from MR. ARTHUR D. DEAN, *supplementary to what has been presented under Chapter LVI, Section 4.*

The work of preparing our youth for vocations is not completed with either of the schemes proposed, for two reasons. (1) The general industrial school, which is a feeder to the apprenticeship system or to a Higher School, is based upon the supposition that somewhere a door is open to its graduates. One of these higher schools is the vocational school course in the High School; the other is the Trade School. (2) In order that there may actually be an open door it is necessary that the school system make provision for those who desire further education but do not care for, and it may be presumed cannot successfully maintain, the academic standards of a course of study which parallels in any way the regular High School.

There are some very definite principles in the organization of Trade Schools which need to be considered.

1. Pupils enter these schools with a well-defined purpose. The period of trying-out is finished. They are there to learn a specific trade to the full extent that is possible in any school plan.

2. This type of school absolutely abandons any specific instruction in the so-called liberal studies. This may seem harsh, but we must remember that the pupil has enrolled for one purpose, and it is fortunate that the school has even one thing, narrow though it may appear to be, to offer him. The pupil of a Trade School is not the type than can be held in school through any liberal studies, which are frankly apart from his pressing needs as he sees them. We must recognize that he is 16 years old, that his school days are numbered, and that, if his participation in the educative process for 8 years before coming to the school has not done something in the way of liberal training, it never will.

TRADE SCHOOL ORGANIZATION.

The Trade School organization requires a very different method than is now, or is likely to be, in vogue in other types of vocational training. The intermediate and secondary vocational schools have in their organization a number of teachers, some on the shop and some on the book work side. The shop work and book work are closely correlated, but this is brought about through co-operation between two kinds of instruction, one primarily vocational, the other primarily liberal and disciplinary.

But the Trade School organization is on a very different basis. Here the particular trade represented forms a school unit in itself. There should be no departments of History, English, Mathematics, Drawing, etc, in this type of school. These subjects, or others which are necessary to trade proficiency, must be taught by the teacher of the trade. He is the master craftsman who knows what is needed to prepare pupils quickly and effectively for the craft which he represents.

The Trade Schools must keep longer hours than the present schools. In this respect, as in many others, they must approach shop conditions. They have no connection with other schools; the pupils do not recite any subject with others. The Trade School is the professional school for the industrial worker, and it presupposes that it is his final schooling place, and that he desires to make his time of attendance as short as possible, consistent with all-round trade training. He is there to reduce his time of apprenticeship, and every hour counts. If he was not in the school he would be in the shop or factory working 54 hours a week, and it will not be any hardship to provide longer school hours for him.

Continuation Schools.

Mr. Dean contends that the school system should furnish as many jumping-off places as possible after the primary or elementary education. At present there is only a jumping-off or leaving place at 14, and another at the end of the High School course, with the diploma. The new plan or system provides several leaving places or points of departure to enter the industries with a fair qualification to succeed well in them. The Continuation School idea in New York State has not been realized to any great extent as yet, but it is being developed in many parts of the United States. Ohio has passed a Continuation School Law, and has a measure of compulsory attendance; Wisconsin has legislated for the organization of a Continuation School system; Iowa has appointed a man at a salary of $5,000 to study the Continuation School system and plan.

Industrial education needs to extend to the still smaller industrial communities. It should relate itself in some way to specific trade needs. It is safe to assume that the only solution open for these small places by which they can provide definite instruction in trade lines will be for them to establish day Continuation Schools which provide for an equitable distribution of the responsibilities for instruction between the shop in which the youth is employed and the school in which he may be excepted to attend for a few hours a week. All the bookwork in the schools applies directly to the business in which he finds himself, when the trade at which he is working calls for any special knowledge, while the shop itself supplies the trade atmosphere. In this way the boys and girls in the smaller industrial centres will be receiving vocational training and will not be neglected, as they necessarily will be if the State considers a scheme of industrial training which includes only general industrial vocational courses in High Schools and Trade Schools.

Evening Schools.

Schools now open their doors to children in the evening; but evening instruction for the child between 14 and 17 is not effective when he is fatigued in will and body. Primarily evening schools should be for young men and women, for those who know what they want through the hard school of experience. No note of disparagement is intended of the value of evening schools for those who are old enough and physically developed enough to do the work. But the pace of the modern shop or department store makes it hard indeed for the growing boy or girl to do good evening school work after a long, hard day spent at a machine or at a bundle counter. Germany has largely superseded her evening schools for young apprentices by the more effective day Continuation School. England has built practically her entire scheme of industrial education upon the evening school phase, and is now seeing her mistake.

SECTION 2: PORTLAND SCHOOL OF TRADES, PORTLAND, OREGON.

This school was organized in 1907 to meet the demand for more skilled mechanics, and to give greater opportunity to young men wanting to learn trades. According to the school prospectus,

> Apprenticeship is not dead, as some say, but owing to our complex social life, new conditions have arisen, and the State must assume new obligations. Through the public schools the State has taken up the work that formerly the parent held as his particular duty; but in large cities the parent is too much engaged, the family life is much more complex, hence the State is essaying to assist the parent. No doubt there will be many trade schools in the public school system in the future.

The school building was formerly used for ordinary school purposes, but has been adapted to meet the new requirements. The courses taught include carpentry, cabinet-making, machine pattern-making, electrical construction, plumbing and gas fitting, architectural and mechanical drawing, bricklaying and plastering.

Students must be 14 years of age and have the equivalent of the Gramma.' School course in education. There are no tuition fees, and no charges except for necessary books, overalls, drawing instruments and waste material or damaged tools. The full course takes 3 years, the work being half practical and half academic.

As a foundation for the course at the Trade School, the manual arts are pursued in the public schools. This training is devised to supply the framework on which the tool teacher will use his art as a means of bringing to the surface all that is best in the boy. During the shop hours the pupil is being familiarized with the elements of mechanical drawing, and learns by easy stages to make working drawings of many of the models before construction.

SECTION 3: THE LICK SCHOOL AND THE WILMERDING SCHOOL OF INDUSTRIAL ARTS, SAN FRANCISCO, CALIFORNIA.

These are entirely separate schools, maintained by separate endowments, but they co-operate so closely that they should be considered together. Both are under the same Director, they are situated on contiguous sites, and all duplication of work is eliminated. The California (or Lick) School of Mechanical Arts offered a strong course in the machinery trades, so when the Wilmerding School was established it offered courses in the building trades. Students at the one school are given full credit for all work done at the other, the Lick School stressing the academic side of the work and the Wilmerding School the practical side. The object of the latter school, as set forth by the founder, was "to teach boys trades, fitting them to make a living with their hands, with little study and plenty of work." The Lick deed of trust, on the other hand, states as the object of that school "to educate males and females in the practical arts of life, such as working in wood, iron and stone, or in any of the metals, and in whatever industry mechanical skill now is or can be hereafter applied."

The Lick School.

The only limit on attendance at this school is that the pupil shall have been born in California, and shall have had a Grammar School education. The capacity of the school is limited, so the admissions are allotted to the various counties of California according to the population. If there are more candidates from any county than the quota allows, admission is determined by competitive examination.

The school provides a 4 year course in each of the following trades: pattern making, forging, machinist. There is no fee charged for tuition, but pupils in trade courses are charged $12 a year for materials used.

During the two preliminary years of the course instruction is given in academic work for 15 and 16 hours per week respectively, and in shop work for 11 and 9 hours. At the beginning of the third year specialization begins, and 22½ hours are given to shop work and 7½ to academic work; in the fourth year the shop practice is increased to 26 hours and the academic is lessened in the same proportion, and confined to heat calculations, boiler and engine tests and electrical calculations.

The Wilmerding School.

This school is open to any earnest, industrious boy who wants to learn one of the building trades as an integral part of his education and preparation for life. Any boy who has completed the Grammar grade is eligible for admission. The maximum age of admission is 21 years. The length of the school year is 40 weeks, and the daily program includes 8 periods of 45 minutes each. Dur-

ng the first two years 4 periods per day are spent in the shops and 4 are devoted to academic instruction. During the last two years the academic instruction is gradually discontinued. The school furnishes all material.

SECTION 4: WILLIAMSON FREE SCHOOL OF MECHANICAL TRADES, NEAR PHILADELPHIA, PA.

This school was founded to afford an opportunity for poor and deserving boys to receive the rudiments of a good English education, and instruction in mechanical trades or handicrafts. The benefits of the school, including board, instruction, clothing, etc., are entirely free.

The number of pupils in 1909-10 was as follows: bricklaying, 55; carpentry, 54, stationary engineers, 27; machinist, 54; pattern making, 42. In the selection of candidates for the school preference is given in the first place to indigent boys, then to boys born in Pennsylvania, more particularly in Philadelphia and surrounding counties. Candidates must be able-bodied healthy males, 16 and under 18 years of age, with ability to pass the entrance examinations, Pupils are indentured to the Trustees, and are graduated as journeymen mechanics. They find no difficulty in obtaining employment—in March, 1910, there were 160 requests from employers for the 51 graduates—and the records of the school show that the majority rapidly advance to executive positions in their trades.

The property of the school consists of 24 buildings located on 230 acres. The eight buildings used for trade purposes are valued at $115,000 and the industrial equipment at $51,000. No outside financial assistance is received by the school, the sole support of which is the income from the endowment fund of $1,575,812. All school books and apparatus are furnished free of charge, and the product of the school, although up to the commercial standard, is not sold, the school authorities believing that a "commercial object" in the work would result in pupils being kept on such processes as they could best execute without regard to their thorough training in all phases of their trade.

SECTION 5: THE DAVID RANKEN JR. SCHOOL OF MECHANICAL TRADES, ST. LOUIS, MO.

This philanthropic institution, founded and liberally endowed by Mr. David Ranken, jr., exists for the purpose of "training and fitting boys and men for the mechanical or manual trades and occupations." Mr. Ranken stipulated that the instruction to be given must always be practical, "having in mind the need of the community and the State for practical workers in mechanical trades, who shall be skilled in their respective trades and occupations."

While not intended primarily to train superintendents and foremen, it is expected that within a few years after graduation many of the students, by virtue of the training they have received, will be enabled to rise to positions of responsibility or go into business for themselves.

The instruction offered in the day classes at present covers carpentry, pattern-making, bricklaying, plumbing, painting and steam-fitting. In the evening classes instruction is offered in these and in other subjects according to demand.

The regular course is open to boys of 15 years or over who have completed the work of the sixth grade in the public schools or its equivalent, and who show aptitude for trade instruction. Applicants who have had experience in a trade may be admitted with less schooling, and these will be assigned such preparatory instruction as will enable them to carry on the regular work of the school.

No set time is assigned for the completion of any one of the courses, the work being almost wholly individual, and a student's progress depends entirely upon his previous education and experience and his diligence. The average student should be able to complete the work in any trade in two years. Special attention is given to mature students who have already made a beginning at a trade before coming to the school and can remain for only a portion of the year.

No work is turned out for sale, but the boys are allowed, on paying for raw material, to make pieces of furniture for themselves. No material used for class purposes is charged to the student, even if wasted.

The average cost per student is $228 per annum, of which the students contribute $30.

A co-operative arrangement has been made with the St. Louis branch of the National Metal Trades Association for the instruction of apprentices in the Machinists' and Pattern-makers' trades. The apprentice is trained in the shop by his employer in the use of tools for machines, and attends the school two half-days a week for instruction in applied mathematics, applied science and drafting. The employer pays the boy his regular wages while in school, and also the tuition fee. The agreement provides that no employer shall make use of any apprentice student under this arrangement to take the place of any striker in the shop, although he may insist upon the apprentice continuing to perform his regular functions in the shop should there be any period of labor disturbances.

SECTION 6: THE HEBREW TECHNICAL INSTITUTE, NEW YORK CITY.

This school was established in 1883, and is supported by its endowments. The curriculum is determined by the demand for workmen in the local trades of building, metal and wood-working. The Institute was visited by the Commission in company with the Principal, Dr. Edgar S. Barney, from whom the following information was obtained.

Most of the boys are aged about 17, coming here when they have completed the grammar school course. The time is divided approximately thus: one-third to English, Mathematics and History (academic); one-third to Science and Drawing; one-third to Shopwork. When boys leave they are considered as advanced apprentices; they are ready to take hold of the trade, and become pretty skilful at it

in a short time; after the thorough course they have had here in the handling and use of tools they advance faster than other boys. The great majority become superintendents and foremen of shops.

The school gives complete courses in Pattern-making, Tool-making, Electrical Construction, Instrument-making, Freehand, Architectural and Mechanical Drawing and Designing. In the first two years the instruction is general for all trades; then in the third year a boy is allowed to specialize, and devotes two-fifths of his time to Shopwork and the rest to Drawing, Science, English or Mathematics allied to that special work.

The teachers are skilled mechanics; superintendents and foremen of shops of fair education who have been trained here to teach. Dr. Barney believed they got the best results in that way, because the teachers know the practical shop side.

In the *Electric Laboratory* boys work at machines, testing, plotting efficiency curves, etc., and a considerable amount of the machinery and instruments have been made in the school—all except the measuring instruments. All articles made here are for real service, and just as good as could be bought elsewhere. Dr. Barney pointed out a switchboard put in by the boys when the building was enlarged, which had been in use for 15 years, remarking that they could do it better now, the standard of work having improved noticeably in every department since the school was first started.

In the *Senior Machine Shop and Tool Room*, boys work for a few hours a day, as they are taking mainly Mechanical Drawing, working from 9 to 11 every day, and giving the rest of their time to Mechanical and English work, with some science. They come here to get a sufficient knowledge of machinery to make them efficient draftsmen. The boys who make machines here make them entirely, preparing their drawings and tools, etc.

In the *Senior Woodworking and Pattern-making Room* lathes are manufactured. Dr. Barney said that they would have no electrically-driven machines, as they were liable to get out of order and require outside assistance to adjust them.

The *First Year Woodworking Room* was fitted with single benches, while the senior room had double benches. The arrangement was necessary on account of the light, but Dr. Barney expressed the opinion that double benches are best, even for beginners.

Specimens of work done in the *Freehand Drawing* department were shown on the walls. Some boys take architectural drawing, and come here for freehand in the afternoons, drawing flowers and objects, etc. For home work they draw from life out at the Bronx "Zoo" and other places.

The *Joinery Room* has light on both sides, and double benches, and hence is a nearly ideal shop. Oil stones are on a separate table near the window, so that individual boys do not require to get out the stone. There were book racks for the boys, and seats near the teacher's bench, so that boys can be called up for verbal explanations. This room is the result of several experiments, and is now nearly perfect.

In the *Instrument Making* department there are lathes and benches for chipping and filing. The latter process is considered good training for the

younger boys, to teach them how to use their hands and the hammer and file, whether they become filers or not. The same with wood-turning; though few of the boys may become wood-turners, pattern-makers have to understand it. The principle followed is that they must learn by doing. Boys were making surveyor's transits, and had turned out dynamos and motors and a 4-cycle gasoline engine which ran well. All work is done under the direction of a skilled mechanic, and is required to be up to commercial standard, accurate to a thousandth-inch. It is rare to find a third year boy unable to work up to this standard.

Machine Drawing. Men in the trades come here for mechanical drawing, but may take only the drawing for their own trade. There are evening classes, which are very successful.

In the *Forge Room* machinery is repaired.

An electrical clock made by the boys was shown operated from a storage battery. It cost only $3.50; it had been running ten years.

All Graduates Become Reliable Citizens.

"This school has graduated 1,100 boys in 27 years, and every one of them, without exception, is leading an honest, straightforward, reliable, respectable life," said Dr. Barney, who expressed the opinion that bringing boys in contact with tools, materials and concrete thing helps to make them honest, industrious and upright, and is the best kind of training for good citizenship. Most of the boys stay at the trade for which they have trained, and Dr. Barney's experience shows that Jews make quite as good mechanics as other boys, though their natural tendency is always to go into business for themselves eventually.

Comparing the ordinary trade school with such a school as this, Dr. Barney expressed the view that the former may do well in a limited centre for a particular industry, but that in a large centre like New York and other great cities, a school like this is best, it being impossible to equip boys for every trade. If they have learnt to use their tools and understand practical drafting, they soon adapt themselves to any kind of shop work, hence this is the best type of school to have. "Since 95% of the people of the United States (and presumably Canada) earn their living by their hands, the education of the future must teach boys to use their hands."

Dr. Barney said he thought this school had exercised its influence on the public schools, and it was looked upon as a pattern of a Technical High School or Technical School, though some of the others had not gone as far as this school.

There is a dining room upstairs at which boys can buy luncheon.

None of the products are sold by the school, Dr. Barney's view being that when a boy can make an article which is saleable, it is time for him to be moved to some other branch of work, so as to get an all-round training.

At the time of the Commission's visit, a gymnasium had not been established, and no regular physical training was undertaken, but Dr. Barney was expecting to open one in a new building.

Educational Excursions.

The boys are taken for educational excursions to places of industry near New York, such as the Brooklyn Navy Yard, or for a geographical trip out to the country; to industrial shops, Natural History Museum, Art Museum, etc., where the teachers take a particular section and give the boys a talk on that subject. They have to take notes and write them out afterwards, and marks are allowed as in other subjects. This is a very important part of the school's work. These visits to establishments in the city are fortnightly, each boy getting one a fortnight. Each visit occupies half a day—from lunch time till 5 or 6 o'clock. The managers of the industries are not averse to the arrangement, and the boys behave well, as they are old enough to realize the importance of their work, and are sincere and industrious.

As most of the boys have hardly ever been outside of the city, excursions are arranged for parties of 10 boys at a time in the summer, to go out 100 miles, e.g. to Trenton, where they visit the brick yards and pottery works; to Delaware Water Gap; to the zinc mines at Franklin; to the slate quarries of Pennsylvania, etc. They walk perhaps 200 miles, starting at 8 or 9 miles a day and getting up to 20.. They see the country, which most of them have never seen before, and also see something of industries.

School Mortality Negligible.

The school mortality is negligible, as very few boys drop out, and if a boy is found to be unsuitable, he is recommended to take some other kind of course. The figures show that 8% voluntarily withdraw in a year's time, exclusive of graduates. There is a long waiting list, which makes it possible to select boys. The school is non-sectarian, and in the evening school nearly half are non-Jewish. There is a simple entrance examination in English, but it is not formal. As this is practically a High School, and the percentage of withdrawals is so low, it would appear that if work of this character were put into the High Schools and made effective, it would reduce the "mortality."

The school has an excellent follow-up system. Twice a year letters of enquiry are sent to all graduates, and many who are in or near the city constantly come in. Out of over 1000 graduates, only about 60 or 70 failed to reply. While the plan entails an immense amount of detail work, it really pays, for it spurs the boys on to do their best, and also enables the school authorities to see whether they are working on right lines.

SECTION 7: NEW YORK TRADE SCHOOL.

(67th STREET AND FIRST AVENUE)

Information gathered from "Conversation" with Mr. H. V. Brill, *Superintendent.*

This is an independent endowed institution providing day and evening trade instruction to beginners and to men already at work. The work of the trade courses is not considered as a part of an apprenticeship, but in a shop where

no regular apprenticeship obtains the graduate is regarded as a handy man who is in a position to learn his trade well. The trades taught are plumbing, electrical work, painting and decorating, sign painting, cornice and skylight work, bricklaying, carpentry, steam and hot water fitting. The length of the day course for each trade is 16 weeks. In the evening school the full course extends over 3 or 4 years.

There is no academic work; a young man has to attend some evening school to get that. The school authorities felt that there was plenty of opportunity for young men if they wanted to brush up on those subjects, and thus the school devotes its facilities only to trade work. If a boy had left the school and was fairly handy in the use of tools it would be possible for him to secure a place as improver; he would have his own tools and would make about half the ordinary rate of pay.

When the school is in full operation there are about 800 day and evening pupils; two thirds in the evening, one-third in the day.

Trades Unions Antagonistic.

The Trades Unions are antagonistic to the trade school idea; they keep the number in the trade as few as possible. Their argument against the trade school is the increase of the number of workers; they have no argument as to the efficiency of the school. The Union regulations restrict the number of apprentices to very few; that makes it difficult for graduates of a trade school to get a foothold in the trade. The School has a waiting list in most of the departments. If a man has aptitude for mechanics, and applies himself earnestly, he will finish the course provided in the 4 months, but if he thinks he has not enough instruction in that time he can stay another period.

The School would like to keep the young men longer than 4 months, but as a rule they belong to poor families and cannot stay. Only some half-dozen come at night after attending the day course.

There is a trade school now in connection with the New York public school system, and the choice between that school and this would depend a good deal on results to be obtained from each.

How Students are Held.

The trust deed of this school prohibits the giving of free instruction, but a merely nominal tuition fee is charged, about one-third the cost of maintenance. The founders felt that a young man who contributed towards his education would appreciate it more than if he got it for nothing. That has proved true in every instance with boys of poor families who came and paid their way. It is a problem with all the institutions that provide good instruction how to hold the young men. The plan here is that as evening students take 3 terms of six months, 3 nights weekly, to complete the full course, the first year they pay the full rate, $12; if they make satisfactory progress during the session and are not absent more than 10 nights they secure admission the following term at half

rate. That has had some effect in improving the regularity of attendance and punctuality, but Mr. Brill would like to see it better than it is. In the day school, tuition for sign painting is $25 per term, for plumbing, $45, and for all other trades $40.

Evening Classes.

In the evening classes in plumbing about 70% are young men at the trade; in bricklaying and plastering nearly all are; in the electrical division perhaps 25% are at the trade. The time in the 3 years' evening course just about equals that time in the 4 months' day course. The school formerly took pupils as young as 15, but it was found they had more interest in baseball. The average age now is from 17 to 20; by that time a fellow begins to think about the future, about the value of a trade, and puts more earnestness in his efforts to master it. The work here is a little beyond the physical strength of a boy around 16 years—building scaffolds, swinging heavy sledges, etc.

A visit was paid to the School. *Painters and Decorators* were doing work for a Civil Service examination. *Plumbing* work is done by the students. *Pattern-making and Carpentry* done by the students was shown. There was a miniature house built by the students in the latter part of the course. A row of 2 storey houses had been erected by students on a property owned by the founder of the school, and they had also built a carpenter shop and bricklaying shop. *Steam and Hot Water* work are separate from plumbing; boys come one year for Plumbing and the next for Steamfitting. *Sign Painting* is separate from Decorating. In *Sheet Metal* work the student makes his own drawings, cuts out the metal and builds up the design, which belongs to the school. *Electrical Wiring* is practically taught, telephone and house wires being laid under the floor of a skeleton house. Lectures are given every other night, the professor explaining the reason why the work is done in a particular way. In the *Printing* class, type is set up three nights a week from MS., typewritten and printed copy. Drawing is taught by a special teacher, and a different section of the class is taught each evening.

The school uses any available finished product for exhibition purposes. Nothing is sold, the policy of the school being against any attempt to utilize the product of students for revenue.

SECTION 8: APPRENTICESHIP COURSES.

Of the various apprenticeship systems in vogue in the United States a number have been selected as typical of the others. The aim in every case is the same, viz., the maintaining of a supply of well trained and competent mechanics who will be capable of adequately filling vacancies which occur from time to time in the ranks of employees of the firms in question. Among the courses investigated by the Commission were those established by the New York Central Railway Lines; the Santa Fé Railway Company; The General Electric Co., West Lynn, Mass.

New York Central Railway.

The Department of Education for Apprentices in connection with this Railway System is at New York and the Company has established schools for apprentices at important points on the system. The central organization deals with the general problems affecting apprentice work, outlines different courses, looks after educational work, organizes new schools, and keeps in close touch with existing schools. The system provides for close supervision and instruction of apprentices by competent apprentice instructors in properly and adequately equipped buildings.

The schools are conducted during working hours, the apprentice being paid for attendance time. Mechanical Drawing is taught in a practical way and the youth is thoroughly trained in his future life-work by a course of carefully graded problems arranged so as to familiarize him with fundamental principles. The instruction in the trade proper is given in the shop by a special instructor who devotes his whole time to the work and who is responsible to the local shop management.

The method of instruction differs radically from the ordinary methods of teaching in the following points:—Text-books are not an essential part of the plan; there is no subdivision into subjects; all principles are clothed in problem form; there is no arbitrary standard of the amount of ground to be covered; no examinations are held.

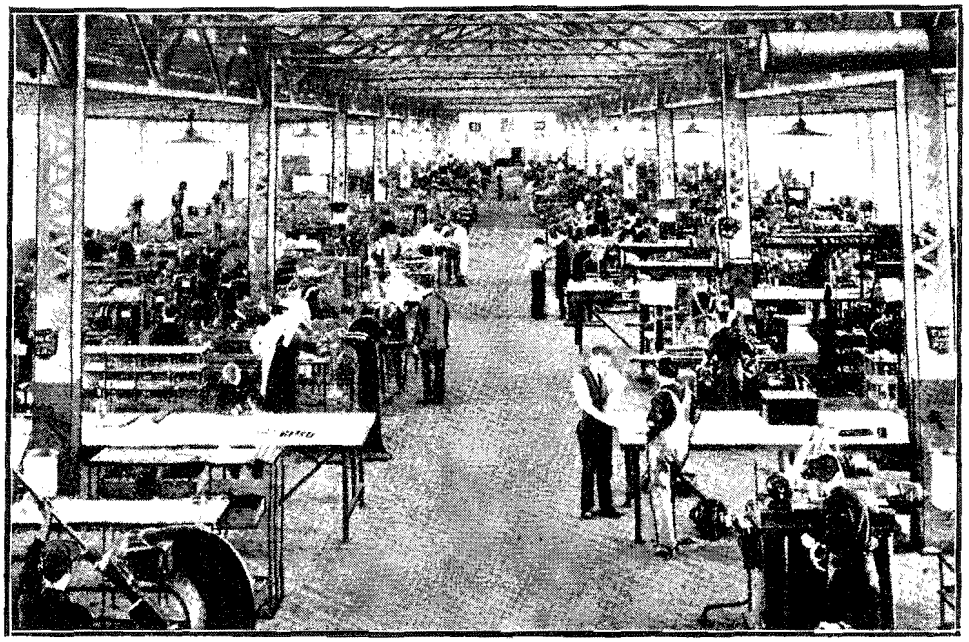
The apprentices are given 2 periods of 2 hours per week, and the course is intended to cover 4 years. The progress and marks of the apprentices are based on the close personal touch maintained between the instructors and the apprentices.

Santa Fé Railway.

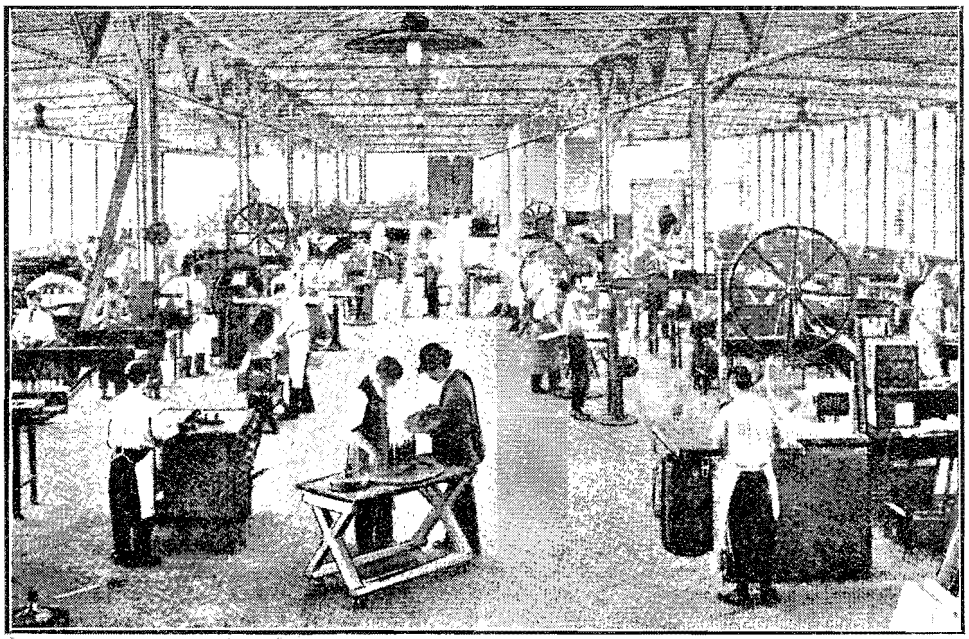
The system inauguraated by this Railway is based on that of the New York Central Lines with characteristic features suited to the distinctive conditions and purposes of the road. Systematic instruction is carried on continuously in two phases—on the shop floor and in the shop school under regular instruction during the whole four years of apprenticeship, the boys being paid from the beginning according to a graduated wage scale. Cigarette smokers are not employed, and any apprentice acquiring the habit is dismissed.

General Electric Company.

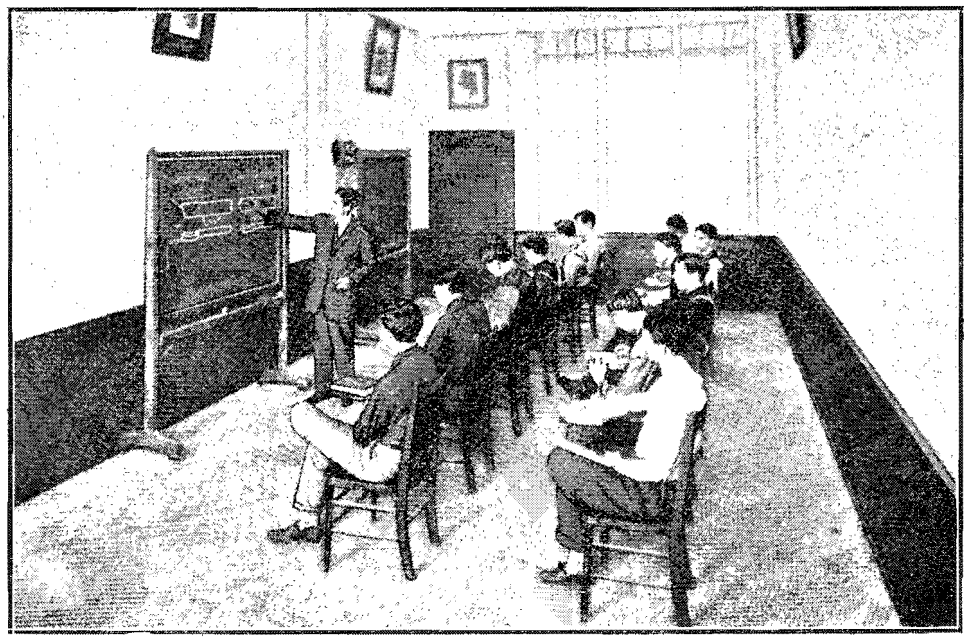
The system of this Company at West Lynn, Mass., is very complete. All apprentices receive class room instruction during working hours without deduction of pay. They are required, however, to devote sufficient time daily to study at home to prepare for the class-room work. Every graduated apprentice receives a cash bonus and a suitably inscribed certificate which states the time devoted to practical training. They are all encouraged to remain in the employ of the Company.



TRAINING ROOM FOR MACHINIST AND TOOL MAKER APPRENTICES, GENERAL ELECTRIC COMPANY, WEST LYNN, MASS.



TRAINING ROOM FOR PATTERN MAKER APPRENTICES.



"PRACTICAL TALK" IN THE CLASS-ROOM, GENERAL ELECTRIC COMPANY, WEST LYNN, MASS.

Class room instruction is based on a grammar school education, and includes (in addition to the regular shop work) Arithmetic, Algebra, Geometry and Plane Trigonometry, Physics as it concerns simple machines, Power Transmission, Strength of Materials, Machine Design, Magnetism and Electricity, Mechanical Drawing.

The school was established in 1902, when the management of the Company came to the conclusion that special training was necessary for the apprentices. It was found that the ordinary foremen in the shop did not as a rule take any interest in the training of apprentices, owing to a number of causes, chiefly the fear of having costly machinery injured by inexperienced boys. The boys were consequently kept working in a more or less narrow groove.

The apprentices are now trained by expert instructors and are then drafted into the various departments as competent workmen. The Company has proved conclusively that this system pays, and although they are now expending $20,000 a year in wages to boys for school time, they are quite satisfied with the results. While other manufacturers get the benefit of these boys to a certain extent, the Company has succeeded in retaining from 65% to 85% of the boys so trained.

Brown & Sharpe's Apprentice School, Providence, R.I.

The apprentices of this firm spend an average of 3 hours weekly in the school during their 4 years of apprenticeship. The school work covers shop mathematics, and the boys get the habit of expressing themselves by talking or writing or making sketches, so as to become interested in and understand mechanical matters. They are constantly urged to attend evening classes while apprenticed, in order to improve their academic knowledge.

The school course is laid out to take up study according to the boy's progress in his shop work. The two things are closely correlated all the way through. In the matter of examination papers the endeavor is to keep to shop methods, and academic terms are not used. A boy of the advanced class inspects the work of the class next lower, writes his opinions of its merits, and initials it precisely as would be done with the actual work in the shop.

Geometry, Algebra and Trigonometry are all taught, not as such, but so far as they are related to the practical work of the boys, who are shown the use of each (without calling it such) in order that they may do their work with understanding.

The boys are paid the regular rate for the time they spend in the school, and learn so rapidly that they very often take positions as sub-foremen in the shops before their apprenticeship is finished.

North End Union School of Printing for Apprentices, Boston, Mass.

This school was established in 1900, at first as an evening class. For the last 6 or 7 years it has been worked as a day school as nearly as possible under shop conditions but without taking outside orders. The school prints several publications, including one of its own and one for the Employers' Association; these giving sufficient practical work for the boys.

The only machines in the school are 2 foot-presses and a press motor—just sufficient for press work as done in a small job printing office.

The boys spend a year in the school and 4 years in the shop. The school is not only for the benefit of the boys, but is in the interests of employers also, who are anxious to get good boys into the trade. There is no fixed course. Each boy works at a frame precisely as a journeyman would, the only difference being that the Instructor is there to tell him about the work, which is graduated according to the boy's progress. Another feature in which the school differs from the shop is in the fact that the boys are taught Drawing in connection with Art Printing. In anything different from a straightaway paragraph the boy must first make a sketch of the work.

The tuition fee is $100, which pays about half the expense, the deficit being made up by the Employers' Association. There is no scholarship or bursary system, but some person who is interested in a boy will sometimes pay his tuition fee, and occasionally an employer will send one of his apprentices to the school.

CHAPTER LXIV: TECHNICAL HIGH SCHOOLS.

SECTION 1 : INTRODUCTORY.

A wide divergence of opinion exists in the United States as to which type of High School will best serve the community and prevail in coming years. Five distinct types at present exist. These may be termed the Academic, Technical, Commercial, Household Arts, and the "Cosmopolitan" or Union High School. The latter includes in some cases all the others as departments of one school. The following is a brief summary of opinions expressed to the Commission by the leaders in education in the United States.

DR. DAVID S. SNEDDEN, Commissioner, Massachusetts Board of Education, says that the Technical High School has been occupying a false position. The ratepayers who furnished the money thought the Technical High School was to be a high-grade Trade School. While the public supposed the Technical High School was training high-grade artisans, it was really preparing pupils for the Institute of Technology. The High School proper should offer only courses of a good strong nature for boys going on to college; on the other hand, the Vocational Schools will differentiate themselves into special schools as clearly distinct as a mining school does.

MR. CHAS. A. PROSSER, Secretary of the National Society for the Promotion of Industrial Education, is of opinion that where the Technical High School includes both the academic and the technical in the one institution, it does not succeed very well in either. The limited shop work is not enough to qualify for industrial life, and the limited or specialized mathematics does not qualify for admission to college.

DR. T. M. BALLIET, Dean of the School of Pedagogy, New York University, thinks the only way to make High Schools thorough successes in a large city is to differentiate them. "Put a man at the head of a Technical High School who has a thorough technical education and appoint a faculty in sympathy with the whole aim and character of that sort of work; in the Commercial High School place a man who has had a superior commercial education and some practical business; and have a corresponding faculty for the literary High School. In the combination High School such as they have in the west, the principal nearly always has an "A.B." and perhaps "Ph.D." attached to his name, but he knows very little about commercial or technical education, hence these commercial and technical sides are not developed as they should be. The development of commercial or technical education can be neglected in that way."

Dr. Balliet advised that in starting new technical departments in High Schools in Canada it would be better in a big place to have a separate building where that can be managed. He thought a shop for Manual Training a very good thing for a classical High School, because it is a good thing for all boys to do some Manual Training, but that is a different thing from a technical school, where a lot of industrial handwork is wanted. In Stuyvesant High School, N.Y. and in Springfield High School, they teach about three-fourths of a trade, and the students can go out and do better work than many journeymen.

PROF. F. H. SYKES, Director of the Extension Department, Teachers' College, Columbia University, is of opinion that in the small towns the Cosmopolitan or Union High School would be the type. Perhaps when the time comes for building a second school, many towns will differentiate, reserving the one school for academic work and devoting the other to technical work. In two years 30 High Schools in New York State which were formerly purely academic have taken in agriculture. A further development will be by the High School taking in Household Arts, using parts of existing buildings to do so.

PROF. G. D. STRAYER, of the Columbia University Extension Dept., cited the cases of St. Louis and Cincinnati, where Cosmopolitan High Schools are doing just as good work as any Technical High School, with the added advantage of the richer school life through the students in all the departments having much in common and helping to educate each other.

In this connection the following information obtained from DR. CHARLES R. RICHARDS, Director of Cooper Union for the Advancement of Science and Art, New York, is pertinent:—

The United States has a very large High School population. It differs from that of the elementary school by greater resources, which allow children to go longer to school, and also by higher ideals in the family home which are communicated to the children. Thus a selected class is sent onward beyond the elementary school. There is the deeply rooted ideal and ambition of the middle class homes of the United States and down to the poorer homes as far as it is possible to do it, to send their boys and girls to the High School. They will make sacrifices for that. That being the fact, and it being so deeply rooted, how is vocational education going to affect the High School?

MANUAL TRAINING VS. TECHNICAL HIGH SCHOOL.

The Manual Training High School, to Dr. Richards' mind, is only a transitional phenomenon—neither fish, flesh nor fowl. It came into the educational system 20 years ago, but in those 20 years two things have been realized (1) that the artisan class, the class of handworkers, do not go to or through the High School, which therefore cannot be depended upon to train that class of workers; (2) that the Manual Training High School curriculum is very hard to defend as a collateral training. On the basis of culture it is very hard to defend its extensive equipment and teachers; and on vocational grounds, it is very much harder to defend because the small measure of manual and technical work it gives does not amount to very much vocationally.

As a matter of record, the Manual Training High Schools have not supplied in any sense the skilled handworkers of the country. The percentage is negligible. A great many have gone into engineering schools; quite a number into drafting rooms, but not into trades.

Of late years the most significant movement in the United States in this particular situation seems to be the movement towards the Technical High School —using technical in a real sense, in the true sense—a movement which it has been hoped might reach the Manual Training High School and result finally in its change into this new type of school. The typical school which represents that idea is the School of Mechanic Arts in San Francisco, sometimes called the Lick School, which has been going for at least 15 or 16 years, and the program of which has been practically copied by the Cleveland Technical High School, and is to be pretty well copied by the new Technical High School in Jersey City. A certain number believe in trying to develop the Technical High School, though not many feel entirely confident as to what it is going to do, because such a school faces the problems of training for the industries by giving a training superior to the Trade School—more science, more mathematics, more technical material—and preparing the graduates ultimately for a superior kind of position. But it is also evident that the graduate cannot step into that superior kind of position immediately upon graduation; so he is asked to go directly into the trade and work with his hands, and it will only be ultimately that his training will serve him for the purpose of carrying him onwards.

Direct Training for Vocations.

The Englishman does not believe in that sort of thing; he says the only way to develop foremen out of superior men is to catch them after they have had experience and then put them to school. What this new Technical High School in the United States is going to produce we must wait to find out. Dr. Richards does not know, but he believes that type of school is a thing to be pushed and developed, and he looks to see all these Manual Training High Schools develop into that kind of school, and be frankly made into Vocational Schools that will train men for the industries.

As to whether this shall be a special school or part of a regular High School Dr Richards thinks the consensus of opinion in the United States is rather strongly towards the organization, wherever possible, of separate schools for vocational purposes, so that the atmosphere of the school may be as thoroughly as possible that of the particular vocation or industry represented, everything in the school being made to centre and focus upon that line of work. Of course it is not always possible to do that, but he thought the separate school would enable pupils to be taken younger.

The idea of the Technical High School has been a high school of standards for entrance parallel to the usual High School. The idea so far is to maintain this High School standard for Science and Mathematics in those Technical High Schools, consequently to hold on to the same requirements for admission and to carry them along in an intensive technical course. It is a thoroughly

differentiated scheme. The starting point of it is a differentiated scheme, but about the matter of standards the idea has been not to lower the usual High School standard.

Part-Time Plan Good Where Workable.

In consideration of the part-time plan wherever that is possible, Dr. Richards thought it likely that a Technical High School of the kind he had outlined or the Preparatory Trade School would be a suitable place to carry on the public school end of that plan. He added that of course there was another school which should be spoken of in connection with the problem just discussed; that is the co-operative school of the Fitchburg type. He thought that was more likely to be a solution. It depends very much, however, on a sympathetic community and a good deal of a specialized community too. They are trying it in Cincinnati and Fitchburg, and there are other communities where it could be made very successful and lots of others where it could not.

The co-operative school and the part-time plan are two of the most interesting developments in industrial education in the United States at present, and he thought them both very far-reaching. He thought a clear distinction would be made if the term" part-time school" was used where boys are already in work and come from work to school; then call that a co-operative school where boys are in school and go once a week to the shop.

Co-ordinated University Plan.

In Cincinnati when they applied the co-ordinated University plan to the High School they stepped on different ground. In the University you have a selected group of men who have chosen their professions; they are fairly mature fellows; they go into the shop and use common sense, not making nuisances of themselves, and they fit into the scheme of shop work, can acquit themselves pretty well, and take back the lessons of the shop to the schoolroom, and so on. But when you come to the High School you have rather a different proposition. In the first place, if you have a general High School you have not got your selected group. The question of having definitely selected a vocation is almost at the basis of that whole scheme of work because then the boys go forward with enthusiasm and interest. They go into that shop with certain definite objects in view. If you start with a special Technical High School you are all right, but you have lessened the number of students, and it is not going to be so easy to work the co-ordinated High School as the University.

At Cincinnati they are giving them 2 years in the High School before they select their vocation. The division of time afterwards is the same—half and half. The actual shop work there with the co-operative High School is not yet started. They are in their second year now. Next year they will begin their actual shopwork on the shopwork basis. The feeling is growing that there is

a considerable period required, not for the gaining of manual skill, but for the thorough assimilation of the shop atmosphere and shop conditions and shop methods of work—much more than we have brought into practice in the past.

Dr. Richards thought the co-operative plan had a great deal to commend it for the American people as compared to the German scheme. In the German Middle Technical School there is a requirement of practical work before entrance, both in the lower and middle form, the German way being to get your experience first, then come from your work and get your science and technology, etc. The Germans are beginning, even for entering the Technical Hochschule [Technical College], to put the emphasis on previous practice. In America he did not think they could bring about for a very long time the practice of getting practical experience in shops before experience in the engineering school.

SECTION 2: COSMOPOLITAN OR UNION HIGH SCHOOLS.

Only the main features of a few typical schools are mentioned; and then a more extended report is given of two schools, The Technical High School, Providence, R.I., and The Hollywood Technical High School, Los Angeles, Cal.

(1) STUYVESANT HIGH SCHOOL, NEW YORK CITY.

This is an improved Manual Training School, the Manual Training being cultural and informational ("for future use", as the Principal put it). The majority of the boys do not go to trades, but to engineering and higher institutions, or to train for professions. There are 2100 boys in attendance, about two-thirds being foreign born.

The course covers 4 years, being general for the first year, with 6 periods weekly devoted to Manual Training, including visits to factories. It is hoped to make the last 2 years largely optional, enabling students who have taken a subject for 3 years to specialize and qualify for positions.

This school has a very special course and equipment for Physics.

The rooms and equipment are used for evening classes, attended by 600 or 700 students, the instruction at these being purely for trade purposes. The Principal said that he selected those pupils and then gave them some kindred supplementary work so as to increase their field of ability, and in some cases to qualify them as foremen.

(2) THE MANUAL TRAINING HIGH SCHOOL, INDIANAPOLIS, IND.

This school combines the curriculum of the ordinary High School and the Manual Training School. The course is a 4 years' one, students being allowed to select (1) *The Mechanical Course*, including Drawing, Science and Mathematics; (2) *The Commercial Course;* (3) *The Academic Course.*

This makes it possible for pupils to fit themselves either for going into some business immediately on leaving the school, or for continued study in any desired line. The Manual Training course may be stressed for 2 years by taking shopwork, and then the pupil may pass on to either the Trade School or complete the Academic Course.

The courses are made elective as far as possible, as the vocations taken up by the boys are so varied that specialization is impossible. All pupils must select some Science subject for their 3rd year, and pupils who have had 2 years of shopwork take Physics and Chemistry in their 3rd and 4th years.

All the teachers but one are graduates of Technical Schools who take summer practical work in some allied industry.

Perdue University allows credit for 1 year for shop work to graduates of this school taking Manual Training.

(3) THE HIGH SCHOOL, CINCINNATI, OHIO.

The Cincinnati High School has 4-year Industrial Courses for Boys, the last 2 years of the course being taken week about in shop and school. By this system the boys have 2 years of general training during which they can decide upon a trade, and start in it at 16 with better prospects of becoming expert. A feature that is especially noticeable is the "Corporate Spirit" of the school. The school authorities work hand in hand with the University of Cincinnati in the selection of teachers and their training, with the result that a high standard of teaching is secured.

The school provides an opportunity for a series of courses:

(1) *Academic Course*, with such groups of studies as have hitherto been offered, and the privilege of electing Manual Training or Domestic Science (Household Arts) as one unit of the 4 or 5 required. This course gives a general cultural education, or leads to a College of Liberal Arts, Law School, Medical College, or College for Teachers.

(2) *Industrial or Technical Course for Boys*, with a group of studies closely related to industrial activities, and in the last two years of the course, with strong emphasis upon some particular phase of industry with applied drawing, applied science, and applied mathematics. The last 2 years of this course might also be offered on the co-operative plan, week about in shop and school.

(3) *Domestic Arts Course*, giving strong emphasis in the last 2 years to industrial work for girls.

(4) *Commercial Course*, with a group of studies large enough to allow some selection, but all having positive value in many phases of commercial activity, and leading either to commercial pursuits or to colleges of commerce.

(5) *Art Course*, for students who in the past have decided to devote themselves to art, and instead of attending High School have attended the Art Academy exclusively. To meet the educational needs of this class, a High School course has been arranged, with the advice of the Director of the Art Academy. It permits the students to give their afternoons to the Academy, and credits them with the work done there the same as if it were done in High School. The course

given in the High School consists of the group of studies which will be most useful to one who makes Art a specialty—mathematics for a knowledge of perspective and designing; botany for intimate knowledge of plant form and detail; French, the language of most value to the artist; history, with especial attention to art and architecture. Students who take this course must register at the Art Academy and pay the regular fee of that institution, $25 a year, which for an institution so celebrated is remarkably small, but if students, of unusual artistic ability and otherwise deserving, are debarred by this fee, their cases will be specially dealt with.

Prominent among the causes for the excellent work and fine spirit among the teachers is the fact that Cincinnati has the most liberal salary scale in that section of the country, hence nothing but an excellent High School could be expected and that is what was found.

(4) THE SOLDAN HIGH SCHOOL, ST. LOUIS, MO.

This is a type of Cosmopolitan High School doing as good work in its Technical Department as any Technical High School in a separate building. The opinion held is that a specialized High School does not approach so nearly the conditions of society as one in which all the courses are offered, and where there is no social distinction due to a different choice of studies. The average attendance is 1400. The plan of the buildings is a hollow square, with workshops at the rear, the latter being well equipped with all necessary appliances. The school has Library, Music, and Lecture Rooms, Rest Rooms, Gymnasiums, Baths, etc. and is tastefully decorated.

Altogether, the appointments of the school, the appearance and bearing of the pupils, and the evident spirit of earnestness of the teachers left nothing further or different to be desired.

(5) THE TECHNICAL HIGH SCHOOL, PROVIDENCE, R.I.

This school offers a combined Academic and Manual Training Course. To meet the requirements of those students who do not intend to complete the 4-year course, such students are allowed, after consultation with parents and teachers, to omit certain studies, so as to take the minimum of academic and the maximum of technical work. This results in their remaining longer at the school.

The school is centralized around the idea of intellectual growth and attainment, and lays various trades under contribution to accomplish this end. More regard is paid to the educational than the vocational value of tool work. The present facilities and equipment do not admit of making the trade interest the primary one, even if it were desirable. Students may be prepared here for higher institutions, and yet have a sound foundation for industrial and commercial life immediately on leaving school.

All students take Drawing daily. Music is taught for one hour weekly to the whole school.

The course at this school has been pronounced excellent for girls who become teachers. Most of the 4th year students go on to higher institutions.

The Evening Classes are so dovetailed in with the day work that it is necessary to have both under the same control, and as far as possible the day teachers are used in them. The Evening School divides the time equally between theory and practice, each shop having a co-ordinated course of Theory, Drawing and Mathematics.

The attendance is 1023 day students and 645 evening.

List of Departments.

1. English.
2. Mathematics.
3. Physics.
4. Modern Languages.
5. Chemistry.
6. History.
7. Mechanical Drawing.
8. Freehand Drawing and Design, with Applied Design in Modeling, Carving, Art Metal Work and Jewelry.
9. Botany and Biology.
10. Domestic Science.
11. Domestic Art.
12. Smithing.
13. Wood Turning, Pattern-making and Foundry.
14. Machineshop Practice.
15. Carpentry and Joinery.
16. Electrical Engineering.

Shop Work.

Boys:	*Girls:*
Carpentry.	Carpentry.
Forging (elementary).	Basketry.
Forging (advanced).	Clay modeling.
Clay modeling.	Wood carving.
Wood carving.	Metal work.
Sheet metal work.	Vase forms and tile work in clay.
Wood turning.	
Pattern making.	
Moulding.	
Chipping and filing.	
Machine work and construction.	

A brief course in elementary woodwork and basketry is arranged for the girls. The laboratory work in physics and chemistry is the same for boys and girls, but while the boys are employed in the shops the girls are at work in Cooking, Plain Sewing, Dressmaking and Millinery. Girls' courses also include Modeling, Pottery, Wood Carving and Hammered Work in Copper and Brass. The course in Botany and Biology is arranged for girls only.

The school now receives factory apprentices (32) on alternate weeks in the vocational co-operative course.

It is an imitation of the Fitchburg, Mass. course.

Co-operative Jewelry Course.

As Rhode Island has over 300 jewelry factories, and about 12 silversmithing establishments, all of which require trained men in every department, especially foremen and superintendents, the leading manufacturers co-operated with the school committee to establish a Co-operative Jewelry Course. After 1 year in the High School, suitable boys may arrange to work in the shops during alternate weeks. For 6 months prior to starting on the co-operative course, these boys are separated from the rest, and given special instruction, so that they may be prepared for the industry. An agreement is entered into between the boy's guardian and the employer, stipulating that he shall serve 3 years on the

half-time plan, for 26 weeks each year for which he is paid. In the shops they are instructed by the foremen, and in the school they receive a general education, with special trade studies in addition, the subjects being English, History of Art, Drawing and Design, Physics and Chemistry, Current Events and Shop Arithmetic in the 2nd year; Industrial History, Chemistry and Metallurgy Modeling and Commercial Geography added in the 3rd year; and Applied Electricity, Commercial Law, American History and Civics, Advertising and Transportation in the 4th year. The work of shop and school is correlated wherever possible. The whole object of the course is to give to all boys who wish, a chance to become educated, competent workmen without loss of time and in the best possible way.

(6) HOLLYWOOD TECHNICAL HIGH SCHOOL, LOS ANGELES, CAL.

This institution is in a suburb of the City of Los Angeles, and consists of 3 magnificent buildings—(a) the original High School building, (b) the Science building, and (c) the Art and Domestic Science building and Auditorium. They are under the direction of Dr. Snyder, a graduate of Harvard, and an experienced teacher from Worcester, Mass. They exhibited all the features of the latest culture in schools from Boston. There is a staff of 25 teachers. The attendance was 458.

In the *Main Building* ordinary cultural subjects are taken—also Manual Training for boys.

The new Science Building just being completed and partially in use is a 3-storey structure with most complete and up-to-date equipment. The following rooms will give some idea of the work being undertaken in this building:—(1) Horticulture, (2) Agriculture, (3) Gas and Steam Engineering, (4) Dynamo and Electric, (5) Woodwork room, (6) Chemical store room, (7) Advanced Business room, (8) Elementary Physics room, (9) Apparatus room, (10) Reception room, (11) Agriculture Laboratory—3 years of Agriculture required, (12) Physical Geography—including Geology, (13) Zoology and Botany, (14) Advanced Reception room, (15) Practical Chemistry, (16) Chemical store room, (17) Chemical lecture room, (18) Balance room, (19) Practical Chemistry, 2 rooms, (20) Photography, (21) Astronomical room, on roof.

Art and Domestic Science Building:—(1) Laundry, (2) Drying room, (3) Sewing room, (4) Fitting room, (5) Stock room, (6) Elements of Nursing room, (7) Cooking room, (8) Pantry, (9) Bread-making room, (10) Reception room, (11) Drawing room, (12) Household Economics room, (13) Pottery and Metal-working room for women. Five other rooms (14 to 18) make up what is called "The Model Flat." They consist of a kitchen, drawing room, pantry, bedroom (including bath room) and dining room, along with appropriate closets, etc. The system of using this model flat is as follows: Every week during session, 3 female students are detailed to take charge of and manage the whole flat. They have to buy supplies for an evening dinner, do the cooking, lay the tables, do the serving, and also manage the whole domestic decoration, and they are compelled to leave the whole flat at the end of their week in a thoroughly clean and orderly

condition for their successors. A regular committee of the staff inspects their work and gives marks for the week. The whole of the furniture of these rooms (with the exception of the bed room) its chairs, tables and decorations were made in the Manual Training Departments of the High School.

The most notable part of the Art building, as to decoration and completeness, is the Auditorium, which has well-fitted-up stage, galleries, and a seating capacity for 1,100. Here the entertainments, public meetings and general lectures of the institution are carried on. On each side are two large rooms which, though closed off by doors, can be thrown into the Auditorium when required. A particularly valuable feature is the air space which prevents sounds from going from one room to the other. One of these side rooms is called the Oratory room and the other the Music room. A course of 4 years in Music, involving all the various departments of a high class training, is given.

Courses and Equipment.

The Hollywood courses comprise Matriculation, Engineering Mathematics, Scientific Course, English, Commercial, Language and Music, Home Economics, Art Course, Manual Arts.

Two general examinations are held yearly, in addition to monthly tests and daily records. The pass standard is 75 per cent. Daily Report slips are filed with the Principal in the case of a pupil's class work not being satisfactory to the teacher in charge.

There are 8 periods daily, with a break of 20 minutes between the 4th and 5th. Three of these intermissions are devoted each week to a general assembly of all the students for a program of singing and speaking by students on selected topics. One of the remaining periods is set aside for debate, and the other for School Society matters.

The Dynamo and Electric Room is to be fitted along lines to illustrate chiefly the method of using such apparatus.

The Domestic Science and Art Building is arranged in old Colonial style. The Laundry Room equipment comprises ironing boards, provision for heating the irons either by gas or electricity—for gas, a large gridiron surmounts a dozen or more burners. The Drying room is gas heated. The Cooking room accommodates 24 pupils. The tables were made by the Manual Training boys. It is provided with a suitable store-room, commercial size bread-mixers, enabling the pupils to make large quantities of bread, which are sold to the Cafeteria Committee.

A Teachers' Rest Room is found on each flat.

The Drawing Room is fitted with Washburn tables made at the Washburn shop, Worcester, Mass., and with a filing cabinet for each student, having an interior space of about 8" x 36" (vertical) divided vertically into two sections one of which is subdivided, the longer space being used for drawing board, etc.

Opposite the *Metal Working Room* where work in brass hammering and stippling is carried on, is a *Craft Room* for leather work.

The Commission was shown a working model made by the Manual Training Class of an old Swedish loom to be used by next year's class.

In the Model Flat 3 girls take charge for the week and spend 2 periods daily, with such additional time as they may choose, after hours. Meals served must have 5 courses and cost not more than 25c. a plate, and girls may invite friends. One girl acts as hostess, one as waitress and a third does the serving. The arrangement of the furniture and decorations, including menu cards, is judged by the Art teacher, while the dinner in its three aspects and cost is judged by the Domestic teacher. Points are allowed, and count as part of the course. All used linen must be laundried by the 3 girls. The result aimed at is "To Dignify Household Duties."

The Commission was greatly impressed by the entire Hollywood equipment. The following features were outstanding: (1) The separation into three buildings (to which the fourth for workshop is to be added), in addition to the large auditorium building, give a character and impressiveness rarely seen.(2) As detailed by the principal, the scheme of government is less democratic than that of the other schools of Los Angeles, combining as it does a section of the teaching staff with representatives of the various classes of students. (3) The system of administration and dealing with absences, of personal supervision of each scholar, and the reports on each scholar by the teachers to the principal, were very notable and complete. (4) Evidently the class of pupils in this residential suburb of Los Angeles have a high appreciation of the value of the most modern kind of education.

SECTION 3: DISTINCTIVELY TECHNICAL HIGH SCHOOLS.

Only the main features of the Technical High Schools at Buffalo and Cleveland are mentioned; and then a more extended report is given of the Polytechnic High School, Los Angeles, Cal., the High School of Mechanic Arts, Boston, Mass., and the Technical High School, Springfield, Mass.

(1) THE TECHNICAL HIGH SCHOOL, BUFFALO, N. Y.

This is a free public institution maintained by the City of Buffalo under the jurisdiction of the Superintendent of Education. It accommodates about 500 students. While it exists primarily for those whose education will not continue beyond the secondary school, and whose future activities will be along industrial lines, it yet makes ample provision for those intending to enter higher institutions. Evening classes held in connection with it supply the needs of those who are already at work.

Pupils have unusual opportunities of observing practical applications of the principles studied in the class-rooms, through visiting industrial plants under the guidance of the teachers, trips being carefully planned to suit the needs of students.

Two 4 year courses are offered:—

(1) *The Industrial Course*, for those not intending to go to higher institutions, comprising general and industrial subjects, and shopwork.

(2) *The Technical College Preparatory Course*, for admission to schools of engineering and scientific and professional schools requiring preliminary technical training.

(2) THE TECHNICAL HIGH SCHOOL, CLEVELAND, OHIO.

The Technical High School had been in operation 4 years, and a new one was in progress of completion, at the time of the Commission's visit.

The course covers 4 years, or students may take 12 quarters in 3 years, as preferred. In all the schools of Cleveland the arrangement is followed of dividing the year into 4 quarters of 3 months, so that pupils can move up every quarter, and the same teacher takes the 3 grades corresponding to one school year. This plan has been found very successful and is considered a progressive step.

Teachers may teach all four quarters of the year, though some do not. Teachers taken from the trades have as a rule turned out satisfactorily. Many of the same teachers take evening work.

The attendance was 1500, of whom 1100 were boys and 400 girls, 25 of the latter taking Trade Dressmaking, Millinery and Institutional Cookery. The evening attendance was 450 students aged between 20 and 30, who came for one subject to help them in their daily work. There were 130 students in the machine shop, with a waiting list of 75, for a 6 months' course 2 nights weekly.

One third of the pupils go to higher institutions; the remaining two -thirds to trades, where they get credit for 1½ years of apprenticeship on graduation from this school. In the 3rd and 4th years, students are allowed to specialize up to 25 periods weekly. The classes contain from 25 to 30 pupils each. Some of the classes are separate for boys and girls.

There is a fine gymnasium, with baths and all necessary equipment. All pupils take Physical Culture 1½ hour weekly.

A branch of the Public Library in the building containing 5,000 volumes is well patronized by the students. 2,000 technical works are included in the collection.

Examples of work done by students are exhibited in a special room.

Elementary Industrial School, Cleveland, Ohio.

This school takes boys who are behind with their work at the public school, and who would otherwise probably leave school altogether. So successful has this school proved that another was about to be opened at the time of the Com-

mission's visit. The work is divided equally between general and industrial, the former being related to the latter. The course lasts 2 years. 20 out of 55 graduates went to the Technical High School, the others to industry.

(3) THE POLYTECHNIC HIGH SCHOOL, LOS ANGELES, CAL.

This is a very large building in the centre of the city. It receives pupils who have passed the 8th grade of the public schools for whom room can be found—about 2,000—many having to be turned away. It was observed that the pupils in this school were considerably older then those found in Canadian schools, many evidently being 18 and 19 years of age. This fact was attributed to the advanced grade of technical training given, which retains both young men and women longer at school.

The Course comprises: Commerce, Domestic Economics, Electricity, Mineralogy, Surveying, Art, Mechanical Drafting, Architecture, Normal Course in Manual Training, Dressmaking and Millinery, Forging Foundry, Cabinet-making, Machine Shop, Matriculation Chemistry.

Dressmaking, Laundering and Cooking departments occupy several rooms and are very popular with the girls. Cooking and Sewing are taken alternately by all girls during two periods daily for the first two years. Full equipment was found in use in connection with Domestic Chemistry, supplementing the training given to the girls in the Household Science department.

Complete Machine Shops.

The Polytechnic has thoroughly fitted out machine shops, in two large rooms, with lathes and mechanical apparatus, in which complicated and advanced wood and iron work was being done; also a well equipped foundry room, under the direction of a practical journeyman mechanic, where complex castings were being made, such as would be used in the erection of machines in a machine shop. Not only the castings for large machines, but also the cores, are made by the school, using ordinary beach sand 30 parts and one part of linseed oil. The shop is supplied with cupola for melting pig-iron, and also with furnace for work in brass, etc.

Woodwork is taught, including the making of core-boxes and patterns. The wood-turning room is supplied with 10 double lathes (back to back), separated by wire screening; also 2 bandsaws, 3 planes, circular saw, etc. Special attention is paid to lighting.

Practical Mechanical Work.

All through the school were seen articles of furniture, practical models for automobiles and engines, and other complicated pieces of machinery, which had been manufactured by the boys. In these workrooms as many as 3 instructors to each room are required, the directors in almost every case being men who had had a workman's education in a trade, and in some cases had gone on to trade schools afterwards. It was quite evident that no one but a trained mechanic would be a competent instructor here. Boys are expected at the end of the first three months to make dovetailed door frames.

In this school large night classes, with an additional staff, are regularly carried on, the attendance being about 500. Advanced work in cabinet-making was noticed, the work of an evening class of one year's standing.

The Commissioners observed the good quality of the work done, its advanced character, the regular system on which the work was carried through, fitting one department into the other, and the "spirit of real work" which characterized both the male and female students in the operations in which they were engaged, which were of a most practical and useful character.

System of Self-Government.

Attention may be called to the system of self-government by the pupils, which obtains also in the other schools of Los Angeles. This covered matters of discipline, dealing with questions of absence, excuses and the like, and also showing a sense of responsibility for the general morale of the school. Further, this system extended to the management of the Cafeterias or lunch rooms found in all the schools, which supply lunches at moderate rates from 8c to 20c, and which, in the Polytechnic and High Schools, are managed by the pupils. The lady manager is directed by a School Committee, and money matters, controlled by the commercial department of the school, involve a system of complete audit and business management similar to that required by a large business establishment. The sum of $60,000 was mentioned as the amount involved during the year in these operations.

Music, Art and Architecture.

A strong feature in the Polytechnic and Los Angeles High School is the advanced training in Art and Music, Drawing, Sculpturing, Modeling, Clay Working, Hand Painting, Firing of Pottery; and the successful work of the students spoke for itself. In both of these large schools (the High School having 2,000 pupils also) advanced classes in Music, (theory, harmony, practice both vocal and instrumental) are carried on to a very large extent. Two large music halls in these schools are in constant use in connection with the musical and literary studies of the pupils.

The Art Building contains a pottery room with complete outfit for moulding, glazing and burning. The Commission was shown a class of 20 engaged in

making charcoal drawings of ordinary objects, also some articles in pressed leather work, the design, coloring, shaping, etc., being the sole work of the individual students.

Architecture is a very marked feature in these schools, both of which claim to have made full house plans for residences and public buildings among the students, carrying out all the details, plans, blueprints, etc. Class plans for house construction, to the value of $60,000, were accepted locally. Indeed, in the Polytechnic, the latest new building just being used was designed and erected under the direction of the Architectural Department. This is the Art Building, fireproof, having 2 stories and basement, the north side being practically all glass. It contains 24 rooms, and was built at a cost of $68,000.

Evening High School.

This school, held in the building of the Polytechnic High School, is open to all over 14 who have completed the grammar school course, or who by virtue of experience or maturity are capable of doing its work. Tuition is free to all under 21, but those over that age are charged $2.50 per term and are entitled to take as many subjects as they desire. In chemistry a deposit of $2 is required to cover breakage.

The hours are 7:15 to 9:15 p.m., divided into two periods. The classes in English, Mathematics, Languages and Commercial Work are all one-hour classes; those in Science, Art, Manual Arts and Domestic Arts are two-hour classes.

In general, it is recommended that students register for two or three evenings per week, using the other evenings for study or recreation, but where the nature of the subjects or the employment of the student during the day warrants, many register for four or five evenings. Registration for one hour only is not encouraged, except in case of students who can not come for the first hour.

The evening High School offers regular High School credit for all work completed which in the judgment of the instructor warrants such credit. The school will also recommend to the commercial world such students as merit this.

The subjects and methods of treatment are selected with special reference to their immediate practical value. All classes are maintained only as long as the attendance justifies. Work in other subjects is offered as soon as the demand is sufficient to warrant forming classes.

(4) THE HIGH SCHOOL OF MECHANIC ARTS, BOSTON, MASS.

This school takes boys of about 14½, who have graduated from the Grammar School. The usual High School courses are given in addition to the special instruction. Its courses are worked out so as to give emphasis to the practical learning of the work—practical in such a way as to call for a higher order of thinking. It aims to prepare for some form of industrial occupation with a view to a supervising position. The course covers 4 years, 2 shop periods of 2 hours each being given each day. The Principal stated that the

school provides courses suited to every class. The instruction is free, and therefore within the reach of all, whilst the richest man could find no better place for his son.

Dr. Palmer stated in the course of a 'Conversation' that the plant was used for evening classes, under the supervision of one or more of the day teachers, it being too valuable for him to allow it out of his control.

Information obtained in "Conversation" with DR. PALMER, *Principal High School of Mechanic Arts, Boston.*

Graduation to this school is from the Boston Grammar Schools, or equivalent training in case of pupils coming from outside places Boys who come here are more or less consciously aiming at some form of industrial activity. In general boys are taken here when they are prepared to enter High School. They leave the Grammar School in June and come here in September. They can graduate from the Grammar School when they are through, but as they cannot go to work until 14, if a boy graduates at 12 he must go for 2 years into some other school; at Continuation evening schools he would not be accepted until he is 14.

Boys have a choice of either coming to this school or of entering a High School in the city. Ordinarily it would not be profitable for a boy to go to any other High School and then to finish here. Dr. Palmer thought it conceivable that he might find it profitable to go to High School for English, although here he gets the usual High School Course in addition to the other instruction. A boy with a distinctly commercial turn of mind would more naturally go to the Commercial High School, while a boy with a literary turn would attend a literary School.

BOSTON'S LARGE HIGH SCHOOL POPULATION.

Dr. Palmer said that in thinking about Boston it was desirable to keep in mind that that city is giving High School instruction to a very much larger number of pupils per thousand inhabitants than any other city in the country —indeed, he thought he would be perfectly safe in saying than any other city in the world. Boston's High School population per thousand inhabitants is rather more than twice, nearly three times, as many as Philadelphia and considerably more than New York.

A plan is under consideration for taking boys from the Grammar School, or perhaps before they leave there, and giving them the elements of a small number of trades as rapidly as possible, or anything elementary looking distinctly towards a trade.

Equipment Attendance Aim.

The best equipment has been furnished with a view to making efficient instruction less expensive. 1500 can be accommodated without serious crowding, and 1450 are in attendance. The course of study is, roughly speaking, what may be found in the typical American Manual Training High School worked out so as to place very much more emphasis on the practical bearing of the work. There is no thought of making a place for the dull boy to get along easily, but the aim is to make the very best place which a boy of poor parents and fairly good ability can attend, and, at the same time, such a place that the richest man in the city cannot find a better one for his son.

The first year boys have Algebra every day, and on alternate days take English, History, Drawing and Elementary Science. The science is a combination of the elements of Physics and Chemistry with no particular text book, elementary experiments being performed by the teacher so as to bring out fundamental scientific facts having a practical bearing. The boys then write an account of this in their notebooks, the purpose being to make an interesting field for subject matter for English composition, to give them some notion of scientific facts of value, so that they will be more interested later on.

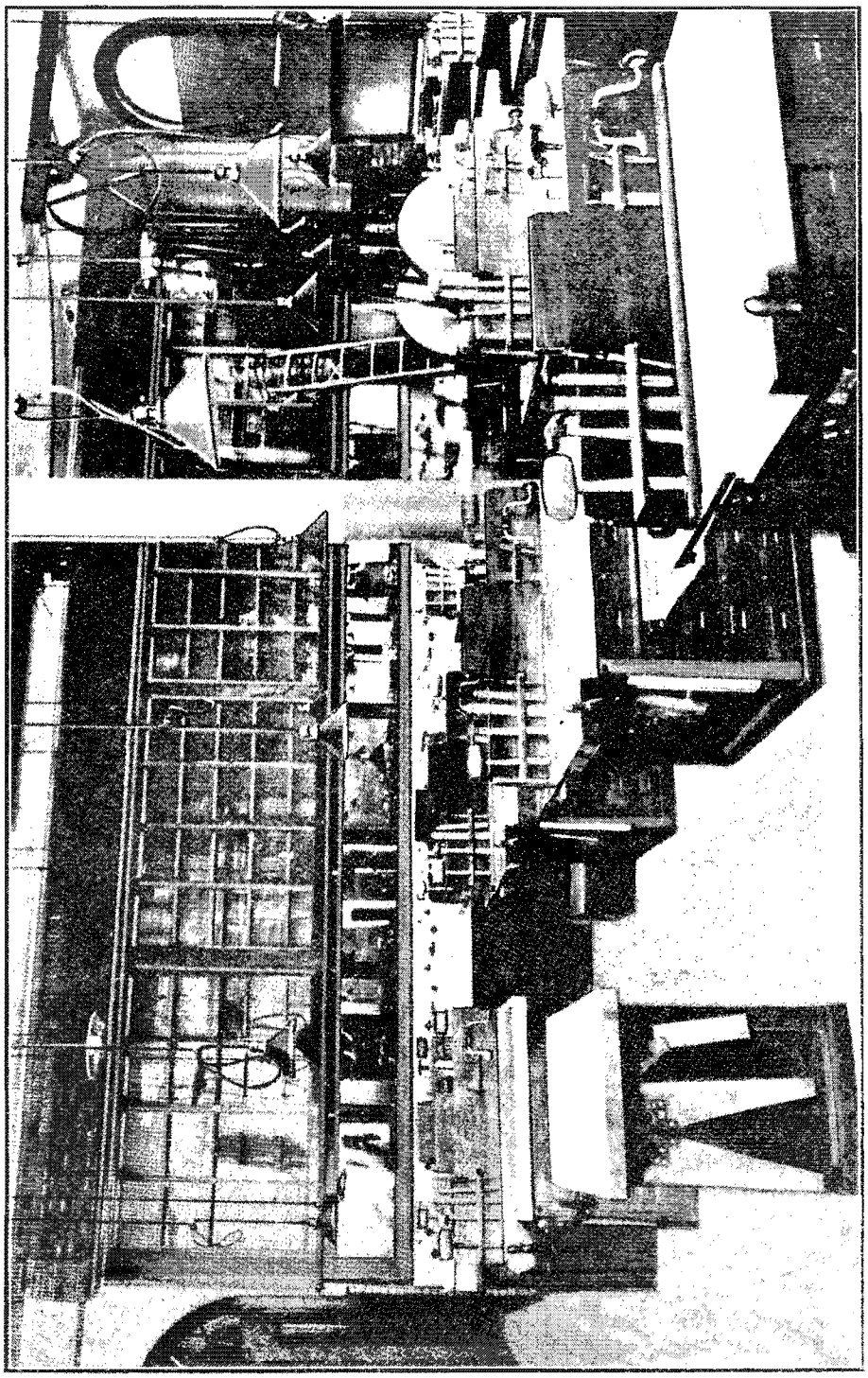
Methods in Physics.

In the higher Physics laboratory a good deal more emphasis is put on the industrial and practical applications of the things the boys do. Here there are a good many experiments on a somewhat larger scale than is usual in High Schools and not exactly of the customary type, the teacher working out a course of his own. The general attempt to cover Physics systematically does not apply here. Mathematics are learned in the other school. The aim is to get the drafting and the shop work and the moulding work more intimately connected with the scientific work. Dr. Palmer added that it was one thing to aim to do this and another to do so actually.

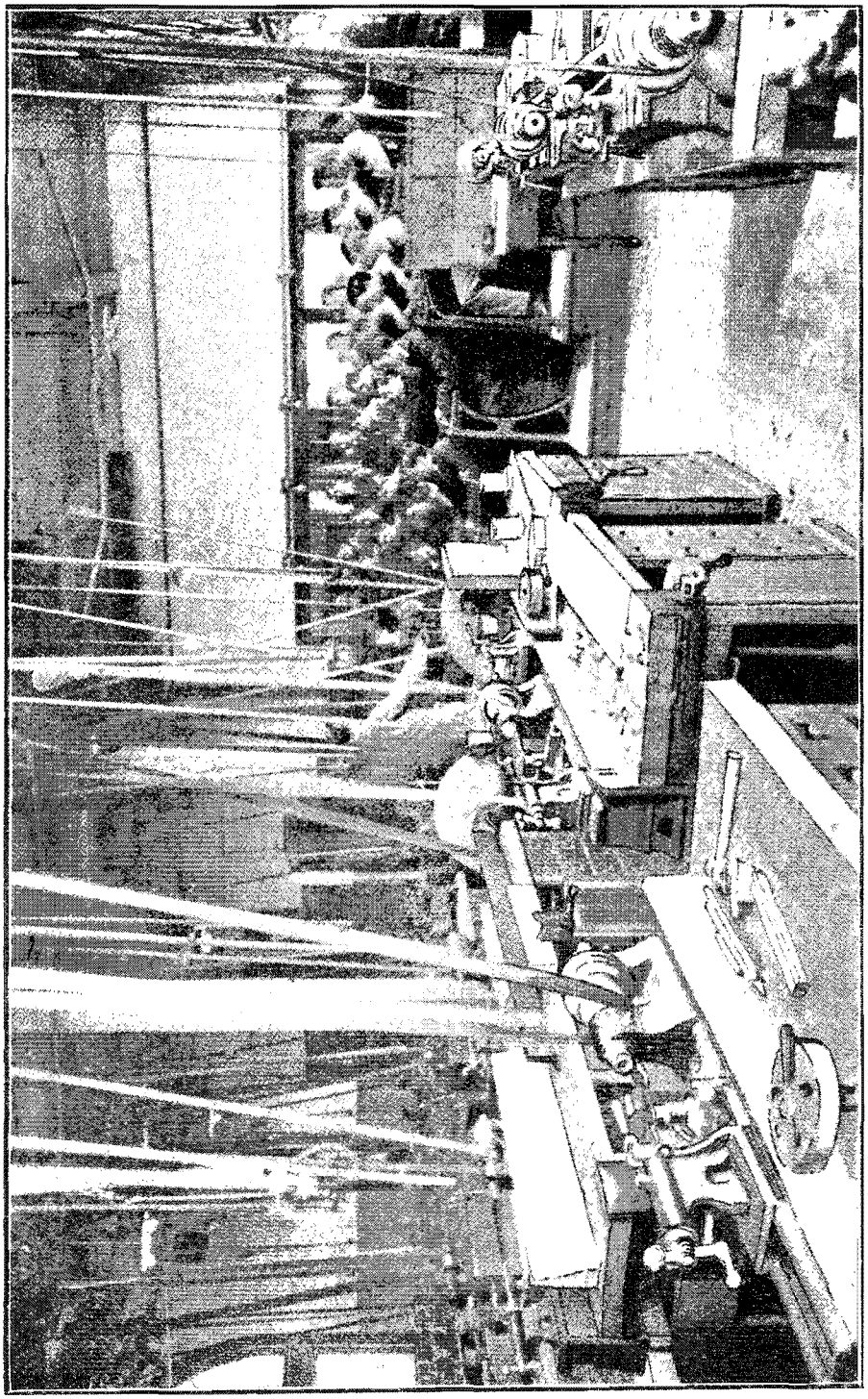
The Commission found the boys plotting curves, reading three-tenth divisions on a scale, obtaining the simple formula to find the forces coming in, supporting an object by two cords, to give them four solutions that might possibly apply; then the boys pick out those that are correct.

Shopwork Rotation and Methods.

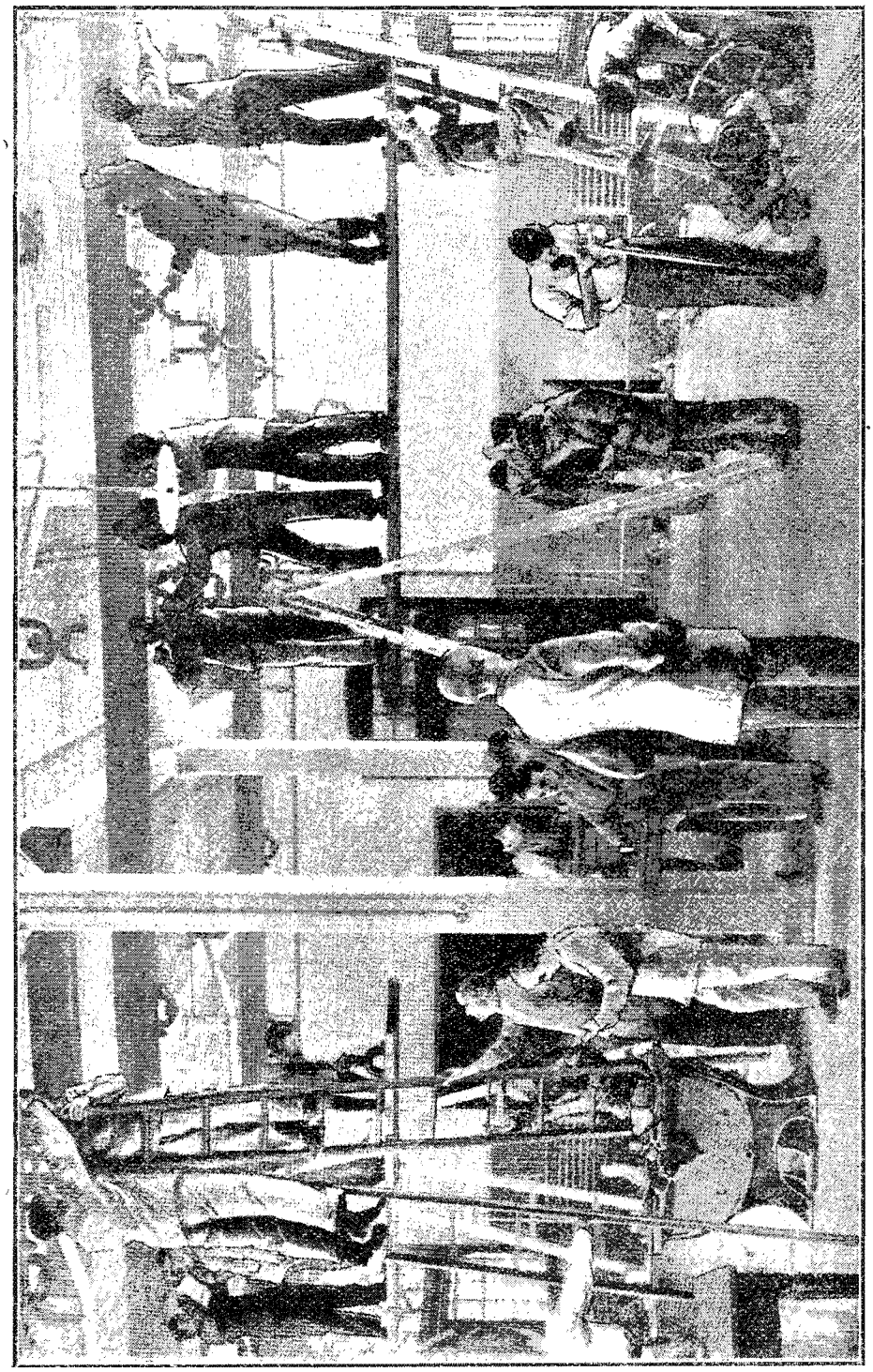
The boys get 2 shop periods of 2 hours a day. There are 4 daily shifts, taking 144 boys each time, so that in a day the 576 boys of the first year are cared for. They are all doing substantially the same thing in this department which consists of pattern-making. Every piece of wood-turning the boys do has some relation to the pattern. The machine shops apart from the pattern, making occupied 3 rooms in which 90 boys could work at a time, and with 4 shifts this allowed for 360 boys to pass through each day. Some of the boys work only on alternate days.



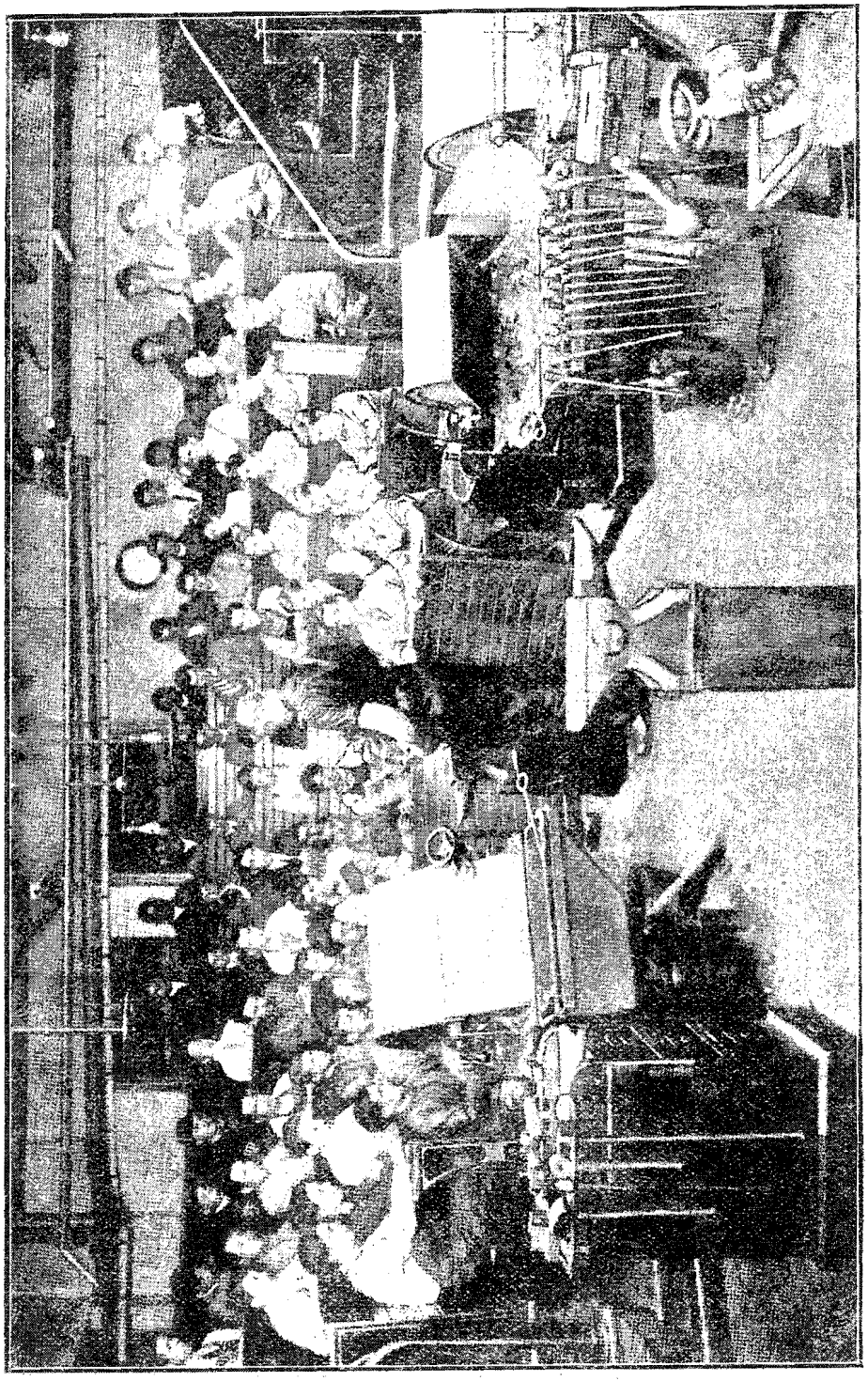
WOODWORKING SHOP, MECHANIC ARTS HIGH SCHOOL, BOSTON, MASS.



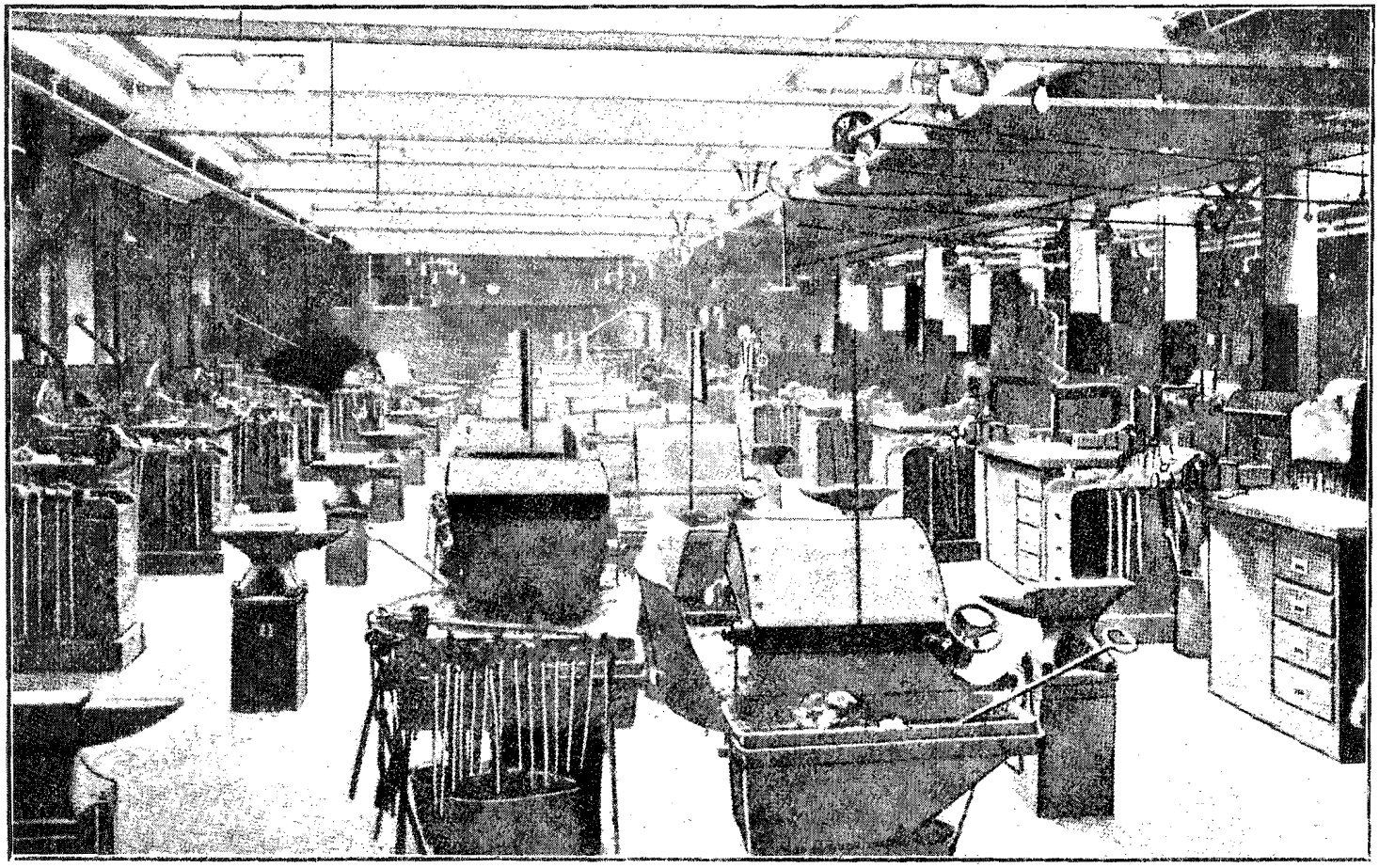
WOOD TURNING SHOP, MECHANIC ARTS HIGH SCHOOL, BOSTON, MASS.



HANGING MACHINERY IN PATTERN MAKING SHOP, MECHANIC ARTS HIGH SCHOOL, BOSTON, MASS.



FORGE SHOP DEMONSTRATION, MECHANIC ARTS HIGH SCHOOL: BOSTON, MASS.



FORGE SHOP, MECHANIC ARTS HIGH SCHOOL: BOSTON, MASS.

In metal working very much attention has been given to every form of equipment with a view to making the whole of the processes as efficient as possible and so as to be able to handle promptly a large number of boys. The work has been systematized like that of a great manufacturing establishment and close attention has been given to all sorts of details, tending to make efficient the giving of instruction to large groups of boys. For example, under the benches are drawers for the sets of tools supplied to the boys, arranged under a system which makes it possible to know whether any of the tools in daily use are missing.

Dr. Palmer said he had seen nearly all the schools in the country, but so far as he knew there was nowhere to be found a forging shop equal in dimensions and equipment to the one in this school; 72 boys can be taken care of at a time with 2 instructors; 2 boys who have recently graduated act as assistants.

How Luncheons are Supplied.

The Women's Educational Industrial Union has a central plant well equipped and prepares food ready to bring not only to this school, but to all in the city. It is a sort of philanthropic organization in the sense that those who assume final financial responsibility are wealthy persons who receive no consideration for their time or financial risk. The work is intended to be self-sustaining. The prices of food are so adjusted that nobody makes any profit. Dr. Palmer was chairman of the committee of final appeal, composed of three headmasters and three representatives of the schools. A boy can get a fair meal, as good as he needs, for 10 cents. Dr. Palmer said that when he selected a meal for himself he seldom made the order above 15 cents, and often not more than 10c. Very good soup with crackers cost 5c.; a hot dish 5c.; custard 3c.; so that 13c.would purchase all that anybody would want.

There is a large central evening industrial school intended for persons, engaged in industries or drafting offices in the day time, who attend in order to get a further knowledge of a great variety of trades. There are between 300 and 500 evening pupils.

Boys Become Supervisors.

A very large percentage of boys from this school obtain employment in lines of work properly related to the special training they received here, a good many of them being in shops. One of them is in control of 400 men at Brown and Sharpe's factory in Providence, and a dozen or 20 are in large supervising positions; those are men who never had any training at the Boston "Tech." Other graduates of this school, who have been through the Institute of Technology, are scattered all round. The list tapers off from those mentioned to others who were working about the town as street-car conductors or motormen, or doing some pretty poor work. Here and there a man is a locomotive engineer; they are doing all sorts of things; they simply represent the life of a great city, and one cannot generalize about them.

Dr. Palmer said the day teachers taught in the evening on the shop side, and he would be very sorry to have any others, because the plant was altogether too valuable. He controlled the whole thing and could prohibit the use of any machine or supplies if he desired to exercise his authority, but as a matter of fact he never did, because one of his teachers was in authority and represented him. The total value of the plant, property and equipment is about one million dollars. The annual budget is not far from $110,000, and is growing. There are 48 regular teachers and 17 specials.

No Social "Class" Distinctions.

Dr. Palmer remarked that some questions of the Commissioners and of other people who visited the school point to a fundamental misconception in asking "What class of boys do you deal with?" He added: "In Canada you are going to deal with the Canadian citizen; we are going to deal with the average American boy. In this country of ours we have no conditions that approach German conditions, and anything that we schoolmen do that looks to put emphasis on class is a fundamental error in a land as democratic as yours and mine. You don't want to do anything to emphasise the point of class."

He then told how he had seen working side by side at the bench, the son of the man who was at the head of the largest railroad corporation in New England, the son of the then Superintendent of Schools in Boston, and next to him a boy who was obliged to blacken boots to earn money to keep him at school. The one who was then blackening boots now holds the best position. That was a thing which could happen over and over again. He explained that his earnestness on this subject was due to the fact that in all this discussion in the United States and Canada, as he had read it and heard it and thought about it, the German idea had been put into the forefront—an idea built upon traditions and an old civilization entirely different from ours, and he was afraid of it. He thought that educators should set their faces as much as possible against the use of the word "class" as related to society, and insist that that distinction is not wise.

Industrial Training Before Graduation.

In reply to a question as to provision in Boston for the industrial education of boys who did not reach graduation from elementary schools, Dr. Palmer replied that a school of an entirely different sort was being started in the city that would aim to teach the elements of a number of trades, and to get hold specifically and definitely of the boy who would not otherwise complete the Grammar School course. That was an entirely different kind of boy, growing out of the fact that financial limitations prevented some boys from going further. Dr. Palmer

thought it probable that some capable boys would get into that school, and later be moved over to this one; and it might happen in the course of the work in this school that some boys would be encouraged to go over there. They would work together in harmony.

(5) THE TECHNICAL HIGH SCHOOL, SPRINGFIELD, MASS.

Information obtained in "Conversation" with CHAS. F. WARNER, *Principal.*

The institution includes 3 separate schools—Central High, Technical High, and Commercial School. All comprise one system, and pupils can transfer from one to the other. Principal Warner remarked that the separation of the schools had resulted in a marked increase of attendance.

Principal Warner had charge for ten years of a Manual Training High School, then took hold of this school when it was unimportant, and has been with it ever since.

The CENTRAL is the old school. The other two, the TECHNICAL and the COMMERCIAL, are branches out of that. The system originated because the old school did not seem to prosper well. Pupils did not, for instance, do training work along the line of Manual Training, which was in existence for years in a department in the old High School, and had received a pretty bad black eye all through its history as a department. When Principal Warner took charge only 13 boys came into the building the first day; in 5 years there were 200 to 300. If the schools had not been separated they would not have had more pupils in technical training in 5 years than 25 at the most. The growth in percentage was enormous; in the first ten years since the opening of the Technical High School, the High School enrolment in Springfield increased about 151%, although in the same period the city population (now 90,000) increased only about 41%. The maximum area of Springfield is 5 miles. Some pupils come from a new section that was admitted. When the city increases to 150,000 the next step will be to form a branch High School, still keeping this central organization for the main High Schools.

Springfield has a strong Trade School with over 400 evening pupils, using the teachers of the Technical High School as far as possible. It is an improving school, to take in mechanics. It is not supposed to be of the same general nature as a technical day school at all. Men 50 years old attend to brush up on their shop work.

TECHNICAL WORK AND METHODS.

The *Technical High School* is a general High School with extra time given to practical work. This means more than the mere addition of practical work; it involves the correlation between Mathematics, Science and Shop-work. The Principal's conception of the word "Technical" does not apply so much to the shop work as to the correlation between the studies and the work. The popular idea of the word "Technical" he considers impractical; its real definition is not so much the practice as the thinking about the practice. Hence this school tries to correlate Shopwork and Drawing with Science and Mathematics and English.

and to a certain extent with foreign languages. Latin is taught, but as a secondary matter, simply because so many people want it and at the same time want the other. No attempt is made to correlate Latin with the shopwork.

The school has a College Preparatory Course, which makes it, so far as that is concerned, a Manual Training High School; about one-third of the pupils are enrolled in that; the other two-thirds are doing what the Principal would call strictly Technical High School work.

There are 650 pupils—200 girls and 450 boys. Very few of the girls are preparing for college; they take strictly technical school work. All the girls are obliged to take some of this technical work; it is not a matter of electing. If they elect this school they elect to take this work, and everybody takes it; it is not a department in a general High School; it is distinctive right through the school; there is not a pupil here who does not have his or her allotment in the practical things, either shops or cooking, sewing, or something of that kind.

Developing Public Speaking.

The Technical High School has a students' committee, and after the English exercises have been set forth in the classes, if any class thinks they have had a good example that morning, the one who gave it is recommended to this committee. Thus every week 10 or 12 pupils appear before the students' committee and give their pieces, and the best are selected for the honor of speaking in the Assembly Hall to the whole school. Perhaps a boy will present a description of how axes are made. He has worked it up originally; he does not read it; he learns it and delivers it; and will illustrate it with drawings if he wants to. He must have it well enough in hand to speak it off. Mechanical subjects are preferred, though they may be historical, or strictly literary, or may deal with political economy; it does not matter. What is wanted is a good thing that will appeal to the school, and a great many technical subjects are thus presented.

Developing Technical Power.

In its own distinctive field, the Technical High School is doing an educational work of much value, by furnishing opportunities for expressing individuality through some form of handwork. The principles of Drawing, Mathematics and Science are applied to the work in the shops and in Household Arts, thus bringing the pupils in contact with realities, and giving a vital meaning to the work. Also, in laying stress upon the value and dignity of the artisan's work, and in furnishing clear ideas of the operation of industrial forces and of the vital relations existing between capital and labor, the school gives the individual a true sense of his economic opportunities and obligations and of his responsibilities as a citizen and an individual. The school, therefore, benefits the individual and the community by developing some technical power; but it concentrates its efforts not so much upon increasing productive efficiency as upon sending out young men and women ready to use their energies and their intelligence for the public good. Art, Music and Science are all taught in a practical manner, and yet in such a way as to bring out the best that is in the pupil.

Securing Teachers.

The first aim is to get some from the trade, but they must have teaching ability and know what they are going to teach. Trained teachers who have also gone out and got the trade cannot be had, so we must start at the trade. Candidates are tested, and if they do not possess teaching ability, they are sent back to the trade. One of the great deficiencies is the lack of a way of teaching them as teachers; they ought to have a Normal School, the Principal said. The Germans had said, "We cannot teach without teachers; so we won't operate these schools until we get the teachers." Then they put the machinery of government to work to make teachers; but that cannot be done here.

Although this Technical High School has been turning out graduates for only about 8 years, six teachers in the local schools are its graduates. When they can get out, these boys are very desirable, and there are so few men fitted for teaching that the boys can get into the High School and compete with their own teachers, and some who have been out only two or three years are getting higher salaries than their former teachers, without having gone to any higher institution, although of course it is better for them to do so. Those boys take a technical course. In a few years the supply of them will be increased.

College Preparatory Course.

This Course prepares for Colleges and Schools of Technology, and advance credit is given by these institutions, enabling boys to save from one year to one and a half of equivalent college work. Every boy has to take 4 years of Mechanical Drawing, together with Freehand Drawing and Design, and from 3 to 4 years in the use of hand and machine tools.

Principal Warner said this School had not gone as far as the Cleveland Schools, which are coming back now a little; for instance, they started out with the idea that they were not going to teach any languages at all, but they had to put in German. They give out to the public that they are not fitting students for college at all, but Cornell has been over there and told them that they will take their pupils into Cornell on their course, so really they are going back to the academic side again.

Technical Course.

This Course has two divisions, in one of which a modern language is required, in the other no language work excepting English. It is intended for boys who do not expect to continue their training in higher scientific schools and colleges, and who on leaving take positions as draftsmen, etc. It gives boys a special opportunity of acquiring practical knowledge of the applications of science and

mathematics in the mechanical trades. In the 3rd and 4th years boys may specialize in the work of the drawing room or the shops.

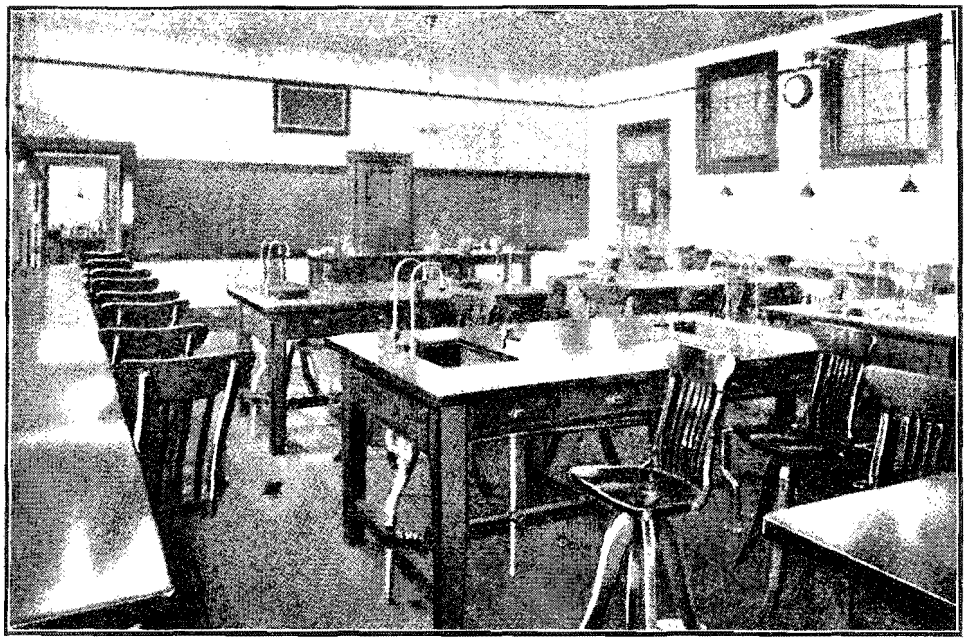
Notes From Visit to the School Shops.

Machine Shop.—Each class builds some machine. (Photographs of machines built in different years). Last year's class built one of the largest machines —a hydraulic press of 6500 pounds. This year's class is going to build a punch press. The school has a regular course, where boys start from the blacksmith's shop and make tools, every man using the tools that he forges down there; then they make something that is useful in the shop; very little exercise work is done. One boy is making on the milling machine a gear which quite frequently breaks in the lathe. A lot of those gears are made, and the same thing is done for every part of the machine which readily breaks out. Lathes are made here for the other department. It is not a very elaborate machine, for there is not time to make such. The most elaborate part is the motor. The school does not emphasize the productive side at all, except as it appreciates the educational side. It is trying to train the boys for positions as foremen or superintendents or designers. They are not supposed to go out of the school and work as machine tenders, but they are supposed to design and erect machines. If they had to fill positions as machinists they could do it; but the other is the most important side that the school is trying to organize. A lot of test tubes for the science department are being made on a factory basis. In this way they bring out the factory idea, which is explained to the boys in a series of lectures on the use and operation of tools.

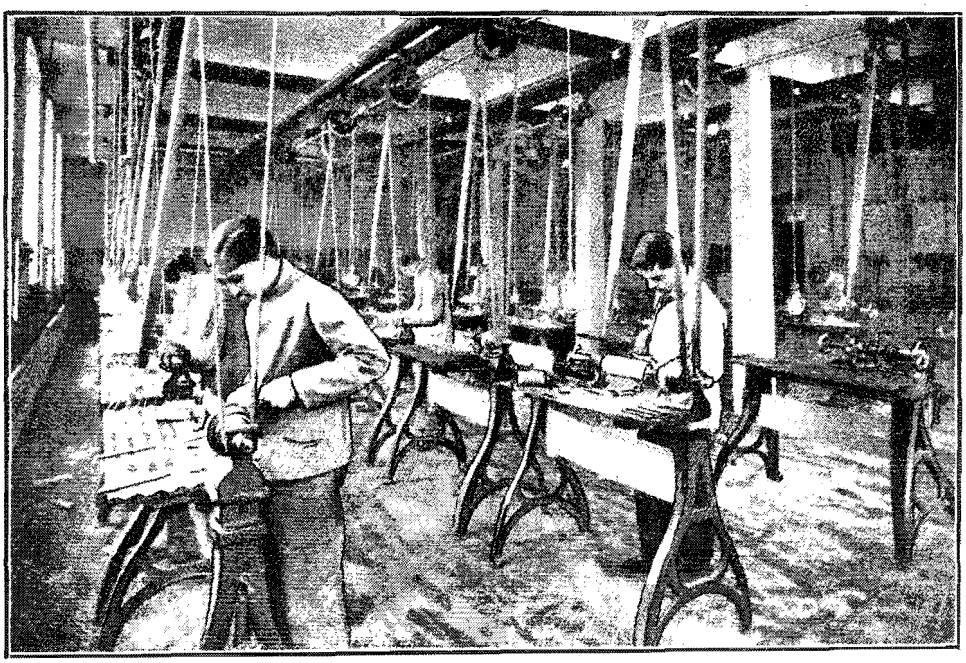
Exhibition of tools made by the students. Punch and die work, the very highest kind of work; men are paid $7 a day for that kind of work. Some fellows who got their start in this school are now working in the city as die sinkers. Springfield being a great centre for machine work, that is the part the school has to emphasize.

Physics.—Applications are found in mechanics daily. Correlation of scientific work with practical work. Boys' and girls' classes in science are separate because of the different kinds of work they are going to correlate it with; for while a great deal is common, and there is a good deal that everybody ought to know, the kind of science the girl is going to use differs from the kind the boy is going to need.

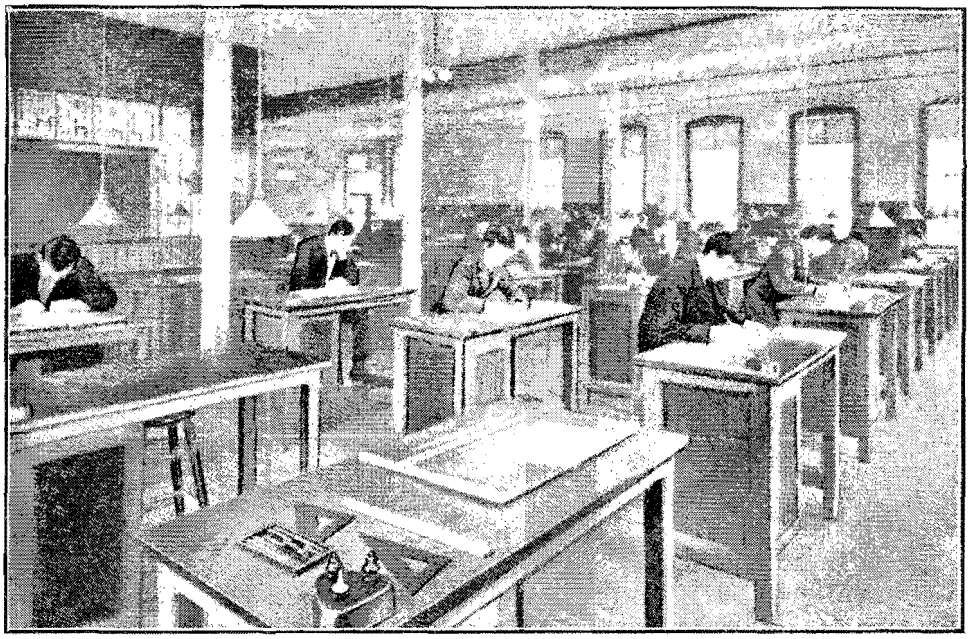
Plant Physiology.—Instead of studying plants merely as items in systematic botany, pupils specialize on the food plants and study them as the sources of food principles as found in plants. Each pupil has a compound microscope and studies the development of the starch in plants, and various changes that cooking makes upon it, etc. Botany as such is thus connected with the applications in Domestic Science. The whole emphasis is thrown upon the utility of the science of botany and of plant physiology. Then they take



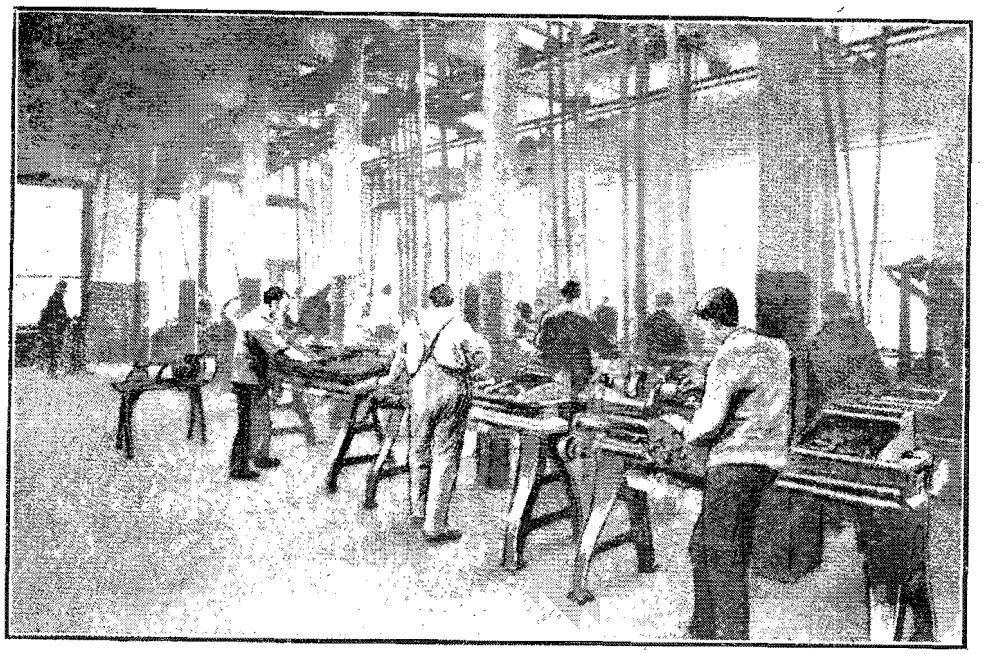
ONE OF THE PHYSICS LABORATORIES.



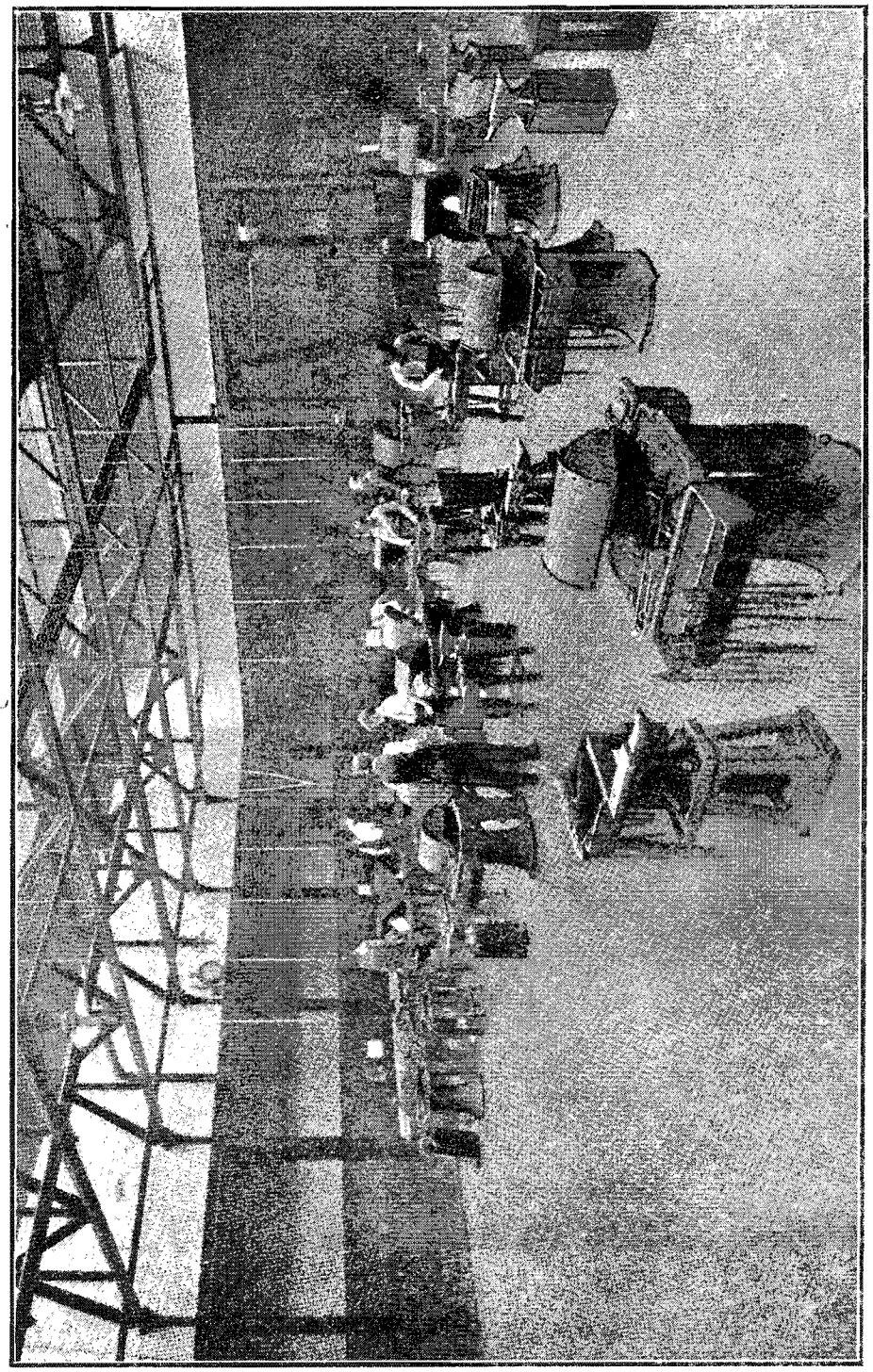
ONE OF THE WOOD-WORKING ROOMS, TECHNICAL HIGH SCHOOL: SPRINGFIELD, MASS.



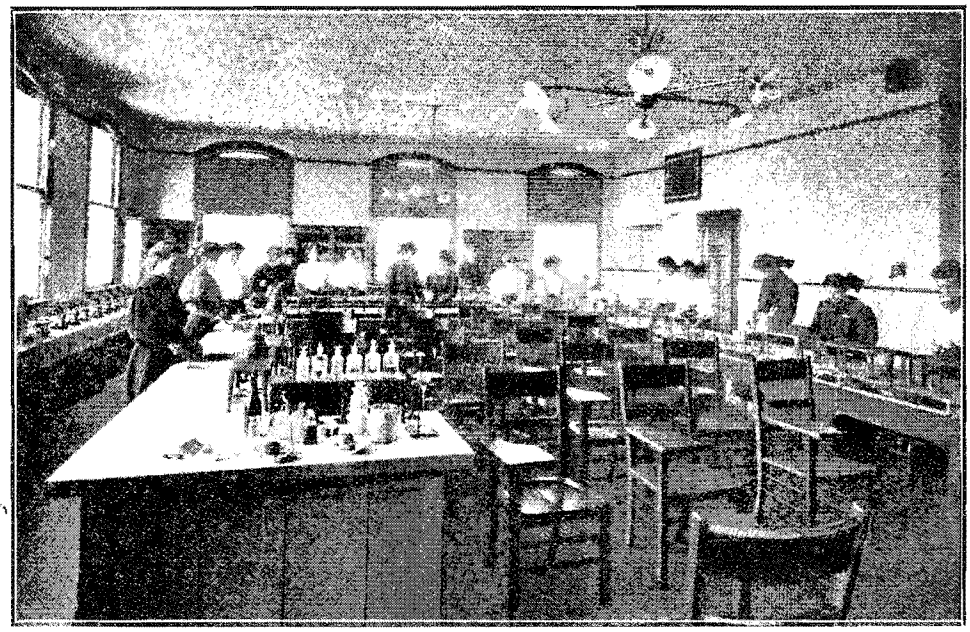
ONE OF THE DRAWING ROOMS.



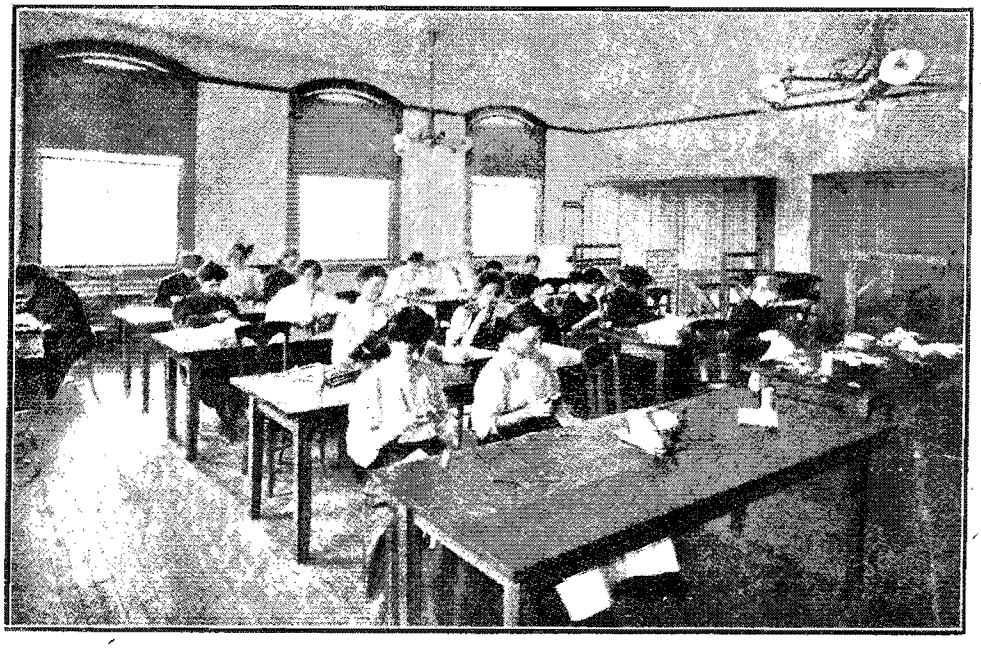
THE MACHINE TOOL ROOM, TECHNICAL HIGH SCHOOL: SPRINGFIELD, MASS.



Forge Shop, Technical High School, Cincinnati, Ohio



HOUSEHOLD SCIENCE.



HOUSEHOLD ARTS, TECHNICAL HIGH SCHOOL: SPRINGFIELD, MASS.

up human physiology and learn how the food elements are related to the building up of human tissues. It is not so much genetics as hygiene. The whole emphas isis thrown on the practical side—chemical processes as worked out in plants and animals.

Electrical Department.—Machine shop, automobile construction; hydraulic press; automobile for testing power and speed; transmission; pony brake; the effect of transmission on the road; air brakes from the railroad; these are set up in the Science Department, operated by compressed air and studied in that way.

Forge Shop.—Teacher giving illustration of forging horse-shoe. Boys can then go to their fires and do the work which has been illustrated.

Woodwork.—Lathes; boys turning wood.

Pattern-making.—High grade work. Making a punch press in the school which if bought would cost $500. They make their own designs, drawings, and patterns, and after getting castings from the foundry, make the press in the machine shop, and get an education at the same time.

Exhibition of Pattern Work.—Large gear pattern made by two boys; would cost $75 if the pattern were made in a regular way.

Applied Design.—Principles of color worked out on sheets. Girls design pottery, rugs, copper work, jewelry, etc., as well as their costumes. They design their own hats and make them. They are getting the fundamental principles to apply in the work room.

Exhibition of hat pins with enamelled heads. Pupils do the enamelling. Specimen copper buckles, balls, etc.; tiles; pupils have to gild and burn them. Basketry.

Courses for Girls.

For girls there are 3 Courses, viz., *Technical*, *College Preparatory*, and *Normal School Preparatory*. The teaching in *Household Technology* covers all that pertains (1) to the house itself, (2) to clothing, (3) to foods. Design, both constructive and decorative, especially in application to the interior of the home, is taken under (1); also principles of plumbing, ventilation, lighting, heating, decoration and general repairs. Under (2) comes sewing, construction of garments, design, drafting, cutting and fitting, fabrics and their cost, artistic expression as well as utility being emphasized all through. Under (3) scientific instruction in foods is given, involving chemistry, physics, etc., and much laboratory work, the aim being to teach not only the chemical composition and nutritive value of foods, but the changes produced by cooking and their relation to digestion and nutrition. The ultimate aim of the course is to fit a graduate to supervise the selection, cooking and serving of food for a family or institution in a thoroughly scientific way.

Domestic Science.—They don't teach cooking merely as such, but rather the chemistry of cooking, and the cooking itself is an incident. They don't work by recipe, but they study out and experiment from the point of view of the chemistry of cooking, then apply it in meals. It is not called a course in cooking, but in Domestic Science.

Millinery.—Hand loom for weaving; designing; hats made here.

Kitchen.—The whole school gets lunch here on the "cafeteria" plan. The principal gets a dinner here for 30 or 35 cents that he says would cost him $1.25 elsewhere. Each student handles his or her own food.

Model House.—House designed by the girls, and built completely by the boys, except the plastering; to be run as a model house for the Domestic Science department; girls are here in groups to run it a week at a time; the bedroom to be used as an emergency room; the house is decorated and fixed in such a way that the girls can re-decorate it.

Commercial High School.

This is a separate building with about 400 pupils. They learn commercial subjects, typewriting and those special things. Besides that, they have history and English, French and German elective; mathematics; a little science, not much. Their general work is in the direction of economics and history applied along that line. They have very good banking rooms. It is a four years' course and very thorough. It has been in existence as a department for 13 or 14 years, and is thoroughly organized and well built up, and now the committee has voted to establish it as a separate school in a separate building.

These things seem to develop better, Mr. Warner says, when they are given separate buildings and separate administrations, although the scheme in Springfield is to bring these three different High Schools so near together that they will form centrally one system, and pupils can transfer from one building to another. For instance, some pupils in the Technical High School who elect to do a little commercial work are sent over to that school, and a Commercial High School boy could elect some shop work here if he wanted to. The Principal thought that would be better than one large institution, because possessing the benefits of separate organization and administration, and also allowing of individual cases being handled by transfers between the buildings.

Results of Technical and Commerical Courses.

Evidence of the value of technical and commercial training may be found in the earning power of the youth of Springfield who have received this training. Questionnaires sent out to graduates of both departments show results as follows:

TECHNICAL.

——	Initial pay per week.	Years since graduation.	Present pay per week.
1903	$8 65	5	$21 87
1904	8 35	4	15 90
1905	7 50	3	14 16
1906	9 83	2	15 57
1907	8 90	1	9 90

COMMERCIAL.

	Initial pay per week.		Years since graduation.	Present pay per week.	
	Men.	Women.		Men.	Women.
1903	$7 01	$6 78	5	$17 14	$11 07
1904	7 03	6 00	4	15 63	10 07
1905	9 95	6 99	3	14 14	9 73
1906	7 03	6 67	2	11 67	8 24
1907	7 55	6 49	1	8 87	6 23

CHAPTER LXV: TWO TEXTILE SCHOOLS.

SECTION 1: THE LOWELL TEXTILE SCHOOL, LOWELL, MASS.

This is a technical and not a trade-teaching school, It was opened in 1897 "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry." Not only did the normal progress of the textile industry require such a school, but through the rapid development of the manufacture of the coarser cotton fabrics in the Southern States a crisis had arrived in the leading industry of New England which could only be met by a wider and more thorough application of the sciences and arts for the production of finer and more varied fabrics.

The present buildings, costing $260,000, were opened in 1902. The equipment of machinery, practically all of which was contributed by manufacturers, inventoried in 1912 at $235,595.53, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the school, adding to the machines such improvements as are made from time to time, and each year some new machine is added by a manufacturer who finds it to his advantage to be represented here. This operates to the mutual advantage of both manufacturer and student. The yearly running cost of the institution is $60,000; number of day students, 150; evening students 600; instructors 29.

The school was established and is managed by a Board of Trustees composed mainly of representatives of textile or textile machine corporations. Associated with them *ex-officio* are several officials of the State and city governments. The State Legislature made a grant of $40,000 for maintenance, $22,000 for boiler house and between $6,000 and $7,000 for equipment; Lowell gives $8,000, which practically pays for the free tuition of evening pupils from that city. The fee for outsiders is the actual cost, about $300 a year. The Trustees have entire administrative control of all school matters, and carry out their will through their committees. It is the policy of the Board that a safe majority of their members shall be persons actively engaged in textile manufacturing, and that the school work shall at all times be in accord with conditions and needs of the local textile industry.

Instruction and Production.

The same instructors serve day and evening classes, thus insuring to the evening pupils from the mills and shops the same able and thorough instruction as the day pupils, for it does not necessarily follow that the humbler youth should have a poorer school. The instructors are all graduates of Textile Schools who have had practical experience in the mills, or else men

who have come direct from the mill and have been trained in the school as instructors, but none are now connected with any mill. The school looms are run primarily for instruction purposes, and students buy at cost anything they particularly desire from the products; whatever else accumulates is disposed of quietly in the market. The aim is to avoid as much as possible the commercial side of the work in order not to detract from the training side of the school.

The production of the school in the matter of variety of fabrics equals the production of 20 or 30 mills; however, the aim is not to turn out large quantities of material, but the reverse—to keep the material down and yet give the greatest possible amount of instruction.

The Trade Unions uphold the school because it is not seeking access to the labor market, but rather assisting those already in the market to be better men.

Practical Machine Work.

The school has an arrangement with a local machine shop by which students are allowed to pick out parts of a machine in the rough, cut the key-way and do the filing, and then return the part to the shop. In this way the students are made to feel that they are working on something of real value. Day students also take down the school machines and put them together again.

Evening students are not put to work on the machines, because they are tired of that after working all day long. It is held to be better for them to discuss mill problems and work questions with the teacher; they want to know the why and the wherefore.

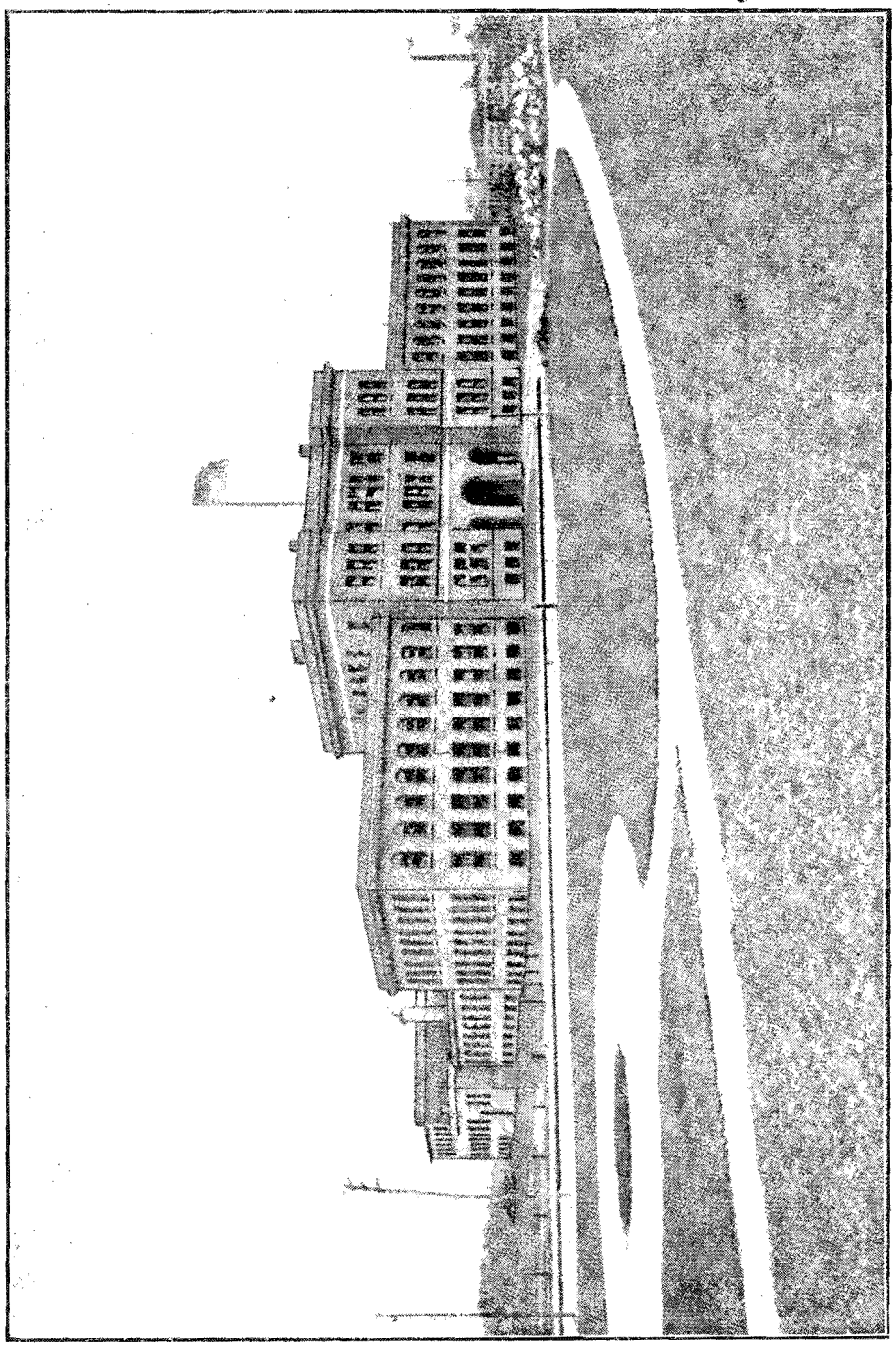
Day and Evening Classes.

Day classes have been organized for those who can devote their entire time for 3 or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular 4-year course of a High School or academy of good standing.

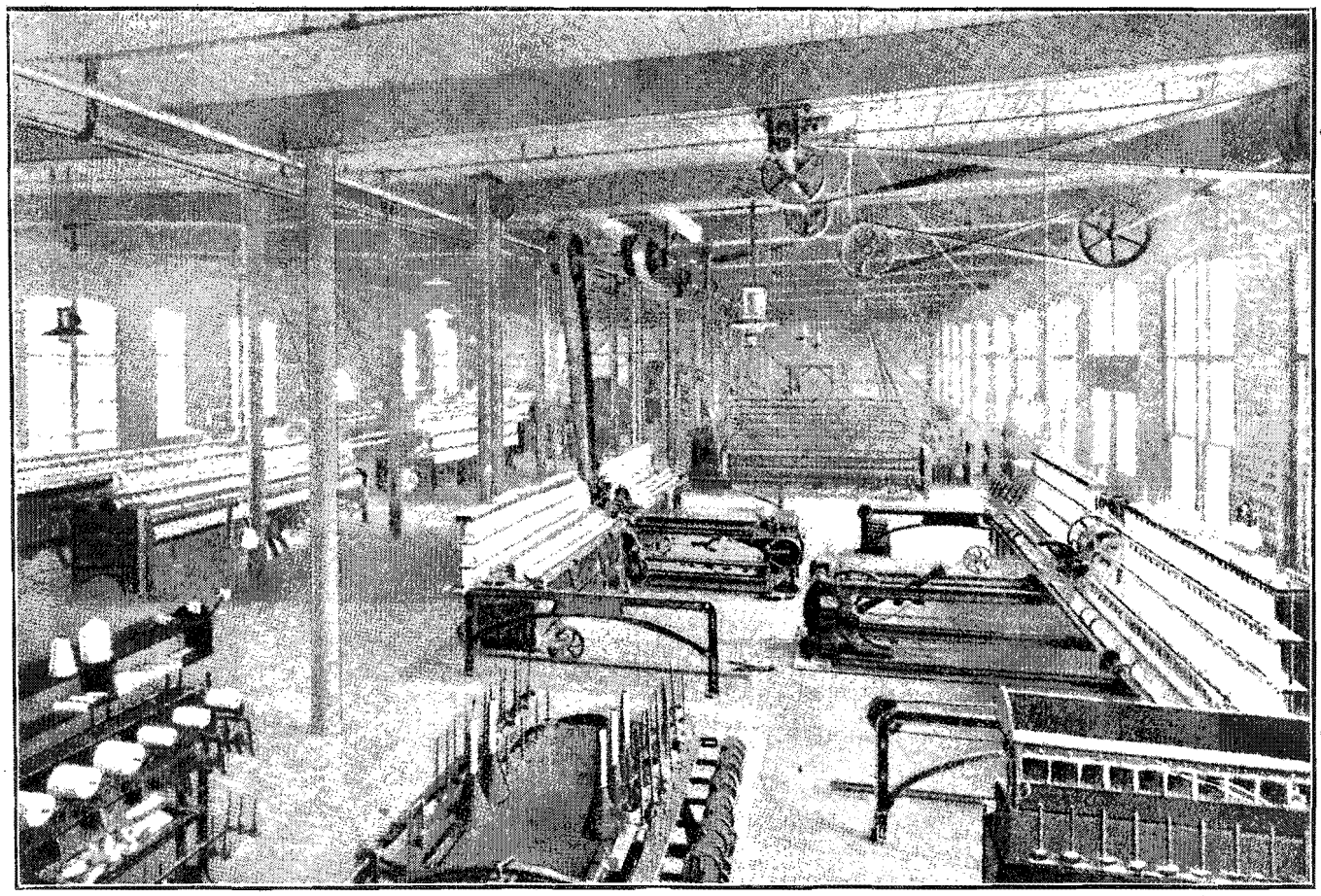
The school has so advanced in the standard and character of its work, as well as the standard for admission to its day classes, that the Legislature of Massachusetts gave permission to the school to grant the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Dyeing (B.T.D.) upon the satisfactory completion of prescribed 4-year courses.

Evening classes are held for about 20 weeks of the year. The courses are similar to those of the day, but are aimed especially to meet the needs of day workers in mills and shops. Those entering these classes should have the equivalent of a Grammar School education.

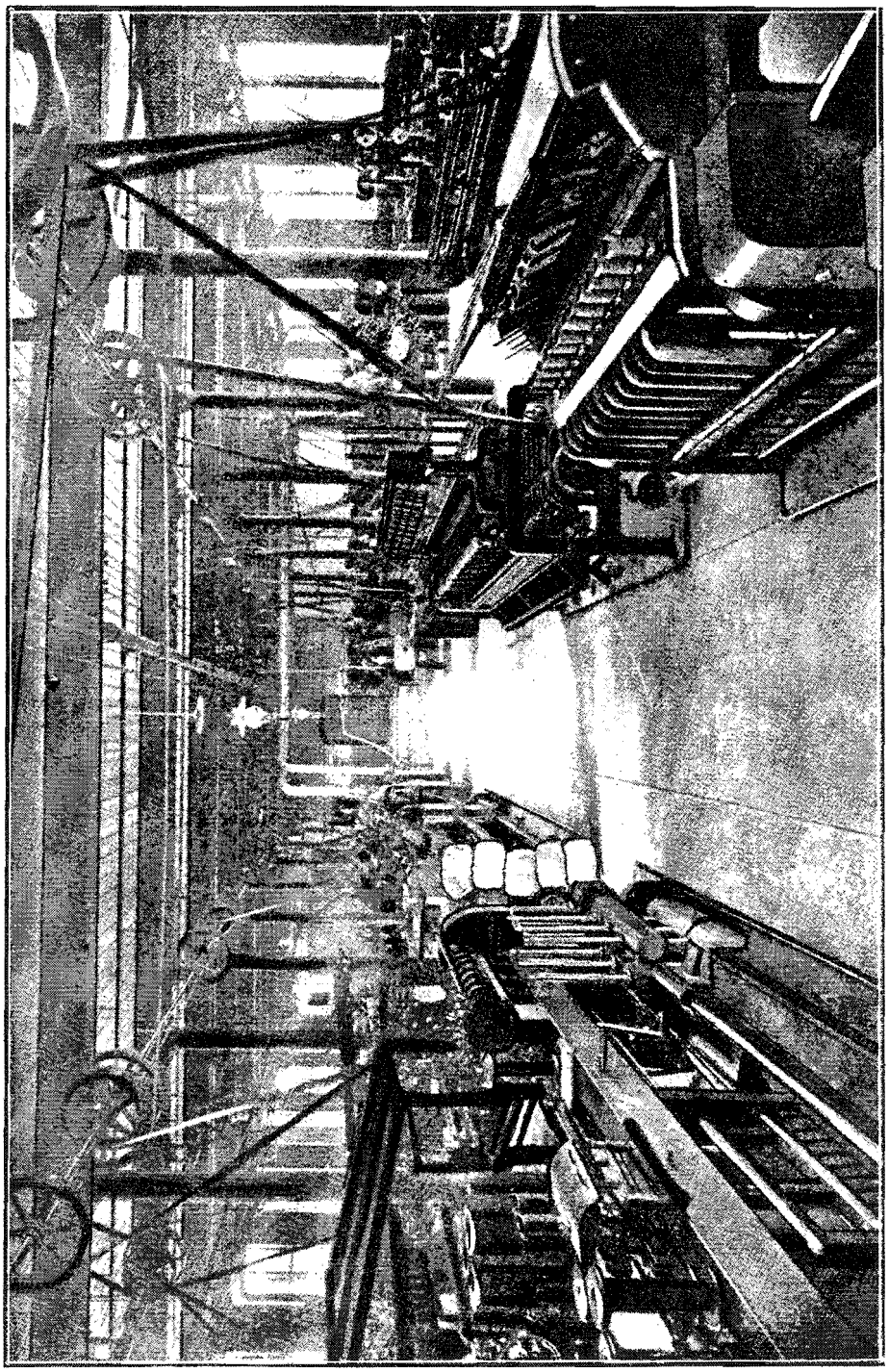
In the manufacturing of cottons and woollens every portion of the various processes, from the raw to the finishing of the cloth, is carried out in the school, and the students before graduation select raw material and out of it make for themselves enough cloth for a suit of clothes, which they wear on graduation day. They purchase the wool and follow it practically through every process, including the designing, doing the actual work themselves.



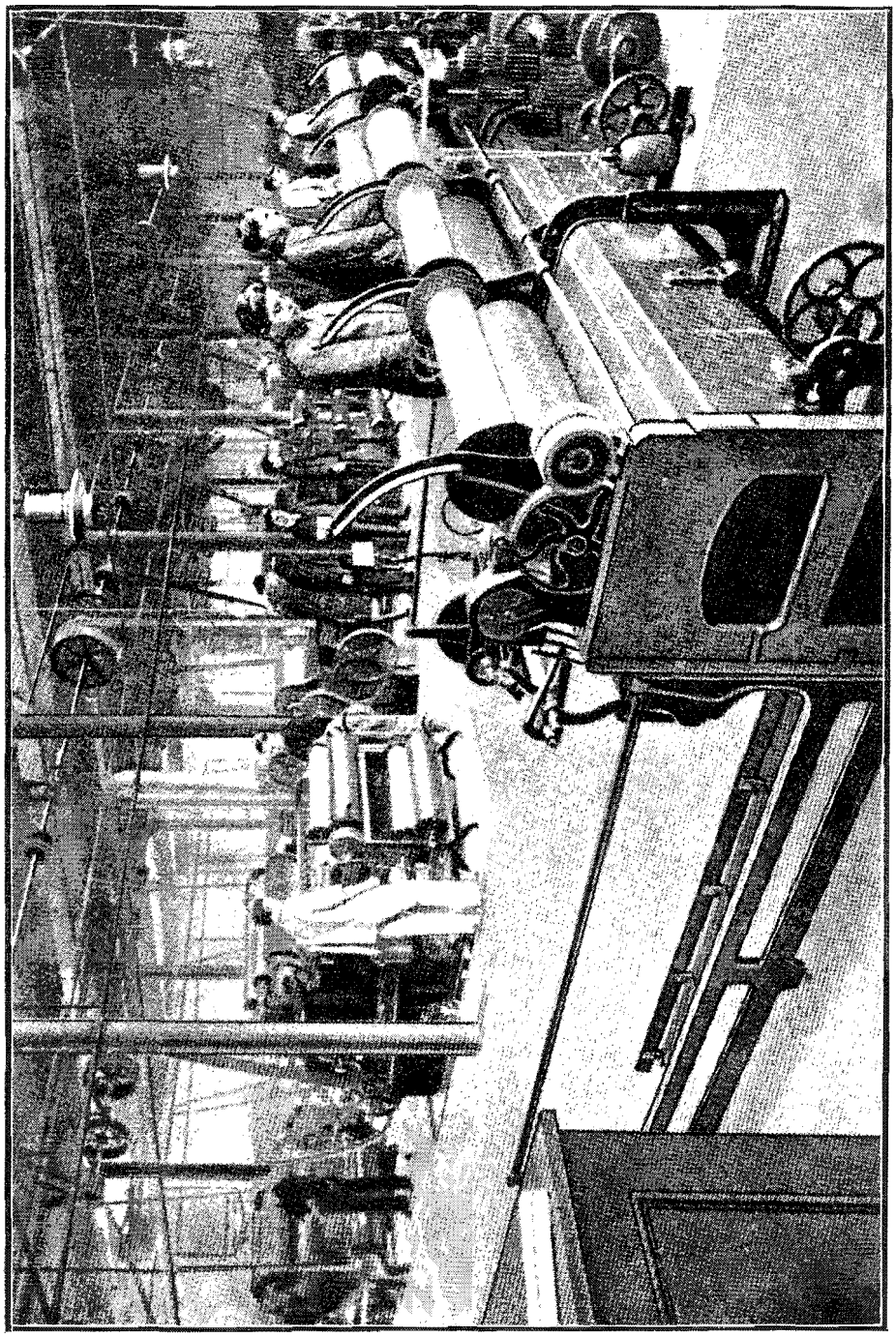
THE TEXTILE SCHOOL: LOWELL, MASS.



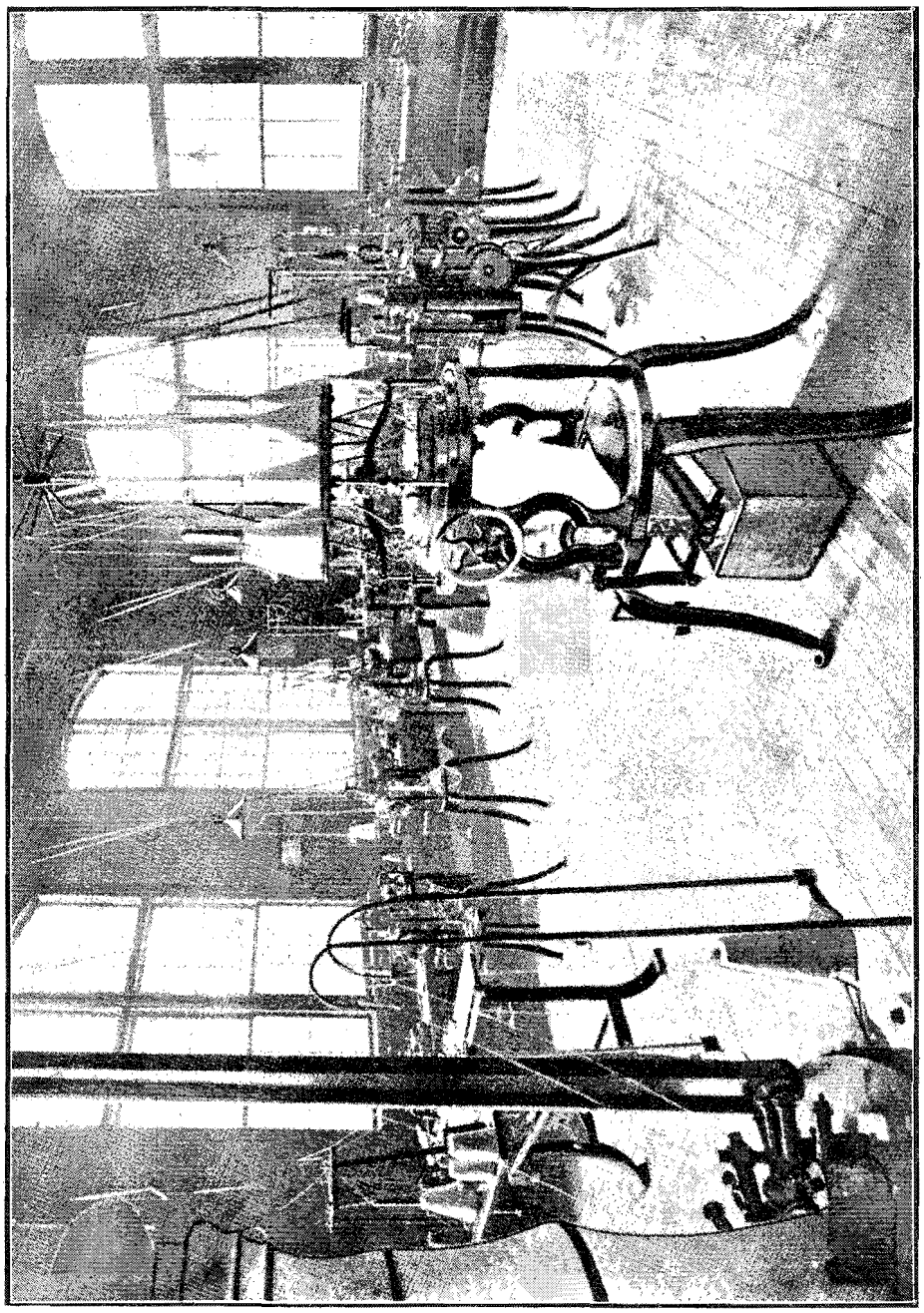
COTTON YARN DEPARTMENT: THE TEXTILE SCHOOL, LOWELL, MASS.



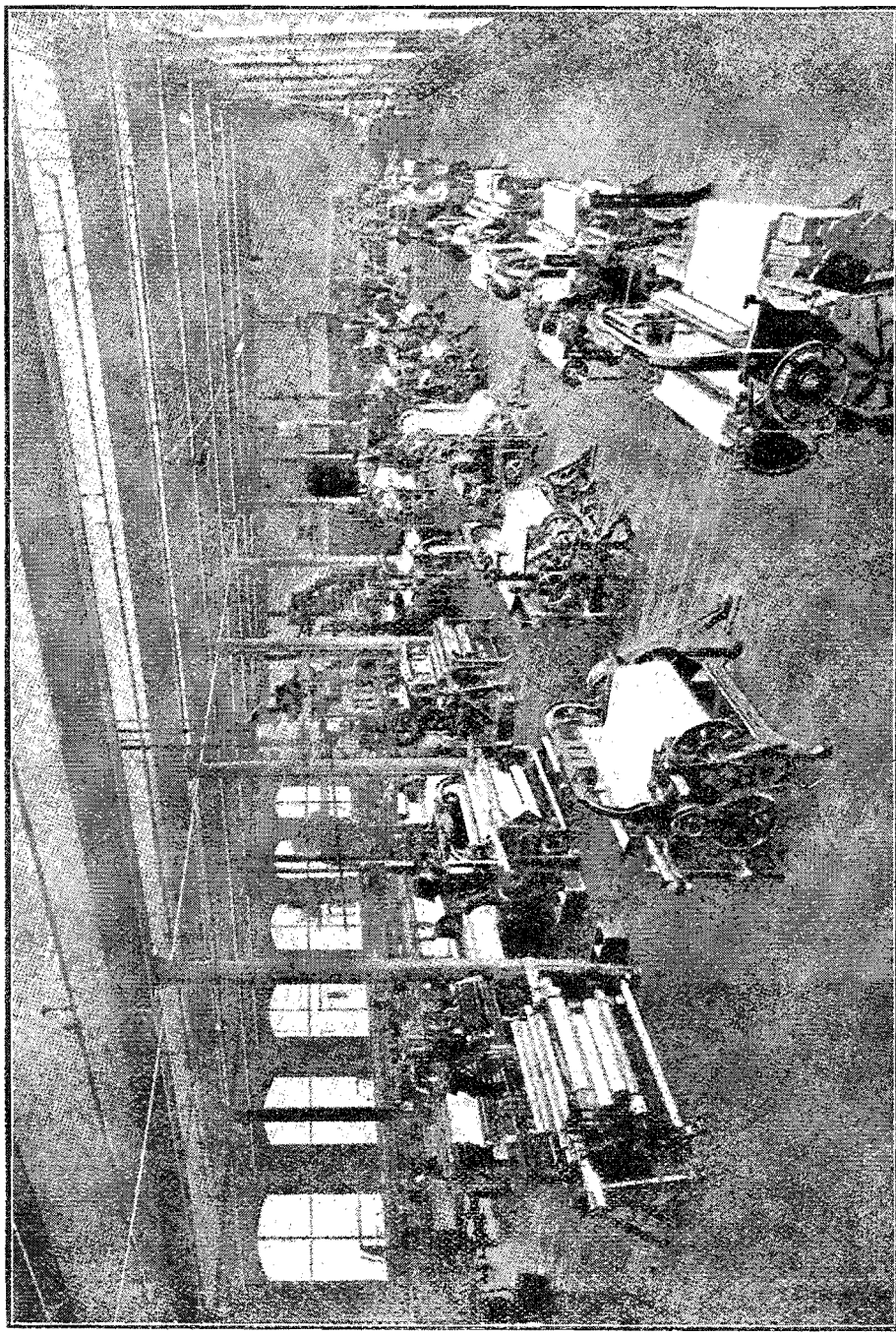
WOOLLEN AND WORSTED YARN DEPARTMENT: THE TEXTILE SCHOOL, LOWELL, MASS.



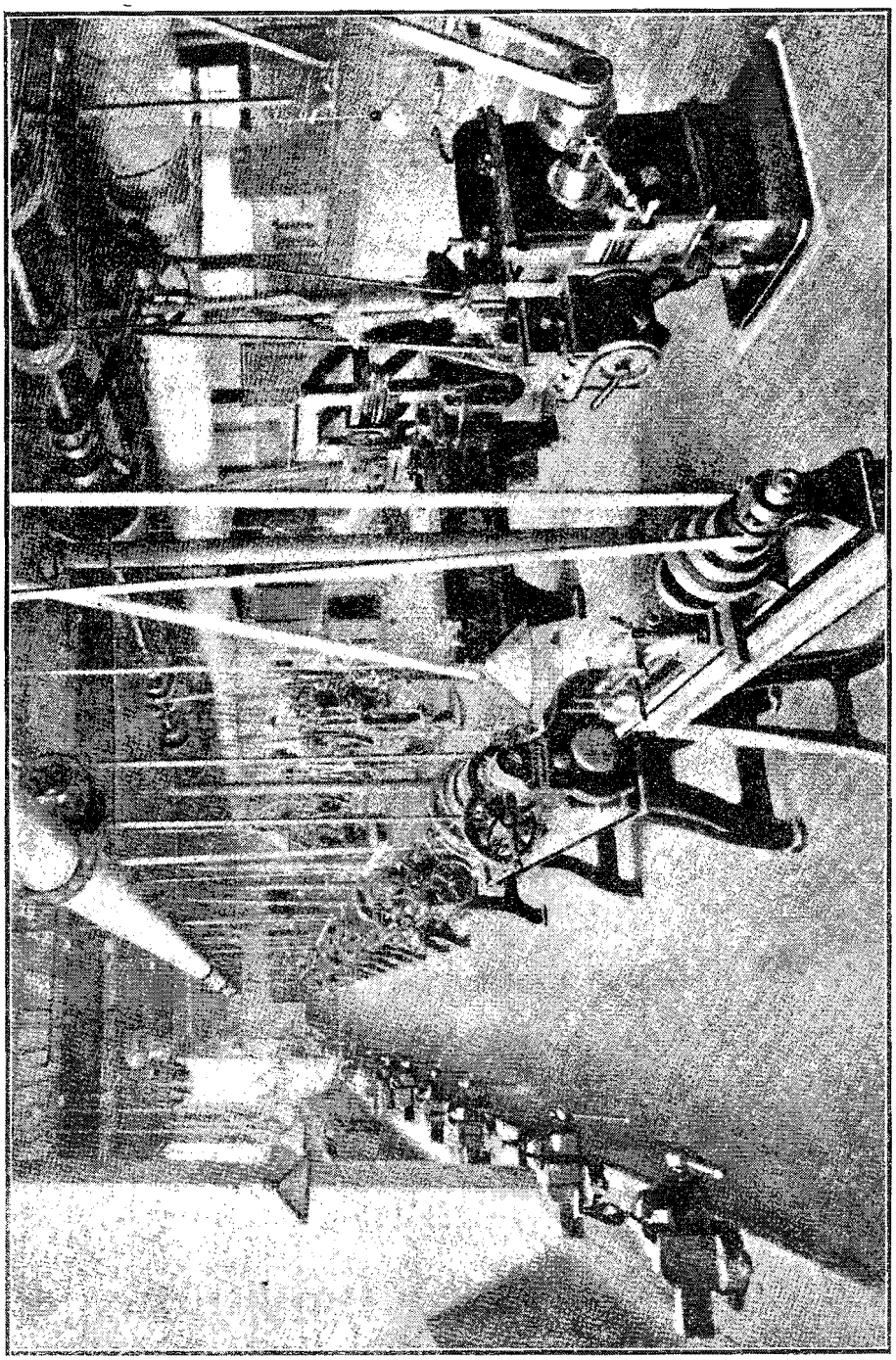
WOOLLEN YARN DEPARTMENT. THE TEXTILE SCHOOL, LOWELL, MASS.



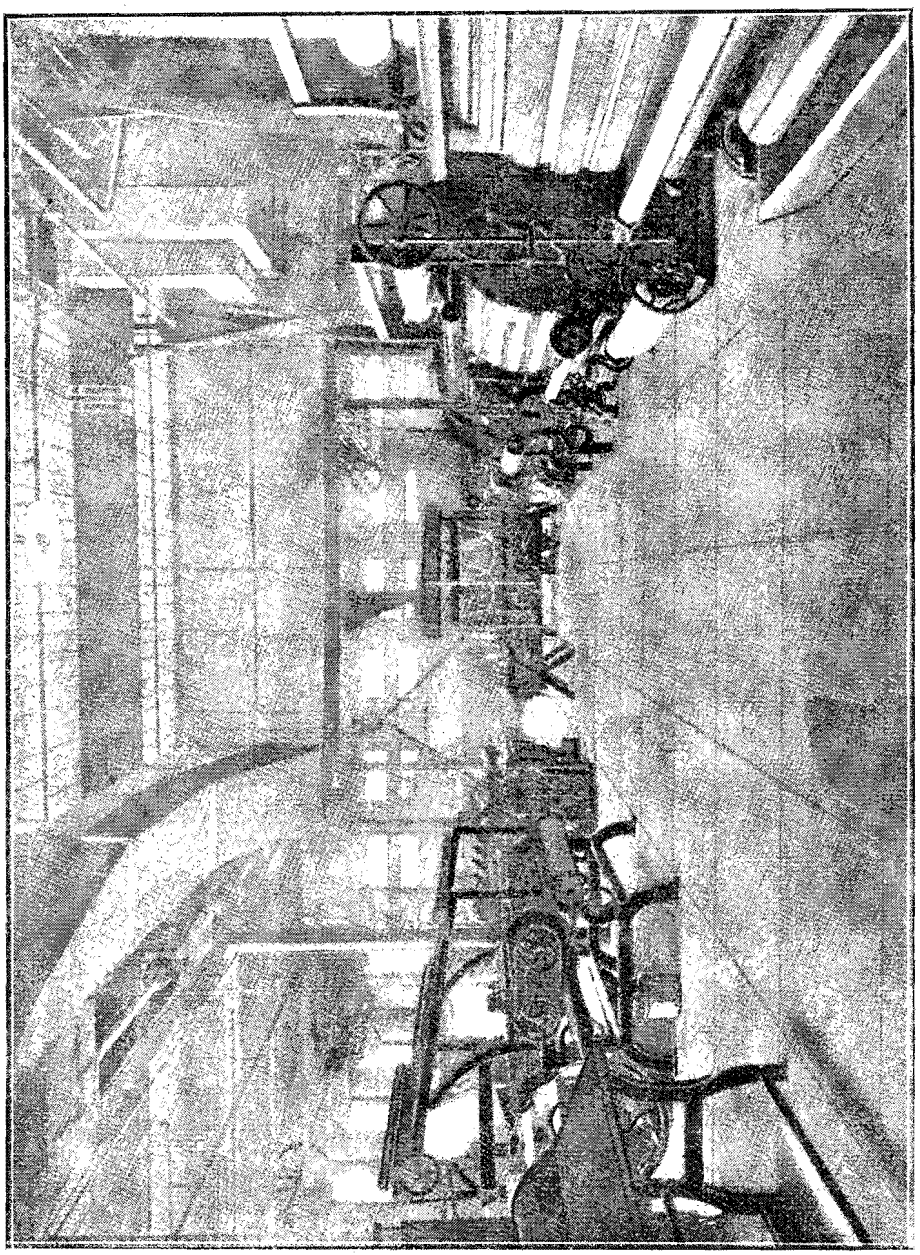
KNITTING DEPARTMENT: THE TEXTILE SCHOOL, LOWELL, MASS.



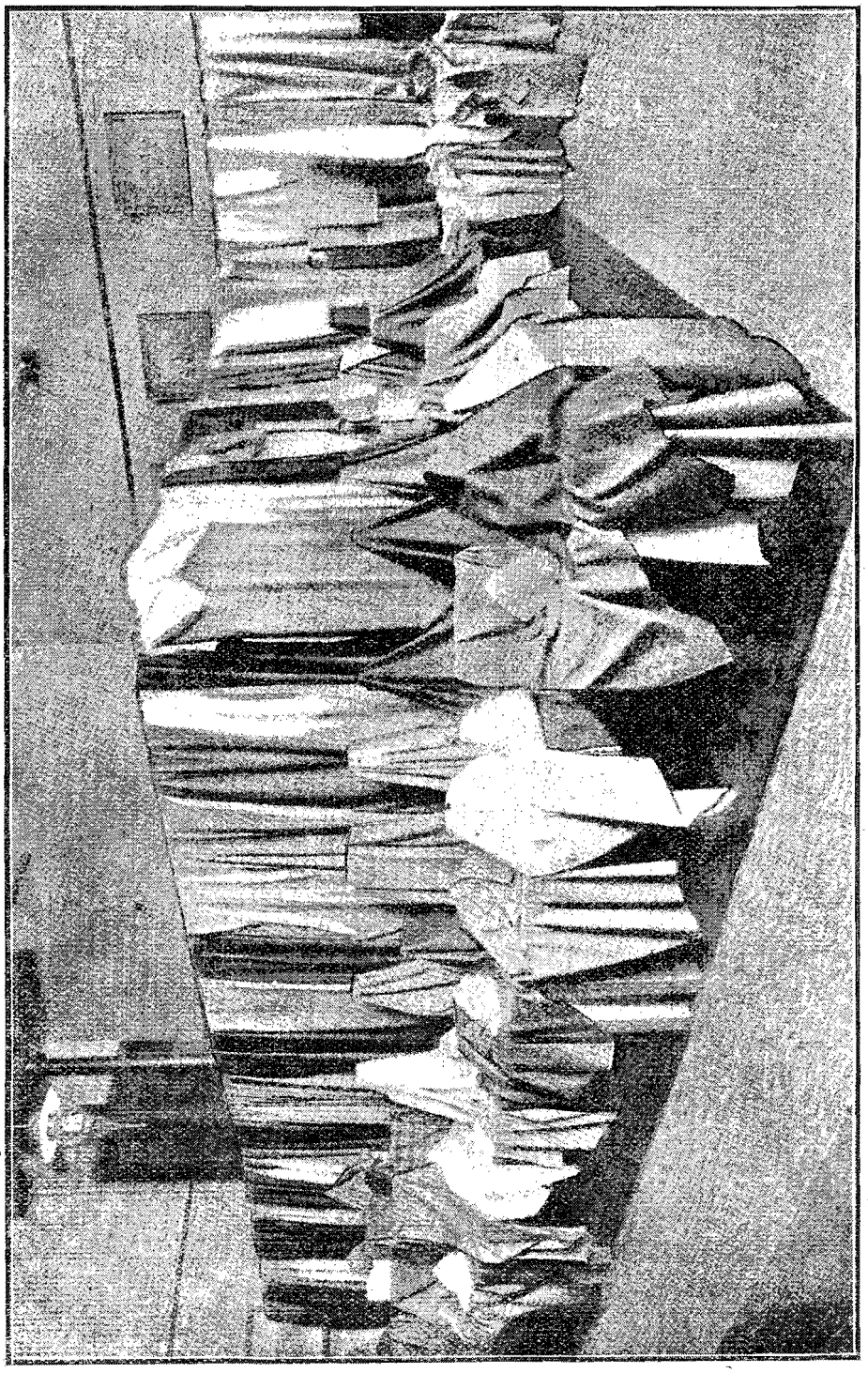
WEAVE ROOM: THE TEXTILE SCHOOL, LOWELL, MASS.



MACHINE SHOP: THE TEXTILE SCHOOL, LOWELL, MASS.



FINISHING DEPARTMENT: THE TEXTILE SCHOOL, LOWELL, MASS.



VIEW OF MANUFACTURED MATERIALS: THE TEXTILE SCHOOL, LOWELL, MASS.

COURSES.

The courses of instruction are especially intended for those who contemplate entering the business of textile manufacturing in any branch, and are sufficiently complete to enable one to start without previous acquaintance with textiles. At the same time those who have been engaged in such business and wish to improve their knowledge and experience can with profit pursue a course of study at the school. They include courses in Steam Engineering, Electricity, Mechanical and Architectural Drawing, Freehand Drawing, Machine Designing, Machine Shop work and other subjects related to the textile trades in addition to the textile occupations proper.

There is one year of preliminary instruction which is common to all courses. Students electing the course in Chemistry and Dyeing or the Course in Chemistry and Textile Coloring must make the selection at the commencement of the second term of the first year. Other students are not required to choose their courses until the end of the first year.

The 4-year degree courses are:—

Textile Engineering.

Chemistry and Textile Coloring.

With the former are offered three textile manufacturing options, viz.:—

1. General Textile.
2. Cotton Manufacturing.
3. Wool Manufacturing.

Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of Textile Chemistry and Textile Engineering. It is maintained that for one to be successful in either of these important branches of industry, as thorough and broad a training is required as in any of the recognized branches of Engineering or of applied industrial science.

With this in mind these courses have been built of a secure framework of Science and Mathematics, and to it has been added the useful application of those branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended and advanced preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included in order that narrowness of judgment and observation may not result by over stimulation of the technical development.

Instruction is first given in the principles of the sciences applicable to the textile and textile machinery industries, followed by instruction in the practical art,—the application of such sciences to the processes and machinery of manufacture. The practical and theoretical parts of the work are very closely correlated.

Day instruction offers 5 3-year courses, and a post-graduate year. For evening instruction these are subdivided into 16 courses. All pupils, day and evening, are presumed to enter for the final diploma at graduation, though for the evening pupil— there being but 8 hours available weekly— it necessarily requires a longer time to reach the standard of acquirement than for the day pupil.

All day freshmen during the first half-year receive the same general instruction. At the beginning of the second half-year they are expected to have chosen one of the 5 regular day courses. Each course, however, in addition to the specialty indicated by its name, includes some features of every other course, as it is found that such instruction adds to the efficiency of the pupil in the line he has chosen.

While there are several regular courses offered, they may generally be grouped in 3 grand divisions: (1) Textile Engineering, (2) Chemistry and Dyeing, and (3) Design.

(1) *Textile Engineering* includes the mechanism of all machinery used in all departments of the school, and also machine-shop practice; instruction in the creation, transmission and application of power, whether steam, hydraulic or gas. In boiler and engine testing, for which a very complete and modern laboratory is provided, the engineers and pupils are frequently called upon, or are afforded opportunities for conducting continuous 24-hour tests, without intermission, of mill power plants, including the analysis of flue gases, etc. This division also includes mill construction, cements and concrete, surveying, involving the laying out of plants, shafting, etc.; physics as involved in the testing of fibres, yarns and fabrics; mechanical drawing, plans for and the construction of equipment. The pupil is first thoroughly grounded in the principles of mechanical, electrical and hydraulic engineering before attacking the more advanced and specialized problems. The higher mathematics belong to this group. Here the plans for buildings are prepared, and all construction conducted during the summer vacation by the engineers and pupils who remain for practical experience in this line of work. Instruction is by lectures, with or without models, blackboard illustrations, mathematical problems for solution, and laboratory work and shop work.

(2) *Chemistry and Dyeing* involves a thorough course in Chemistry, followed by an applied course, first in the laboratories, and finally on commercial vats, presses, kiers, dryers, etc., in raw stock, yarns and fabrics. A specia land growing branch is the making of dyes from raw minerals, vegetables, oils, etc. A special laboratory is equipped for testing coal and oil.

(3) *Design* includes (a) instruction in color, conventionalizing of nature forms, historic ornament, etc., fundamental to all branches of decorative art, and then (b) the application thereof to textiles. Included under this head is all fabric weaving and finishing.

Incidental to these general divisions is instruction in English, German, French and Physical Culture.

Diplomas are awarded for 3-year courses in Cotton Manufacturing, Wool Manufacturing, Textile Design (General Textile Course), Chemistry and Dyeing, Textile Engineering.

COURSES FOR WOMEN.

Although all classes are open to women, the courses which have appealed especially to their tastes have been Textile Designing and Decorative Art. Some have pursued courses in Chemistry, and have added to their work in Design some instruction in Power Weaving and Finishing. These special courses have in general been followed for 3 years, and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

SECTION 2: NEW BEDFORD TEXTILE SCHOOL, MASS.

This school, as contrasted with that at Lowell, is intended more for workers and working foremen. It has no finishing department, and of the heads of the 7 departments, 3 were graduates of technical institutions and the others had worked their way up.

There are 30,000 mill operatives in the 60 cotton mills of the town. Day pupils number 40, evening students 800.

The machinery in the school is valued at $75,000, and was contributed mainly by the manufacturers.

The school furnishes a very complete course in cotton manufacturing from the seed-pod to the finished article. The institution is a cotton mill in reduced form, but with all necessary appliances, including full-sized and up-to-date machines. The 7 day instructors, who are heads of departments, assisted by 20 others, act as evening instructors. These assistants are men employed in the mills during the day, who have themselves graduated through the school and have ability to instruct others.

The School Director considers 2 evenings a week as much as men can stand. One evening is devoted to practical weaving and loom-fixing, and the other to theory. For the evening classes the lectures in typewritten form are first distributed to the students and then discussed.

The boys start with plain weaving, some then take fancy weaving and others follow on with design. The day course in designing covers 2 years. In the course for knitting and sewing the machines are on a commercial basis, and are complete in every detail. The Instructor believes the machine is an absolute necessity in teaching an operation.

The city granted $25,000 towards the building of the school, and gives $10,000 annually towards maintenance. The State has contributed at various times sums aggregating $123,000 to the building account, and makes an annual grant of $20,000 towards maintenance.

No fee is charged to students from New Bedford or the State of Massachusetts, but American pupils from outside the State pay a fee of $50, and foreigners $150.

SESSIONAL PAPER No. 191d

CHAPTER LXVI: THREE TECHNICAL INSTITUTIONS OF THE HIGHEST GRADE.

SECTION 1: COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART, NEW YORK.

Information obtained from "Conversation" with DR. CHARLES R. RICHARDS, *Director.*

Cooper Union has been established 50 years, and has about 2,500 students, its chief province being Evening Class work. There are four Day Courses: (1) School of Technical Science, with 300 students, which is in reality purely a Technical Engineering School without any work in Language, History or culture studies of that kind, with standards at the 4th year about the same as those of the engineering schools of the country; (2) The Women's Art School, with about 275 students, which has been part of the institution almost since its beginning; (3) School for Stenography; (4) School for Telegraphy. The Day School with about 700 students is held more because of having the building and equipment than because the Trustees primarily believe in Day School work.

The Evening work always has been and always will be the important work. It is what Peter Cooper had in his mind when founding the institution and what the Trustees have in their minds. The work there is similar in some respects and different in others from the usual Evening work. It divides into two sides, one called the Art side—not a very good name—which takes in all the classes in Drawing and Modeling. It covers a four year course in Architectural Drawing; a four year course in Drawing which ends with Drawing from the life model; a course in Drawing from the model which ends in Drawing from the figure.

The other side, called the School of Science, is rather unique, being really courses in Civil, Mechanical and Electrical Engineering and Chemistry. They were started as consecutive, co-ordinated courses. Two of them have been going on for about 49 years, which fact makes possible the position they are in today. They are 5 year courses taken 5 nights a week—the man comes an average of 5 nights a week for 4 years.

UNIQUE COURSES EVOLVED.

These courses do not seem to be paralleled anywhere else in this country or abroad, and owe their character first to the fact that somebody had the idea of starting them, and secondly to the fact that they have been going for 50 years. They represent the kind of thing that cannot be developed suddenly. Courses of this kind could not be built up in a few years, for it is only during a long

course of years, with the results coming from graduates of successful courses, that the efforts and sacrifices needed for them can be developed in a large number of people.

Students are admitted by examination in algebra through quadratic equations and plane geometry. One course is still called the course in General Science. It used to be a good title in the old days when men came to get that scientific training which their vocations demanded, when some Physics, Chemistry and Mathematics were given; but they have steadily become more and more technical until today they are courses in Engineering. That General Science course branches off in the fourth year to either Civil or Mechanical Engineering.

Persistence in Attendance.

Last year there were 1,500 applicants for admission to the first year, and there came to the entrance examination 550 students, from whom about 175 were taken, plus 25 who repeat or hold over for some reason from the previous year, the entering class thus being 200. The persistence of attendance at these courses is rather a remarkable thing—the first year 200; second 175; third 150, fourth 125, fifth, 100. That is a persistency that is not equalled in any day Engineering School in the country.

The Selective Principle.

Here the selective principle runs all through; first, in the selection of the man; second, in the elimination by the test examinations; then by the wear and tear; so that in the fourth year you have a remarkable body of men, who would do well if they did not have Cooper Union at all.

Once you get a large number of applicants wanting to take a course you can apply the selective principle, and when that bears on the situation you have the biggest influence on all education. Single-subject courses have never been added on the Technical side, simply because those Engineering Courses took all the available room.

A new building is being added just across the street which may be used entirely for the scientific and technical work. When that is completed there will be no effort to increase very largely the numbers in the regular Engineering Courses, but single-subject courses on the Technical side will be added, which will round out the scheme of instruction here in a certain way.

Comparison with Day Engineering Schools.

The total amount of time in the engineering courses here as compared with a 4 year day Engineering School is between 40 per cent and 50 per cent; but the great element of strength about these men (outside of the selective quality of the work) is the fact that they are working during the day-time at related work. That great element of strength allows men with 40 per cent of the time on

theoretical work to take positions of responsibility, and to stand up in theoretical work alongside trained men graduating from day schools. While many of those men start in the first year working in the shops, by the time they are in the fourth year of study many of them get work in the drafting rooms, engineers' offices, field surveying, etc. The same qualities that have carried them through the fourth year have been operating in their daily work.

The Cooper Union gives these graduates a diploma, or a degree of Bachelor of Science, which among engineers is just as acceptable as those of the Day Engineering Schools, because its quality is recognised, for it means that a man has been studying 5 years for 5 nights a week. When these men have been out three years they may apply for a professional degree—C. E., M. E., E. E.—by showing that they have had charge of responsible engineering work, or have been solely responsible for the designing of engineering work. They are judged by a committee of 3 men, one a member of the Faculty, and two Engineers not connected with the Institution, and on the recommendation of this committee they are admitted to the degree. Dr. Richards thought this rather a good scheme— to make the degree dependent upon the candidate's experience in work.

While this evening work on its technical side is not applicable, or possible to reproduce to any large extent, in small communities, it seemed to Dr. Richards, after his experience here, and seeing the soundness, strength and virility of it, that it might well be involved in any large scheme of education for certain focal or strategic points. In a large territory, perhaps at a few strategic points, there might well be a development of this kind of thing, which is a workingman's college idea.

Evening and Day Courses Contrasted.

The evening courses do not to any extent become feeders for the day-work, though there are certain transfers from one to the other. If a man finds he has the time and resources he transfers from the Evening School to the Day School, and *vice versa*. Of course the Day School gives more hours of instruction than the other; and it encourages the same type of men as the Evening School—those who have had practical technical experience—and 40% of the most recent entering class would answer this description. It is hoped to differentiate the day-work from the regular Engineering Schools, with which they do not want to compete, and to have it largely fulfil a special purpose.

Asked whether a University or a Polytechnic could not have these Evening Schools and do the same kind of work, Dr. Richards suggested the liability of any University man doing day school University work, who has not somehow or other been inoculated with the real meaning and importance of Evening School work, to look down upon it and make it a very secondary affair, and a measure of much lower standards.

"Sizing up" Students.

On the entrance examination English is used not so much as a test of efficiency as to bar out those who cannot use English with facility. For the Day School there is also a personal examination of the candidate before the Committee of

Faculty, who examine him in regard to his previous experience, whether he is going to support himself or whether his parents support him, his general make-up and character. They also give him a physical examination. They try to "size him up," and attach as much importance to that personal examination, though it counts only one in four, as to written examinations.

The Day Courses are strictly Technical, with no Language or History in them at all, and end, like the other, in a degree. The Day School takes in only 120 students. Last year there were 514 applications for the first year; about 260 came to examination, and out of these 105 were taken, the other 15 being repeaters.

In the newer courses the standard has been raised. While the old courses have been running 49 years, the Electrical Course covers the later developments which have been coming in the last 12 years. There is a remarkable development, and that course is gaining very much upon the older course. Out of the 910 applications for admission last year, only 380 came to the examination, but as only 80 students are admitted in the first year their average grade was very high. The standard has been going up every year because the number of applicants is growing so rapidly.

Where Teachers Come From.

The 5 heads of departments (all degree men, and in all cases with practical experience as well), besides 24 other men, give their whole time day and evening. A considerable additional number attend for evening work. In the School of Science they are mostly working in engineering offices of some kind or other during the day and teach here in the evening. An instructor teaching calculus and geometry is in a civil engineering concern; an instructor in trigonometry comes from a neighbouring institution; a man teaching drawing comes from the civil engineering department of the city; the man next him the same way; the next man teaching algebra and geometry is in a civil engineering office; the next is a graduate student at Columbia, who comes here to teach his specialty, mathematics; another man teaching algebra and geometry is head of a drafting room; the next teaching electrical measurements, who has to teach the theory, is a B.S., graduate from Cooper Union, and is now with the New York Telephone Company; and so on. The degrees are not held so generally by the drawing teachers.

The Society of Civil Engineers applies the same test as Cooper Union applies to these men for the advanced degree, and looks at the degree in the same way as those of the Day School; and a large number of these graduates are in the Civil Engineering Society. The teachers average 4 nights a week, 2 hours a night. The total capacity of the institution for day and evening classes is 3,100. The average age of admission to the Science School is between 17 and 18, but it goes up as you increase, so that in the second year it is higher than 18 to 19. The mature men seem to hold on better; the younger men drop out more.

SESSIONAL PAPER No. 191d

REPORT OF THE DIRECTOR.

The disproportion between the number of persons applying for admission and the accommodations of our present building is even greater this year than in the past. Figures for the year are as follows:—

Night School of Science	3,159
Night School of Art	1,947
Day School of Technical Science	490
Woman's Art School	196
School of Stenography and Typewriting for Women	191
School of Telegraphy for Women	50
Debate and Elocution	190
Civics and Economics	138
	6,361

In addition to these new applications, there were 1,940 students promoted from the classes of the previous year qualified to take up work in the institution, making the total demand upon the classes at the beginning of the present year amount to 8,301 individuals.

The Cooper Union Free Day School of Technical Science affords opportunity to pursue the branches of study which lead directly to the practice and profession of Engineering.

A 4-year course of study is provided which is designed with reference to the needs of students who intend to follow either Civil, Mechanical or Electrical Engineering.

The instruction is given by lectures, recitations, and laboratory work.

The daily sessions of the school are held between 9.45 a.m. and 3.15 p.m.

Outdoor surveys in the Civil Engineering Department may be continued beyond the hour above mentioned.

Degrees and Diplomas.

Students who complete one of the above outlined courses in Engineering, receive the Degree of Bachelor of Engineering. The Degree, however, is conferred only on those students who have been members of each and all of the classes of one of the courses for the last two years of the course, who have been regular in attendance upon all the exercises of those classes, and who have passed the examinations of the same.

Advanced Degrees.

The Degree of Civil Engineer, of Electrical Engineer, or Mechanical Engineer, is conferred by the Board of Trustees upon graduates of the Cooper Union, who have had, after graduation, three years of engineering practice, which shall have included the designing or responsible charge of engineering work.

The higher degrees are conferred upon those who have first earned the Degree of Bachelor of Engineering.

Scholarships.

There are six scholarships of $100 each, for the benefit of students of the Day School.

To obtain one of these scholarships, a student must have a high standing in his class; but other things being equal, the scholarships are awarded to students most in need of assistance.

The scholarships are granted for one year, but by re-applying at the proper time, holders of scholarships will receive preference over new applicants, providing their work during the year has been equal to the standard required for the granting of scholarships.

A student who wishes to apply for one of these scholarships must submit a statement giving such information as will enable the Trustees to award the gifts to the best possible advantage.

FREE NIGHT SCHOOL OF SCIENCE.

There are four distinct courses in this Department:

A 5-year course in General Science.

A 5-year course in Chemistry.

A 4-year Course in Electrical Engineering.

A 3-year course in Mechanical Drawing.

Each applicant for admission must be at least 16 years of age. Residence in New York City *is not* a necessary condition of admission.

Women are admitted to any of the classes in the Scientific Department for which they are fitted.

Pupils are enabled to purchase at the school all the text-books and drawing materials they require, at prices considerably lower than the retail rates.

Free Night School of Art.

Students in the class for Modeling—whether from casts or from the figure—in those for Decorative Design, and for Architecture, have been brought to realize the value of Free-hand Drawing as a preparation and aid to progress in their special work, and are more frequently taking preliminary or parallel courses in Drawing with the regular classes.

In various reports reference has been made to the difficulty of eradicating a tendency, too frequent among our students (fostered no doubt by the demands of their daytime occupations), to expending the greater part of their time and effort in the production of highly elaborated work rather than to the acquisition of a ready and truthful rendering of form, proportion, and action. By dint of insistence upon the more vital qualities of Drawing and by the discouragement of superficial finish and attention to detail, higher aims and a better practice have been established.

In effecting this improvement the institution of our Life Class was of immediate and general service, as it was the consummation of the hopes of years. The somewhat narrow space available offered no ideal opportunities, but by the introduction of partitions, the installation of suitable lights, etc., the necessary physical conditions were provided for a class in which twenty or more students have been working from the living figure, earnestly and with decided success. The impetus given to the lower classes is marked.

Subjects include Decorative Design, Modeling, Modeling from the Living Figure.

Free Art School For Women.

Applicants must be at least 16 and not over 35. Residence in New York is not necessary for admission. Applicants for the Class in Decorative Design should be at least 18 years old. Applicants for the classes in Oil Painting, Drawing from Life, Illustration, and the Advanced Antique, must submit drawings from life or the full length cast. Applicants for the Classes in Miniature Painting and Decorative Design must submit drawings either from the head or from an ornamental form, in cast. The class in Modeling is only for pupils well advanced in Drawing, and the applicant must submit Drawings to demonstrate her fitness. This branch of Art is essential to students preparing to teach Art in the public schools.

Diplomas are awarded only to those students who have three first grade certificates. Each diploma will state for what classes the certificates were given, and every additional first grade certificate will be added to the diploma.

Report of the Art Director of the Woman's Art School.

The Modeling Class has been active as heretofore in its various branches. The present class being largely composed of new members, the exhibition of a high degree of ability cannot fairly be expected in the work of the year.

The lectures on Anatomy, Perspective, Composition, and on the History of Art have been well attended. The latter course embraced visits to the Metropolitan Museum of Art and the writing up of their notes by the students. The other lectures also demand more from the students than mere attendance; in each subject notes are taken, problems solved, or compositions offered for criticism, and, in some, examinations are held.

Free School of Stenography and Typewriting for Women.

The term begins the second of October and ends about the middle of May.

The school hours are from 9 a.m. to 1 p.m. every day, except Saturday. Applicants must be at least eighteen years of age and not over thirty-five. Application for admission may be made between August 1 and September 1. Applicants must be prepared to pass an examination in penmanship, spelling, composition and writing from dictation. Munson's system of stenography is used. Graduates of one term are qualified to take positions. Number of students admitted, 56.

Free School of Telegraphy for Women.

The term begins the second of October and ends about the middle of May.

The school hours are from 9 a.m. to 1 p.m. every day, except Saturday. Applicants must be at least sixteen years of age and not over twenty-four. Application for admission may be made between July 1 and October 1. Applicants must be prepared to pass an examination in penmanship, spelling and writing from dictation. Number of students admitted, 25.

SECTION 2: CARNEGIE TECHNICAL SCHOOLS, PITTSBURGH, PA.

These comprise 4 separate schools, in all of which both day and night courses are given. A student enters whichever school offers instruction for the particular vocation he has chosen.

The School of Applied Science.

This school is for the training of young men who wish to become Electrical, Chemical, Civil, Mechanical, Commercial, Metallurgical, Mining or Sanitary

Engineers. The aim is to equip the student with the scientific principles underlying his chosen field, and at the same time to train the reasoning faculties and develop the power of applying abstract theory to practical operations so that he may be able to utilize in industrial fields the knowledge acquired in the schools. Energy, initiative and individual capacity are recognized as of paramount importance, and emphasis is laid upon the necessity of forming habits, character and associations which will make these traits of permanent productive value.

THE SCHOOL OF APPLIED INDUSTRIES.

This school gives instruction to three groups of students:

(1) Regular 3-year industrial courses for those young men who desire broad industrial education equipping them to become foremen, inspectors, assistant master mechanics, assistant superintendents, etc., in the manufacturing and building trade industries.

The Day Industrial Course, departing from the usual custom of emphasizing skill alone, is outlined to include a broad general foundation for habits of observation, initiative and thoroughness. It endeavours to train the mind and give a knowledge of processes, leaving the acquirement of exceptional skill to the student's after career in gainful occupations. Special emphasis is placed on the necessity of the graduate becoming a good citizen, having those principles of right living, personal hygiene and a knowledge of the general industrial conditions of the country at his command to enable him to become resourceful in the event of necessity. The plan of instruction contemplates courses which comprise a group of correlated trades and industries so that the graduate may have a wide range of opportunity when seeking employment.

(2) *Special Short Courses* (one year) in which thorough instruction in a single trade is given to those mature enough to profit by it. These courses are particularly advantageous to young men approaching their majority who, having served the larger portion of their apprenticeship, wish to enter the field of skilled workmen with more training than the shop generally gives to the average apprentice.

(3) *Night Trade Courses* for men already engaged in the trades, or those who need a more thorough course than can be secured in their daily work and wish to combine up-to-date practice with theory, and thus increase their efficiency and earning power. These courses are in the nature of continuation schools in which men who reside and work within a reasonable distance of Pittsburgh may secure intensive trade instruction combined with such theory as it is possible to offer with the facilities of the institution and the limited time which the student can give to study.

Courses for Teachers.—Day school courses are also offered for the training of teachers for Manual Training, Industrial and Trade Schools. These courses

require approximately 3 years, but men now engaged in teaching who offer evidence of thorough preparation in any subject of the course receive credit for it and thereby reduce the length of time required for graduation.

(See the fuller description of this School under Section 3 immediately following).

THE SCHOOL OF APPLIED DESIGN.

This school is for the education and training of students in Art and Design. It offers courses in Architecture, Interior Decoration and Illustration; further courses are to be added when the new building, to be entirely devoted to the Arts, is completed. Advancement from stage to stage of the work is based on a system of acquirement of 'credits' which allows the greatest possible flexibility of adjustment of work to individual ability.

THE MARGARET MORRISON CARNEGIE SCHOOL.

This school is for the education and training of women for the home and for leadership as well as for occupations requiring technical specialization. (See statement by Miss West, page 1541).

SECTION 3: THE SCHOOL OF APPLIED INDUSTRIES, CARNEGIE FOUNDATION, PITTSBURGH, PA.

This school is a part of the Carnegie Technical Schools for which the city of Pittsburgh provided the site and Mr. Andrew Carnegie the funds for the buildings and equipment in addition to an endowment of $7,000,000.

In the School of Applied Industries young men who desire to enter industrial work are assisted to select a congenial trade, and are given instruction not only in that trade but in all closely allied subjects, thus preparing them to start in as competent workmen. Older men who are already engaged in trade may obtain in the school such additional information relating to their work as will increase their efficiency and consequent earning power.

The school is open to both day and evening pupils. There is no fixed age limit on school entrance, although 16 is regarded as the earliest age at which a pupil can fully appreciate the responsibility of the work. As a rule no work for wages is done by the pupils during the school year, but pupils are encouraged to seek employment during vacations in lines of work similar to the courses pursued in the school, and there is a bureau organized especially for this purpose.

COURSES AND TRADES.

In the Day School two courses are given:—(1) A regular industrial course extending over 2 or 3 years, intended for young men who present evidence of

good scholarship, and whose age warrants the expenditure of time to lay a broad foundation for trade work. This course deals with the sciences fundamental to all trades, and includes practice in the various shops. (2) A short course, which may be finished in 1 year for maturer men who possess considerable experience in a trade, and who desire to confine their efforts to improving themselves in that trade only.

A course for teachers to take charge of departments in Manual Training and Trade Schools is also offered.

The different trades dealt with in the school are bricklaying, electric wiring, forging, foundry work, machinist, pattern-making, plumbing, stationary engineering, heating and ventilating, sheet metal and cornice work.

The Evening Courses are intended primarily for those who are working at a trade. In addition to the trades taught in the day school, house painting, graining and sign painting are taught. In the formation of classes preference is given to men already at work, as it is recognized that they are in the best position to make use of the instruction. The usual time required to complete a course is 4 years.

Information obtained from 'Conversation' with DR. A. A. HAMERSCHLAG, SC.D., *Director of Carnegie Technical Schools, Pittsburgh, Pa.*

Dr. Hamerschlag considers that the period of adolescence is too early a stage, physical and mental, for the child to determine with wisdom its own natural aptitudes, but he is very much concerned that children even sooner than 14 shall secure something besides mere book-learning. They need a development of the motor centers, the activity nerves, which can only come from play and work. If that play can be made educational, i.e. stimulating to those nerve centers, it makes the material capable of intellectual fertilization when they go through their adolescent period.

DIFFERENTIATION IN SCHOOL WORK BEFORE 14.

It seemed to him tremendously important for people interested in Industrial Education to get out of their minds the mistaken notion that the period of a child's life up to 14 is a wasted period if he is not trained for actual shop practice or for brain work or agriculture.

Referring to a recent statement that one American city proposes to educate the children so that there shall be no jar to the child when he leaves school and goes into the factory, Dr. Hamerschlag thought nothing could be more disagreeable to a child than to feel that its environment in school was not richer, better, more formative and more stimulating than the atmosphere of a factory. Hence there ought to be a jar; there should not be any slipping from childhood into harness; certain active nerve centers in the body and brain should resent harness, if people are to rise even in the scale of industrial activity instead of becoming automatons or machine attendants. While he wanted the child to have some acquaintance with industrial processes, it should not be through

Manual Training of the crude type, which tries to imitate factory processes, for he claimed this paralyses, and is not sufficiently educational. He asked: 'Which would do the most towards stimulating and educating the child's mind—the quick conformation in clay through its fingers of something which is beautiful in shape and form, or the slow and tedious imitative process of trying to make a poorly-designed chair because it happens to be wood ?' Educatively, the clay would do most for the child; for physical development the chair might do most.

Dealing with the period of a child at the age of 14 or 15, when there is still room to do something beyond what the elementary school could have done, he disputed the statement that this can be given only through certain industrial channels.

Expression Through Work.

This institution, by stimulating the Arts, stands as a refutation of the idea that the only way to give Manual Training is through wood and iron. It offers an outlet for those who want instruction in the Arts, whether Painting, Architecture, Music or the Drama, believing that everything vocational, whether in the Fine Arts or in the trades, is equally uplifting and equally desirable in the civilization strength of a country, by virtue of the possibilities it gives the human being to express one's self through work. No one can say that the labor of the bricklayer is less dignified or less important than that of the machinist; and the latter cannot say that his labor is less dignified than that of the artist. They are all valuable, because they are all expressions of individual human beings, all of whom have human variance.

The ideal system of education in Dr. Hamerschlag's opinion is the one which offers to the greatest number of children the greatest number of elective methods of expressing themselves through work. The general proposition is this: You have so many different variables; you want so many human avenues by which the children can get training through work. That is the finest educational idea. But you cannot do that if too early in life you narrow the vocational impulse into a few mediums. Color may be a medium for one child; music for another; form for another; various materials give different media for different children and all you want is that the child shall express himself in work of his greatest capacity, whatever that may be. If it is on the lower scale he naturally turns into the lower scale of industrial activity; if on the higher scale he rises, whether you provide the work or not; but he rises faster if you have the different agencies to develop him to the position of leadership.

Selection from the Mass.

Dr. Hamerschlag defined the difference between work and education by saying that the thing a child is compelled to do, which is induced by things outside of himself, is usually waste, educationally; but if he craves work it is educational. If he has to work it may be wasted as far as his educational growth—not his usefulness—is concerned; for it may be so distasteful, and the reaction may be so strong within the child, that psychologically it hurts him. Those are the two

extremes. Midway between them we have the great normal group, of whom we must think educationally. We cannot run education for the experts; it must be for the benefit of the great mass of the people, whether it be an institution for research or one for leadership. It must be for the mass, because out of the mass springs the individual who becomes the leader. It is like having hundreds and hundreds of roses in order to produce an 'American Beauty' by elimination. The others are roses, and each has its place, but they are not the exceptional. We must include the great mass.

The important thing is to have a great number of electives, and no sharply-defined lines between the stages of elementary, secondary and higher education. They must be as flexible as the human variant, so that the individual can fit himself in to any one of the educational schemes. The idea of trying to limit the life of intellectual activity at a certain period is just as extremely bad as it would be to concentrate in another period all the motor activity with no intellectual activity. It must be a gradual transition; it is the transition we see in connection with all industry. There is no sharply-defined place at which we can say: 'This is the point where an educational institution ought to shut off one form of activity'. Activities ought to be continuous; therefore he did not like the proposition which dealt only with the 14-18 period. If he had his way in Pittsburgh he would begin at the kindergarten to make the child use its hands and get the sense of form and of color so that it could begin to express itself; and he would continue some forms of those activities all through its schooling, up through the college and university, running it in varying quantities, parallel with great principles and methods by which the child could express itself.

Differentiation at 12 Years.

Dr. Robertson cited the schools of Winnipeg, which now have hand work all the way from the kindergarten to the High School; he had not seen any better organized school system. On the one hand there are a good many of the boys of whom it is known, from their parents' circumstances and perhaps because of their own taste, that they will leave school at 14 and earn their living at hand labor, even in the higher spheres of activity; on the other hand, there are other boys of whom it is known that they will go at least through the High School. Now would it be a good thing, he asked, to differentiate the course of training as early as 12, and give some manipulative training to those boys?

Dr. Hamerschlag replied that he thought the reverse should be done, because the one who is going on to the university will be deprived of hand work, while the other is going to get a dose of it for his whole life. To balance things, the one who is to go into academic life ought to have the over-dose. He believed it better to allow hand work to bear its proper proportion all through, and take it as part of the educative nerve formation of the child or the man.

Dr. Robertson, assuming for clearness of explanation a slight distinction between manipulative exercises which may give a boy manual training, and practical work which would have some commercial value in its product, asked

whether it would be a good thing to have a boy do some real work of the latter kind in school, when he gets past 12, if it has also educational quality?

DR. HAMERSCHLAG thought the commercial work ought to be very slight if at all before 16, for the reason that you cannot train perfect teachers, nor get them to keep the proper relationship between material output and education. There would be a constant striving after output, with too much time devoted to what may be considered the minor product, while sacrificing the bigger product, education. If we had an ideal teaching-colony, we could say arbitrarily, 'We will spend 10% of the time of the student in productive activity which has an economic value'. But unfortunately, with the limitations of our teachers we have no such Utopian educational possibility. Therefore we go to the other extreme, and for fear of that very tendency we make nothing for the market—nothing that is definitely economic. The Worcester Polytechnic and some other institutions, like the Williamson School, concentrate in that direction.

GENERAL CULTURE WITH TECHNICAL TRAINING.

In Dr. Hamerschlag's judgment the Cincinnati scheme is going to produce capable, economic foremen or managers, "but they cannot insert in their curriculum, (because they have not sufficient hours), much of the imaginative vitality which we give to our education. During hours when their students are confined to marketable product we are taking our industrial students through fields that in the average trade school are thought non-productive, and are trying to stimulate their imaginations in other directions.

"For instance, students of the Engineering School must take their courses in History and Music; those in Applied Design must take their studies in Applied Art. They are being taught that an ounce of brains moulded into a great wheel is worth 20 cents a pound, but the same thing beautified by the inspiration of genius or of art may be worth $1,000. They are getting the relationship of what we might call the artistic side to the productive side".

BUSINESS VALUE OF DESIGN.

DR. HAMERSCHLAG: I heard one of my teachers giving an example the other day that was most interesting. He described a man who was manufacturing covers for bedsteads, woven textiles, the pattern being rather tawdry—impossible coloring and an impossible pattern. The salesman could not sell for this factory in great quantity, so he came back and stated that if he could get a good pattern, even with the same amount of material in it, he could double and treble the business. The manufacturer sought out a good designer, who merely outlined a more beautiful pattern that had some point to it, some motive, and some good color. The same quality of worsted or cotton material was used, and the same amount of labor went into the production of this pattern, but the business trebled and quadrupled. So we keep telling these students that they must keep their eyes and their imagination trained for increasing the value of the product as well as for merely making the product accurately.

DR. BRYCE: Will you turn out men as well qualified for doing practical work?

DR. HAMERSCHLAG: Better; they are infinitely better by actual test. I had charge of the New York Trade School for a dozen years before I came here. I have been through all the stages trying to work out the problem of short apprenticeship, intensive skill, and I have compared it with what we have done here, and our students do better work because they are mentally stimulated as well as equally skilled. The skill comes automatically if the inspiration, the love of doing the best, is properly established in the man.

CO-OPERATION AND CORRELATION.

DR. ROBERTSON: Has he plenty of opportunity ?

DR. HAMERSCHLAG; He gets plenty of opportuntiy for work leading to skill in this institution. In Saturday employment and very largely in day work, and coming here at night, and also in the long summer period when he is at economic work, he gets the correlation of the two. I am convinced that our system of co-operation between the Trades Union, through its education committees, and the manufacturers through our night classes and Saturday employment, is an infinitely stronger medium than anything which would be more crystallized and more cut-and-dried into periods, because we can attract a much greater mass, we can depend more upon the student's initiative, and we can also be absolutely free from any dictation from any outside source. We are absolutely free to handle the educational proposition as experts; the manufacturer is equally free to handle his individuals as working units; and the outside associations of labor men must recognize the value of this as a competing force. We are unrestricted, and I believe the great essential thing for any educator is to have a free field and no favor to anyone except the individual, because our product must be the man.

Having been around these buildings you will realize we have everything from the most elementary trade workshops up to research, which latter we do not think belongs here at all. We believe ours is a big enough work to utilize the knowledge which has been secured by other agencies, without trying to search around for that. We believe research is the function of the institution at Washington, while our business is the man, the woman—not the science, not the subject-matter—and we must stimulate and build them up. I say that if you in Canada are going to do good things in education you must keep constantly in mind the man and the woman, and not the subject. Allow the subject to be merely the vehicle by which they express themselves, and make that many-sided.

THE NEW KIND OF APPRENTICE.

Being asked what he was going to manage to put in the place of a system of apprenticeship that is gone, Dr. Hamerschlag replied: This is doing it, for the reason that we don't need the old-fashioned apprenticeship any more. Our system of manufacture, our units of establishment, are no longer the sub-

divided units of the home and the small factory; they are the great mill, the great enterprise. Even in agriculture the time when man and horse labor produced the corn is threatened with change by the great machinery that is being used—ploughs mechanically driven and harvesting devices. It is not a question any more of producing that kind of apprentice.

The new kind of apprentice cannot be produced in those big establishments because the processes are too minutely subdivided; machinery subdivides entire processes; therefore the student must be allowed to come outside. The apprentice must be permitted to get a general view of the thing and its relationship; then when he finds himself in a portion of it he is not absolutely like the semi-skilled helper in the shoe shop who does a certain portion of work on the last and does'nt know what relation it bears to any other part of the shoe; whose work is only temporary automatic labor, ultimately to be supplanted by the machine, and himself probably to be driven further down into lower occupations. He must be equipped for the change in the arts either by night school or in some other way.

I am called the father of night school work in this city, yet I am only a very young man. What I cannot understand is how we were so many generations without the night school, which doubles the number of students. There are just as many young men in this institution in the evening as in the day time. I want public schools to do the same thing—double their capacity. I want every big organization to partially help to educate its masses. The great danger in leaving education entirely to these industries, is that of making it too narrow.

MENTALITY VS. MACHINER

MR. SIMPSON: Under the factory system, with its organization and subdivision today, and the education of the mechanic going on outside the factory altogether, what will be the result if a man is educated in school to cover a certain number of departments in a factory, yet on the other hand the manufacturer confines him to the drudgery of one occupation after he leaves school—there being no compulsory influence over the manufacturer to allow that man to utilize the particular education which he has received in the school?

DR. HAMERSCHLAG: That is what is taking place today. Very soon the individual refuses to remain in that harness which deprives him of his liberty, or else he remains in it to his great individual harm. Pyschologically he becomes deadened by routine processes, or gets into a position of resentment which ultimately makes him leave that employment and seek something for which he has not been well trained. Then he rises to another avenue, and the general principles applicable to all industrial arts carry him through. For instance, a student may leave this institution trained as an electrical wire man, and find that he is put into the process shop where they make a lamp socket, repeated a thousand times. I have known that boy get deadened by his work, then resent it, and leave to go and work in a machine shop, beginning at less than half the pay he got as a skilled man in the other field; but in a year I would see him rise quickly over the untrained individual, and come out as a manufactory unit, but not in the

direct avenue of the trade he began. Opportunities of that type are simply tremendous, unlimited, because the development of labor-saving machinery is more and more demanding a sharper mentality than in the old days, for it requires a much bigger mental vision and a much better comprehension of processes to work quickly than slowly.

Trade Unions and New Processes.

Mr. Simpson: But in factories today we see hundreds and thousands whose motions are simply dictated by the revolutions of a machine, and who from their daily labor get no intellectual inspiration.

Dr. Hamerschlag: That ought not to be. They ought to be supplied by municipality or government or private endowment with opportunites for play, for recreation, for study in the balance of their day, to allow them to get out of that and allow others to get in. I am in a pretty good position to talk about the men who come to me from the labor unions, and they have a perfectly legimate claim for organization, for demanding a minimum rate, and for doing everything except 'soldiering'. I agree with everything except that you ought not to restrict the individual. Give the fullest free rein to create more opportunities, and make the standard of quality of your work command recognition; and I say, 'Come up here as individuals, and take whatever we have, equip yourselves, and go back able to do more and demand more; you are worth more, and you ought to have it.' A great many of them have done it, and have done it successfully. Presidents of Unions have been in here as students, and have gone back and formed educational committees and said, 'Boys, we have got to get ahead of this new method of using this material before anybody else does, and we are going to demand 50 cents a day more for doing it that way, because there is no supply.' Now, if other people can hold their product at market rates, why shouldn't labor hold its at market rates? As long as restriction is based on quality and merit, I don't know but it is a good thing; but when it is not based on quality and merit it is a bad thing. This institution and others have to help the working man get his position properly asserted, and see that the community gives merit, skill and ability their reward.

The ideal system would be, where compelling necessity puts a child into harness at 14, to also compel the user of the labor of that unformed, undeveloped man, to contribute something to his educational stimulus; he must not be deprived at that adolescent period of some chance to form himself—to resent, if you will, this hard, atrophying, terrible work.

Moving Pictures and Evening Classes.

I have no doubt that ultimately we are going to see the moving picture machine a very remarkable stimulating medium. We have them all over our school. There are lots and lots of students that cannot get the thing through the ears, that get it through the eyes. I have been a great advocate of evening classes. I believe that with an 8 hours day in this country a great many of the working population are going to get their education outside of working time.

With the improvement of transportation facilities and lighting methods, there is no doubt that the so-called night school is destined to play a very important part in general education.

Further Education of Skilled Workmen.

Dr. Robertson: Is it your view that the workman after he has passed his apprentice period altogether will prolong his education in some agreeable way?

Dr. Hamerschlag: Yes, we have them here, all journeymen, all averaging 30 or 40 years of age; not exceptional men; we have a whole mass of them; I suppose I have 200.

Dr. Robertson: Is it your view that the workmen will devote themselves systematically two evenings a week to some sort of civic as well as industrial culture?

Dr. Hamerschlag: That is what they do here. The journeyman who comes here does not want any shop work here, nor to be taught in another fashion the things he already knows. He comes here to get something supplementary to it—largely, we find, because he craves institutional activity. He wants to be a member of the Glee Club, or to be with the students, or wants to be a force in the city, and he wants a kind of combination of education and club. He wants college traditions reduced to him as an expression of his life here. So he comes here and takes subjects like English, if deficient in it, so that he may understand more about philosophy. I found a fellow last night sitting in the hallway reading the life of Carlyle. I asked him how he happened to read that. He said, 'Well, I am very much interested in social democracy, and our teacher mentioned that Carlyle had said some things about it, so I got this from the library, and while waiting for my classmates to meet me for a little debate I thought I would read it.'

Stimulating Social and Civic Spirit.

That is typical of a whole lot of these men. They are not here for hand improvement, for skill, for increasing wage-earning alone, but because they want to be part of some stimulating life. These are the sociological developments of which Mr. Field has charge. They have athletics, dramatic club, debating clubs, literary clubs, glee clubs, and all. This whole institution is permeated and filled with all those different kinds of activities, in which these men classifiy themselves not by virtue of the subject they are studying but by virtue of their common inclination. We have fellows who form themselves into a club to visit the museum. In the summer they go out and make collections of butterflies; some of them are interested in anthropology; others find here a lot of other fellows who are studying about our government, and they will go into those clubs. If they stayed out in their own district they might find two or three fellows; here they are always sure to get 25 or 30. We encourage that by giving no money ourselves. We say, 'If you want that and really believe in it, you believe in it enough to pay up your fee which supports all these activities.'

This kind of education is recognized as developing social and civic spirit as well as industrial profits; and we encourage our fellows to stand for public office in the city. I suppose 10 officers of the outlying boroughs are our own graduates. Every school has its course in civics; even the girls there have been studying their relationship to it. We think the time has come when the women must have an appreciation of what their civic duties are, and we encourage them in that direction. That is what we mean by widening their household interests and stimulating their imagination. That is a thing which ought never to be neglected or small, because you are interested in the plan of increasing the productivity of the hand.

Discussion of Economics, Civics, Etc.

MR. SIMPSON: In your course of civics do your boys study the development of the Trades Union movement?

DR. HAMERSCHLAG: Yes; not only that, but in civics and economics they have constant debates, and we frequently bring in men from both sides. We get a business man to give his view; a corporation leader to give his side; and a socialist leader to give his side—not at big classes and mass meetings, but where there is intimate discussion. Then we go to this point also—we speak of the philosophy of industrial economics, discussing the piece system, the output system, the wage system, the day rate, the month rate, the industrial accident liability insurance, the question of pensions—that is usually the hardest discussion of the year, whether the pension for the employee is a right or a privilege, and out of which side of the cash drawer it should come, and where it is actually deducted. These are the live topics before these fellows for discussion, because we believe that is the only way we can open their minds. It is an interesting thing to notice sometimes the reactive forces which take place; a man who is arguing in favor of one condition finally gets into a place where he is arguing on the other side. It takes a pretty able man to keep the logic of his argument constantly on one side of the question where you have a lot of young fellows, all eager, all interjecting their questions. We have had some very interesting experiences in that direction.

SECTION 4: MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

Information obtained in "Conversation" with PRESIDENT MACLAURIN.

This Institute (familiarly known as "The Tech."), the Massachusetts Agricultural College at Amherst, and the Worcester Polytechnic, are the only three institutions of higher technical education receiving help from the State of Massachusetts. The Polytechnic has a course parallel to that of the Institute, but nothing like the equipment, and confines its work to Civil, Electrical and Mining Engineering, receiving about $15,000 a year. The Agricultural College, founded about 50 years ago, is now entirely supported by the State, receiving

$50,000 yearly. It has a farm, but its work is not nearly so extensive as that of Wisconsin and some of the Western Colleges. Massachusetts' share of Federal grants under the Morrill Land Grant Act was divided, two-thirds going to the Agricultural College and one-third to this Institute, which agreed to keep away from Agriculture and Forestry.

State Aid and Early Work.

For the last 20 years this Institute has been getting $25,000 a year from the State, but beginning in 1912 it will receive $100,000 yearly for ten years, in view of the special problem of moving to new site, building, etc. The annual expenditure is $700,000. The Institute gets nothing from the Government for research, and has no direct dealings with the Federal Government in connection with the Morrill Act, the money from that source coming to the different States, which apportion it. The amount is gradually increasing, as it varies with the value of the land. The two Acts under which the Institute has been receiving money from the Federal Government through the State of Massachusetts are the Morrill Act of July 2, 1862, and an additional Endowment Act of Congress, August 30, 1890, but the Institute is not in any sense a State institution except that it gets this $25,000 to $30,000 from the Morrill Act. The State has representatives on its Board of Trustees.

The Institute began just 50 years ago in a very small way with 15 students and 5 instructors in the present building. In those days the courses were not really technical. It had a few courses in Chemistry and Physics, really only scientific courses. They had a very clear idea of building up a Technical Institute, but the Civil War broke out only a few days after the Charter was signed, money was hard to get, and the time was not opportune for founding such an institution; so they went along very cautiously for a number of years and had very small numbers. As soon as they could finance even in a very modest way they started to have somewhat definite schools, beginning with the old well-established Civil Engineering and Mechanical courses. Then in a year or two they formed a Mining course. They ran along like that for quite a while.

In addition to ordinary Engineering courses the Institute now gives courses in (1) Public Health, (2) Architecture, (3) Ship Building.

How the Public Health Work Began.

All along they had done a good deal of Chemistry, and it so happened that they got men who were interested in the application of Chemistry to problems of Sanitation and Public Health, etc., and began to specialize along those lines. That ultimately led to the establishment of a special course called Public Health, which has come to be a very important field of work for the Institute, in which it gives a degree. It has been found that they can do work which apparently the Medical Schools cannot do as well. There is a tremendous demand all through the country for men trained in the Engineering School who add to a certain amount of engineering knowledge the necessary amount of Bacteriology, Chemistry, etc., required to administer Public Health Departments in the various

States. For every graduate in those courses places could be got for ten. Every new city is always wanting something done by administrators of Health Departments, men to put down proper sewage systems, etc. The Department is not very large relatively to the others, but has grown very important. It has been helped by the liberality of private benefactors. An anonymous woman takes a great interest in it, and has given a great deal of money each year for investigations and research into certain problems of public health. An experiment station in sewage disposal has been established, and there for many years researches and experiments have been made into various methods of disposal and treatment of sewage, etc. Extremely important work has been done, which is known in Germany and England, and men come from there and from various parts of the United States to learn about it.

Work in Industrial Chemistry and Research.

The work in Chemistry began along stereotyped lines, but it was realized that it was better to get in touch with industries and find why there was not so much chemical industry in the United States as there ought to be, and how the Institute could stimulate it. The first thing to do was to get hold of first-rate men. One was brought from England and one from Germany, and a large department has been built up, comprising between 50 and 60 professors and instructors. A very important part of the work has the definite aim of keeping in touch with the industries of the country. In order to do this, students every year organize at their own expense summer excursions for six weeks, and visit industries all over the country as far west as Chicago, spending three or four days in various works.

More important than that in some ways has proved the expedient of establishing a series of laboratories to undertake experiments for different chemical industries. This has proved extremely valuable both to the Institute and to the industries. Those laboratories are maintained by the industries, but there is no direct profit in it to the Institute. Agreements have been made with the DuPont Powder Company, what is known as the "Powder Trust," the United States Steel Corporation, Edison Electric Company, General Electric Company, Arlington Cotton Mills, and a great many large Corporations to undertake for them the routine work of research, which is done in the Institute. For instance, the Powder Company find some difficulty in the manufacture of some particular kind of explosive; their own men have tackled those problems but have not found a solution; so they agree to pay so much a year for the Institute to do that work, being charged only the actual cost of investigation, salaries, running expenses and materials.

Graduates and Research Problems.

The Institute now has a staff which practically does nothing but that work; and it has been found especially valuable to put young graduates at those problems—it gives them their head. If they make a successful hit they get in

touch, for instance, with the Steel Trust, who usually write to the Institute to send a representative. The Steel Corporation in manufacturing particular metal sheets could not get a uniform product; perhaps five out of every hundred sheets would be different, mainly in color, from any other sheets, although all were similarly treated, which meant that 5% of their product was lost, because they could not sell it in that form. They puzzled over it for a long time, but could not make it out, so they asked the Institute to investigate that problem, and after working two or three years the Institute men ultimately straightened it out. Another problem is that of corrosion of various metals, why they rust, and the proper way to prevent rust under different conditions—a large problem because of such a variety of conditions. That involved really years of research, and is not finished yet. The Powder Company have similar problems.

Saving $300,000 a Year.

The Gorham Company in Providence, R.I., making what is called sterling silver, have problems of annealing which have caused very much trouble for years, but which the Institute men attacked very successfully, saving by that single investigation about $300,000 a year not merely to that company but to a group of companies interested. The Institute received no direct benefit at all except the cost of the investigation, part of its policy being not to charge for such things. The professor who had charge of that investigation was and still is a teaching professor, but the research part of his work has become so important that the teaching has slipped into the background for lack of time.

When the department of Physics was started 30 years ago there was no such thing as Practical Electricity, Dynamos, etc., and this was the first institution in the world to establish a department of Electrical Engineering. The Institute is always having pressure put upon it to establish some new thing.

Training Foremen in Evening Classes.

In the early days of the Institute it was thought necessary to cater for foremen, but it was afterwards found that it had to have a definite aim, which is now to prepare for the Engineering profession.

Although the establishment of evening courses for training foremen was of no direct benefit to the Institute, yet it freely loaned its building and apparatus and actually supplies instructors to the Lowell Institute, which conducts these classes and pays instructors extra remuneration for their evening work out of its own funds. These classes have about 100 students training as workmen, foremen and superintendents. On completion of a 2 year course graduates may enter the second year of the day class. About 10 are now taking advantage of this plan.

This evening instruction work is voluntary on the part of the Institute professors. The older men do not care to give up their evenings, but most of the younger are quite glad to undertake it, find it very interesting, and are mostly quite enthusiastic about it, as it brings them in touch with keen men who on the

practical side often know more than the instructors. The authorities encourage this, because it helps instructors to keep in touch with actual conditions in practice, which the history of the Institute shows is the key-note of success.

VISIT TO THE INSTITUTE.

There are 1,600 students paying $250 each, but each man costs the Institute nearly $400 a year, counting administration, teaching, fitting and upkeep of laboratories, but nothing for plant or upkeep on buildings. The authorities, afraid the school will grow too big, keep it as small as possible by sifting continually on entrance and during the 4 years, so that graduates are not more than a third of the men who enter. At the end of the first 5 weeks all freshmen are examined, their marks tabulated on large sheets and set up in a room where all their instructors meet and discuss the men's work, pass certain votes, and report on work which is "unsatisfactory" or "very unsatisfactory." If the student does not improve he will not be allowed to remain until the end of the term. These reports are sent to the faculty and adopted *en bloc*, and parents are notified. Five weeks further on there is another examination and the same thing is done, only in a more serious form—the whole faculty decides on the marks. If a man's marks show that he is not able to do the work, or if in the opinion of the instructors he could have done better work but will not, he is required to withdraw. This seldom happens at the end of the first term unless his work is exceedingly bad. He is allowed to go on for 2 years with warnings in the form of votes of the faculty and notices to his parents. Out of a class of 400 under this system there would be about 10 required to withdraw each term, or 80 in four years. Some have to withdraw on account of failure of resources, etc.

Features Noted by Commission.

The following features were noted:—(1) Entrance Examination of high grade including English, French and German. (2) English Composition and Chemistry are stressed in first year's course. (3) Correlation of Chemistry with the industries in subsequent years. (4) Special Research Laboratories for the Industries under separate staff.

Of the 1,600 students, 185 come after complete courses in the colleges, or after two or three years; those men, after examination, are placed higher up. French and German are required for matriculation. English Composition and Physics are given in the first year, very well-educated individual instructors being employed, so that each student can have a quarter of an hour. The aim is that the men have an idea of English as a collateral subject. The men who teach English also act as advisers to those students, who are encouraged to talk to their adviser on all subjects, hence a confidential relation grows up between them. Students are divided according to ability, in the sections. The student has class room and also individual work. The instructors are changed in the term. There are very few special students, and these are mature.

School for Industrial Foremen.

Those who are deficient in education or come for only one subject, such as drawing, are discouraged not only for lack of room but because the slower men in the section would carry the standard down. A man who has taken the Scranton course but who has not the standing for entering is rather discouraged, as it is not the wisest way to spend his money, the Institute's position being so much higher; but in the evening the School for Industrial Foremen already referred to, which is absolutely free, uses the laboratory. The Institute instructors use the same laboratory, but conduct the course in a different way, as those men, about 100, take the 2 years' Mechanical or Electrical course and get a certificate for industrial work, not a degree, as they do not require the same standing.

Various Training Features.

In the Architectural Dept. there is a fine collection of photographs, classified; an excellent collection of books and students' drawings. In this course a great deal of Freehand Drawing is given on the board to develop the artistic side. The teacher is a "Prix de Rome" man. Students get a course in history of civilization; proper coloring; work with pencil, pen and ink; throughout the year a large amount of freehand drawing. All the students get freehand drawing the first year; the Architects get a little more after they have decided on their course.

The Institute does not charge fees to manufacturers for tests nor give certificates of such, the making of tests being a perquisite of the professors of Engineering, who sometimes earn more fees outside the school than within. The experience with practical problems is helpful to students, and also brings them in touch with the manufacturing community, besides giving the professors an opportunity of placing students, who are thus able to get a living wage from the start.

Special Manual Training work is required in all 4 years. No set pieces are made, but all principles are fully taught, and in each course a very full line of types is covered, practice being given on all the things that can be made with saw and chisel.

Director Smith of the Manual Arts Department claims a very distinct superiority for the laboratory method of teaching principles, and says that when the student gives his whole time to the work he can turn out a thorough mechanic in six weeks.

The material from Prof. Della Voss' Technical School in Russia which was exhibited at the Centennial Exposition in Philadelphia in 1876 is in possession of this Institute, whose faculty was the first in the country to start this branch of work.

COURSES AND DEGREE.

Only one degree is given for all graduates in whatever Department—that of Bachelor of Science.

FOUR-YEAR UNDERGRADUATE COURSES.

Regular Cour es of Study leading to the degree are offered in:—

Civil Engineering, Mechanical Engineering, Mining Engineering and Metallurgy, Architecture, Chemistry, Electrical Engineering, Biology and Public Health, Physics, General Science, Chemical Engineering, Sanitary Engineering, Geology and Geodesy, Naval Architecture and Marine Engineering, Electro-chemistry.

In most of these Courses distinct Options are offered in the later years which enable the student to concentrate more of his attention upon some one side of his profession. In no case, however, is the specialization carried so far as to preclude a thorough training in all the fundamental branches of the subject. The more important of these Options are as follows:—

Civil Engineering.—1 Hydraulic Engineering, 2 Railroad Engineering.

Mechanical Engineering.—1 Marine Engineering, 2 Locomotive Construction, 3 Mill Engineering, 4 Heating and Ventilating Engineering, 5 Steam Turbine Engineering.

Mining Engineering and Metallurgy.—1 Mining and Metallurgy, 2 Metallurgy, 3 Mining Geology.

FIVE-YEAR UNDERGRADUATE COURSES.

These Courses leading to the degree are designed to meet the needs of 3 different classes of students:—(1) Those who wish to complete in 5 years the work of 2 allied Courses; (2) Those who wish to combine with the work of a single professional Course a larger proportion of humanistic studies and of work in general science; (3) Those who wish to distribute the work of a single Course over 5 years without undertaking additional required studies.

For all 3 classes the foundation is a common 5-year schedule including all the studies of one of the professional Courses, the difference lying in the use of the free time not assigned in this schedule. In all cases, moreover, the work of the first year is identical with that of one of the regular 4-year Courses, thus affording the student an opportunity to base his choice on a year's experience and on conference with members of the Faculty.

COURSES FOR TEACHERS.

To teachers and to persons of mature age engaged in technical pursuits, and wishing to devote some time to scientific study, the Institute offers the amplest opportunities in its lecture-rooms and laboratories. Such persons may in general be admitted without formal examination, on satisfying the Faculty that they are qualified to undertake the work proposed. They will be expected after admission to attend the same exercises and examinations as other students.

CIVIL ENGINEERING COURSE.

This Course is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based. Particular care is taken to enforce the application of principles taught; the student is made familiar with the use of engineering instruments and the usual problems of practice.

Civil Engineering is the broadest in scope of the engineering professions, being the parent stem from which have diverged all the other branches; but, even though these have become recognized as distinct professions, the field of Civil Engineering still remains so large that no one can become expert in its whole extent. It covers Topographical Engineering; the building of railroads, harbours, docks, and other works serving the purposes of commerce and transportation; Municipal Engineering, including the construction of sewers, waterworks, roads, and streets; Structural Engineering, including the construction of bridges, buildings, walls, foundations, and all fixed structures; Hydraulics, the development of water power and other branches. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class-room, the drawing room, the field, and the testing laboratory.

In the comparatively advanced work of the fourth year the student is offered a choice between two Options or lines of study; namely, a general Option in Civil Engineering, including the study of Hydraulic and Sanitary Engineering in considerable detail, and an Option in which more than usual attention is devoted to highways, railroads, and railroad management. Students desiring to pursue in greater detail the study of Geodesy and Topography are offered opportunity to do so.

MECHANICAL ENGINEERING COURSE.

This Course aims to equip the student to deal with general engineering problems from the most favorable standpoint.

Courses are given in the class-room, in the drawing-room, and in the Engineering Laboratories, the object being: (1) to give the student practice in such work as engineers in the pursuit of their profession are called upon to perform; (2) to enable him to base all his work upon some principles, not upon empirical rules; (3) to teach him to perform original investigations; and (4) to enable him, by means of a thorough familiarity with both the theoretical and the practical aspects of his business, to deal intelligently with other men.

Mathematics, Physics, and Applied Mechanics are given, the last including the study of the Strength of Materials, with practice in testing.

The recitation-room work of the Department begins with the study of Mechanism, the construction of gear-teeth, and courses on valve-gears, and the mechanisms found in machine-tools and cotton machinery. Courses are given on Thermo-dynamics, Steam Boilers, and the Theory of the Steam-engine; also upon Applied Dynamics, Hydraulics, Hydraulic Motors, Foundations, and Industrial Management, the last involving a study of the organization and the relations of the various departments of an industrial establishment, and the determination of costs.

A course in Machine Design is also given in the fourth year, the main object of which is the applications of principles already learned to the solution of problems in design. In the fourth year, also, the student is offered the option of courses in Marine Engineering, Locomotive Construction, Mill Engineering, Heating and Ventilating Engineering, and Steam Turbine Engineering. Instruction in Drawing extends up to the end of the third year, and its aim is to teach the proper way of making the necessary dimensioned drawings, tracings, and blue prints for use in practice. Instruction is also given in the design of gear-teeth, valve-gears, and other mechanism designs.

The instruction in the Engineering Laboratories in its earlier portions is devoted to giving the student a drill in such experimental work as an engineer has constantly to perform, such as boiler tests, engine, etc. The latter work and the thesis work take very largely the form of investigation.

MINING ENGINEERING AND METALLURGY.

The demands made upon the mining and metallurgical engineer call of necessity for training in a great variety of lines. The policy of the School, accordingly, is to give him the underlying principles of Mathematics, Physics, Chemistry, Mineralogy, Geology, Mining Engineering, and Metallurgy, as well as some practical knowledge of Mechanical, Civil, and Electrical Engineering. Thus equipped, he can after graduation take up specialized work, with the expectation of carrying it on successfully.

Beginning with the second year, 3 optional lines of study are open to the student. With the studies included under the first Option the Course is a general one, adapted to the needs of students who prefer not to make an immediate choice between professional specialties. Those who have not a serious reason for doing otherwise are advised to take this Option.

The second group of optional studies is arranged with reference to Mechanism and the Steam-engine, the time necessary being taken from Surveying, Geology, and Mining Engineering. This Option is adapted especially for the iron and steel metallurgist. Option 3. is identical with Option 1. up to the middle of the third year, and is arranged to meet the needs of students desiring to devote themselves especially to the geological side of Mining Engineering, or to join the National Geological Survey or one of the State Geological Surveys along economic lines.

Valuable opportunities are offered for observation and field work in the Summer School of Mining and Metallurgy, and in mineralogical and geological excursions, as well as in the ample laboratories of the Institute.

For students able to devote an additional year to professional study, subjects for an Advanced Course of one year, which may lead to the degree of Master of Science, have been arranged. In view of the various demands likely to be made upon the professional mining engineer, such an extension of the Course offers peculiar advantages, even if taken without the intention of obtaining a higher degree.

CHAPTER LXVII: DRAWING, DESIGN AND ART.

SECTION 1: INTRODUCTORY.

Two problems in Art, relating to the school work from elementary up to and including High School grade, call for solution:—

(1) How to introduce Drawing, Design and Art in the lower grades and carry it logically through until it diffuses good taste and develops into the elements of Designing and Mechanical Drawing, requiring comparatively little additional training in technique in order to be available for manufacturing and constructive industries.

(2) How to co-ordinate the courses of study so that the so-called new subjects —Manual Training, Domestic Science and Nature Study —may have full opportunity for development along with Drawing, Design and Art, while at the same time the so-called cultural (literary or academic) studies shall not suffer but become more effective.

These two problems are fundamental to all technical training; for on all sides it is conceded that any system of Industrial Training and Technical Education must be based upon a foundation laid in the elementary schools. If the elements of Art, namely, Freehand Drawing and Designing, are lacking in the lower schools, we may look in vain for original designs for our manufacturers, and will remain in the position of the stove manufacturer who in his evidence in Toronto complained that he must slavishly copy American designs because he could get none in Canada. So, also, if the new hand-and-eye subjects cannot have full scope in our schools we shall flounder in the quagmire of fruitless effort, of book-learning unrelated to the world's insistent cry for workers.

The Key to the Problems.

In Art, that little-understood and often despised hand-maiden of Industry, we may find the guide and teacher who will bring into organized relation all the separate elements, making them work together for the common good. The key to the problem is found in the close relation of the school to life. Art, in broad terms, is the expression of man's thoughts, feelings, experiences and aspirations.

Industry, invention, tools, processes, machinery and art-expression in myriad forms being among the agencies which man employs to advance civilization, the measure of success in education, and especially in Technical Education, will be the manner in which the forces, movements and expressions are made

familiar to the young and the methods by which academic and manual work, art and industrial work, are blended in school experience.

The whole effort must be to make the school blend with life; make it serve the interests of life; and make the pupils ready to step out into responsible, conserving and contributing life.

Art in Rural Schools.

An example: Many of the drawings of weeds, etc., which appear in print in connection with a monthly nature-study publication are made by the children of one American school. This question was put to the Nature Study teacher who writes the articles referred to:—"Assume a one-roomed Canadian rural school with 20 children taught by a 19-year old girl who has had six months' Normal training, in the course of which she got practically no Nature Study, having had very little of that in the High School, but who can use her pencil in drawing, could such a girl help her students in the matter of agricultural instruction if she took up simply the weeds and taught the children how to draw them?" After long reflection he answered, "If she could teach the children to draw the weeds, she would give them the elements of agriculture, for they could then draw all the grains and flowers, and would be interested in studying them."

Another example: Mr. O. J. Kern, School Superintendent of Winnebago County, Illinois, for 10 years, in beautifully printed and illustrated reports, themselves works of art, has emphasized outdoor art for country life, the beautifying of school grounds and the improvement of buildings; also indoor art, school sanitation and decoration, travelling libraries, art exhibits, pictures, etc.

To stem the drift toward city life he claims that it is money well spent to make the school-house and everything about it attractive and beautiful. Here is one of the centres of the life of the community—the one in which is gathered its most impressionable element. The school is supported at public expense in order to make good citizens. It aims at securing the highest possible development of mind and character. Every element of order, neatness, and beauty, every broadening of influences, every appeal to the finer nature of the child, means better men and women and a more prosperous and attractive community

Supt. Kern argues that country school grounds should set forth the highest ideals and influences of the countryside; this will help to spiritualise country life and agriculture. "Are we dreamers," he asks, "if we contend that the glory and beauty of country life, as well as the vision of larger yields of corn, may help the young men to decide for the farm? A glorified life on an 80 acre farm may be as valuable a national asset as a bin of high-bred corn testing 20% protein. Who knows?" He emphasizes the importance of Arbor Day planting, and shows by illustrations of trees and shrubs and photographs of artistic sur-

roundings of large manufacturing buildings, how profitable, educationally and commercially, is outdoor beauty.

Definitions of Drawing, Design and Art.

In the Year Book for 1903 of the Council of Supervisors of the Manual Arts, the following definition is given of what Art is:—

The term ART in its broadest sense may include almost the whole voluntary self-expression of the race. The modes of utterance through which man expresses his thought and feeling are language, music, gesture, construction, painting, sculpture and the other "arts." The natural instrument of expression of form and color ideas is the hand.

"FINE ART is the free and adequate embodiment of the idea, in a form peculiarly appropriate to the idea itself." (Hegel).

THE MANUAL ARTS are, and always have been, the natural modes of expression in many lines of useful knowledge, and for some of man's highest thought.

The Educational Values of the Manual Arts in the Development of the Child are thus stated:—

The child learns to know the world by making and doing, by tactile and visual percepts, through actual experiences to self-realization. The development of any faculty is in direct ratio to its employment; self activity must be the means of the child's growth. The work of the child's hands must express the living interests of the child. The manual arts give play to the instinctive tendencies of the child's life. Civilized human beings are compelled to be artists; man is constrained to express himself in form and color whether he will or no, as in dress and furnishings.

Finally, drawing, painting, modelling and making, including the designing, constructing and decorating of useful articles of whatever kinds, in paper, wood, metals, textiles, or pottery, may fulfil in the highest degree the natural conditions of self-activity.

The demand does not involve the idea of preparing for trades or "making artists;" it is based on the nature of the child and the general principles of education.

"What we need is more kinds of ability, not more kinds of knowledge." (Hadley).

Art Study is related to social activity in the school and social sympathy in the adult. It is the business of the school to develop social activity, and the Manual Arts are particularly well adapted to this development, besides forming a link between school and home.

We need the study of the Manual Arts for the sympathetic comprehension of our race. Only through such means man becomes broadly socialized, or identified with his race. Art Study thus viewed acquires a profound moral significance.

Industrial Art lies at the foundation of manufacture. The knowledge of design has high commercial value. Thus taste combined with skill is an important basis of national wealth. The welfare and happiness of the commonwealth demand that the State be equipped with skilled workmen, and take its place in supplying the world's market. The foundations of such education must be laid in the schools.

Art is a condition and result of contentment in work. Happiness arises through the natural exercises of the powers. The desire for self-expression and the expression of the beautiful are instinctive. Contentment in labor is largely conditioned on the possibility of exercising these. Self-expression and beauty are also a result of contentment in labor. The Art in a thing is "the expression of man's pleasure in successful labor". (Morris).

Since the majority of men cannot get these conditions in their labor, it must be supplied in their environment. Contact with the beautiful in nature and art is indispensable together with the opportunity for self-expression. It is incumbent upon the State to prepare the condition essential to the happiness of the workers. Art education is necessary for the achievement of these results, and it must begin in the public schools. Hygiene and economy demand that children be kept happy in their school work.

"The aesthetic view of life is the necessary complement to the scientific. It is the constructive imagination (identical with the poetic faculty) to which we are indebted for the generalizations of science as well as for all real art. The training of the constructive imagination is far the most important part of education". (Eliot).

Liberal education demands both the intellectual and aesthetic points of view. The arts subjects represent the aesthetic point of view in education. The Art idea is inseparably related to the happiness and efficiency of the members of the commonwealth.

SESSIONAL PAPER No. 191d

SECTION 2: SCHOOL ART IN CINCINNATI, OHIO.

Art work begins in the Kindergarten, the object being to encourage the children to express themselves regardless of technique, which is not developed until the 4th grade. There is a very careful course in manual gymnastics which develops the hand and gives muscular control. White chalk is used on the blackboard, the pupil turning the piece of chalk sideways to produce "mass", the object is to emphasize mass and thus enable the pupil to see in the result the solid thing, and to think of all the "content" of the "mass" instead of mere outline. The periphery is formed by enlarging and defining the mass.

Control of the hand is needed in the young, and this can be got by drawing large objects. Blackboard work does not lead to fluent movement, on account of grit in the chalk; charcoal on paper in making large forms gives better results. Art Supervisor Vogel considers the brush ideal, because it gives both mass and fluency of movement, and does not require much muscle. He is not looking for power in muscle, but for control. Although clay modeling was discarded in the first two grades because teachers objected that children became soiled and desks and floors dirty, and because of fear that it was not entirely sanitary, Prof. Vogel believes that clay is the ideal material because actual things reproduced give permanent form. Plasticine is inferior to clay because, being so costly (25c. per lb.) the material must be restored to the original lump.

Nature Study Through Water Colors.

Nature Study is developed almost entirely through the medium of water colors. In the Fall and Spring, Nature Study takes up almost the whole time devoted to Drawing and Art. As soon as possible each child gets an individual subject on his desk, a flower, a plant, a vegetable or fruit form, a piece of wood or vine. There is a personal feeling in regard to the plant that rests on the desk, a feeling of ownership, a closer intimacy and relation between the student and the subject; thus the student sees more and is led to report more in his painting. The pupil studies the plant or specimen in detail, and also has the problem before him of properly relating it to his sheet of paper as to shape and arrangement—practically a problem in artistic "composition" which he himself must solve.

In grades 6, 7 and 8 some conventionalizing is done—enough to prepare pupils for this and for design work when they reach the High School. Abstract forms are used, the suggestions involving independent results. A spirit of rhythm prevails in these lessons, and the child must feel and express it. The aim is simplicity—beauty in a few strokes; a positive, direct expression of thought without any wavering. Balance, rhythm and harmony are taught. The forms are finally colored in two tones of a single color, working up to complementary harmonies.

From the lower grades upward the elements of design are given, and in grades 6 to 8 design is taught for its own sake. In the first five grades the con-

structive work is with paper and cardboard and book covers, etc., associated with the four seasons and the holiday season. In the fifth grade strawboard is covered and used as sand scratches, calendar backs, covers for booklets, notepads, etc.

Art and Manual Training.

Pupils go direct to the Manual Training shop in the seventh grade. They first make mechanical drawings of all articles which are arranged in series, all the shops doing practically the same work except at holiday seasons. The object of making finished articles is to give satisfaction; hence chip carving is preferred to deep carving, the latter being more slow and taking more time in the making of an object.

All Art work is paralleled with the Manual Training work and where possible correlated. If the students make a Swiss broom holder, or a box, or a book frame, the Art teacher takes up structural and applied design. In the girls' department the study of the successive stages and applications of Art is taken up when the teacher requests it. In the lower grades the object is primarily to develop expression by means of various materials. Paralleling this later on is the development of original design in colors and wood.

A certain time is devoted to drawing from objects, generally pottery forms, such as vases, bowls, cups, as beautiful as can be obtained, also tinware and domestic articles. The drawing is oftentimes associated with fruits and vegetables.

In the lower grades posing work is associated with the expression work. The plan is to set a pupil before the class in a certain pose for a very short time, then let the class draw from memory, then bring the model back to test and compare results.

Art in Millinery.

In the High School, Art is related to the home, to the store or shop, the office, the street, the individual. The latter involves the study of one's wearing apparel, designs for stick-pins, etc. Girls work out problems in millinery, first drawing a design of a hat form, getting suggestions from the frame. It may not be the particular frame they are going to use, but they study the form and draw the elliptical surface; then work out the trimmings, using a piece of ribbon. If they intend to use velvet, silk or feathers they study the texture of these and make their compositions, then work out the plan in the classroom in millinery. Because they have lived this experience they have a higher conception of what they want, and the result may be entirely different in the millinery shop, because this planning in the Art Department has the same effect on the student as making three or four different styles of hats.

Sometimes young people will depart from the drawing or painting and produce an actual hat, which is brought to the Art room and used by the class as a model for object drawing.

SESSIONAL PAPER No. 191d

Art in Actual Life.

In the Art department the students work out all the decorative and instructive features, and then in the Domestic Science room they work it out in actual materials. Art in relation to the home involves the arrangement of pictures on the wall; the proper harmonizing of furniture; the different parts of furniture and their relation to certain rooms; color schemes in rooms; working out in the Domestic Science room after the sixth grade cushion covers, curtains, "throws", and other decorative features. Art in relation to the shop involves the making of articles such as furniture, machinery, etc.. Art in relation to the office involves the appropriate selection of furniture. Art in relation to the street involves a study of construction and architecture; civic art in general; yard, gardens, parks, streets, etc.

SECTION 3: SCHOOL ART IN SALT LAKE CITY, UTAH.

The Normal Training School in connection with the University of Utah takes pupils at 5 years of age into the Kindergarten, carries them on to the eighth grade (age about 13), and graduates them into the High School.

In this school, Industry and Art go hand in hand from the very beginning of the course. The little tots delight in constructing paper houses and all necessary furniture, made from cardboard, cut and folded as directed by the teacher.

The Home the Unit of Activity.

The Home is here the unit of all activity; hence food, clothing and shelter are the elements which constantly call for provision throughout the grades. The Home in the kindergarten is a weak affair made of paper; but as the child matures and develops, his ideas take on a more substantial form, and a few grades higher up we find the Home and its furniture made of wood, requiring various tools to fashion them, artistic designs for wall-paper, and painting to ornament the home; also various articles to make it comfortable, beautiful, and bright, such as floor mats woven in raffia, rugs made of woollen yarn, hammocks netted, etc.

The heads of the Home are the recipients of the chief attentions of the pupils. To the father or mother are many of the letters addressed which are used for writing practice by the little ones. For the home are made numerous articles in the workshop. To father or mother would be presented the Christmas gifts upon which hundreds of busy fingers were working when our visit was made; and on special school occasions invitations, designed, written, printed or painted by the pupils are always sent to the parents. This co-operation between School and Home is one of the vital and valuable features of this Training School; and to the constant interest of parents much of its remarkable success as a teaching agency is due. The Home as the center and pivot of the entire organization

gives coherence and meaning to all the elements and activities in the multifarious life of the little school community—its work, studies, play, projects, and performances. To use an artistic phrase, the Home is the *motif* of the picture.

Children's Individuality Sacred.

The greatest possible latitude is allowed for individuality. These teachers have travelled so far from the old dogmatic, pedantic, critical, punishing conception of teaching, that they seem to have gone to the other extreme and become too modest in control and discipline and dictation; yet under their benign administration the children grow and develop "while you wait." Their animation, their enthusiastic expression, the adding of another object or color to their art work, or a new combination of strands in their weaving, betoken active mental development. Thus woven into their brain structure never to be forgotten, will be the hand-movements, the artistic forms and the esthetic outlines involved in cardboard folding, raffia-plaiting, wool-weaving, in cord-netting, clay-modeling, wood-working, decoration with colored chalks and paints, the construction of descriptions—(in poem as well as prose)—of the flowers they have grown, the birds they have tended, the babbling brooks which have charmed them with their music, the little dramas they have written and performed in order to illustrate their conceptions of Robinson Crusoe, Hiawatha, the Utah Pioneers, or the chivalrous lords and lovely ladies of the days when knighthood was in flower.

School-Garden Work, Dramatic Reading, etc.

But the utilitarian is not overshadowed by the esthetic, for here "Nature Study with a School Garden" is featured very strongly. The pupils cultivate a 10-acre plot, and from one season's diligent and intelligent culture they made a revenue of $250, which was used for school improvements. They have built an arbor surrounded with creeping vines, not merely providing a cool shelter but encouraging the botany instinct.

Text books and set subjects are merely incidental, subordinate elements here. Reading takes dramatic form when possible. The Commission saw four children reading (dramatically) a story from "Alice in Wonderland" holding the book in one hand, but "suiting the action to the word."

In the highest grade some books are regularly used —speller, arithmetic, geography, history and reader—in combination with lessons prepared by the teachers and printed at the school printing plant. Activities such as sewing, cooking, weaving, etc., call for many words more or less technical, not found in ordinary spelling and reading books, and these are provided on special sheets. Much of the history and the industrial material is obtained from magazines and supplementary reading books.

The students are continually winning first place and distinctive honors in competition with scholars of their own age who are taught by ordinary methods. The Principal finds by actual experiment that as he increases the work in the Manual Arts (now occupying nearly 50% of the school time) he makes the pupils more proficient in academic studies. This is not remarkable in view of the fact that if you thoroughly interest a boy or girl in a piece of work you start a whole flood of thinking and reading and discussion on that line. Thus the workman becomes educated through work, both by the unseen process of brain-building and by his own active efforts in acquiring knowledge.

Art as Hand-Maid of Utility.

Through all the grades, Art is treated as an expression of thought, and the children are encouraged to express themselves, though in ever so weak a way. The thought that calls for expression may be suggested by reading, by a lesson in history or geography, by observation, by nature study or domestic science, by occurrences in the school or at play or work, by a passing public event, or the arrival of a special season of the year.

But Art is not allowed to soar; it keeps close to the ground and to the dictates of utility. Articles are made for the home; presents for mother and father; benches, sand-boxes, arbors, etc., for the playground. The element of timeliness is also present. At Christmas season all the children make gifts for parents; room decorations represent Christmas bells and mistletoe; wall paper is designed of conventionalized holly leaves; the reading lesson, written neatly on the blackboard, is the story of Bethlehem, etc. The thought running through all the work is that articles and pictures made must be useful, timely, interesting, beautifully suggestive.

Keeping School Close to Industries.

The industries are closely related to the school life and work. In the lower grades the teachers have beautiful pictures, some in colors, collected from magazines and elsewhere, showing harvest scenes, mining, milling, etc. Then the trades and occupations are shown—firemen, light-house keepers, fishermen, sailors—men who risk their lives for the good of society. These pictures are used as the basis of talks and questions by teachers, and of drawings by pupils, who also represent the scenes or actors in clay, paper, wood, by compositions in prose and verse, or by dramatic representation. The making of the firemen's helmet in paper is one of the features in the lower grades. The talks and the readings are calculated to impress upon the children an idea of the great service rendered to the community by toilers in various occupations, especially hazardous ones.

The spirit of brotherhood is developed by children making little grinders and sifters, and with these removing the bran from wheat and making little loaves of bread, thus getting an impression of the pioneer's difficulties. During the visit of the Commission a "Pioneer Supper" was cooked entirely in the Domestic

Science Department, and the children served their visiting parents with a menu peculiar to the early days of the State. The children grow popcorn in their school garden, then prepare it in the Domestic Science Department and send it to the Orphans' Home.

Visit to a Bakery.

The pupils visit factories and give their impressions in cut paper, in drawings, in clay, in wood, and various other ways. In the Commission's Exhibit of Drawing and Industrial Art is a series of sketches in color made by these children in the second grade, giving their impressions of a bakery after a visit to one. The baker was delighted to have the children visit his establishment, and he made it interesting to them by giving them a treat. All the manufacturers are pleased to have visits from pupils.

Each grade is entitled to decorate its room in its own way; thus no two rooms are alike. In the 5th grade room the wall was covered with plain paper which was decorated by the children in colors, making a very good imitation of wall paper in a conventionalized pattern. In other cases walls are covered with friezes, some of them highly ornamental, and others descriptive of some historical period—Colonial scenes, the landing of the Pilgrim Fathers, the "Mayflower," or a Dutch pattern with windmills, canals, etc. Some of the older scholars were furnished by the printing office with beautiful printed mottoes, space being left for the initial letter, which was filled in by the scholars themselves in colors. All the rooms have plaster casts representing art and art concepts.

Technique only after Struggle.

The principle of giving formal information and instruction only when it is called for by the pupil is worked out to the limit in this school, especially in the Art department. The little tot has seen, felt or thought something which it wishes to express on paper, but the child has not learned its A.B.C. or how to write the letters; so how can it put down words? It has not learned to draw, so how can it make artistic lines? The teacher, who holds that feeling is the foundation of Art, and that technique is subordinate, tells him to go ahead and do his best; perhaps after discussion of the idea she may suggest the form which the drawing should take. Then the child begins to struggle, and the result would be pitiful if it were not so hopeful of what he will do when he has learned the alphabet of Art. Some of the clay modeling bore striking evidence of lack of instruction in technique, for while the figures expressed their general contour as to dress and attitude, they entirely lacked facial features—the young artists evidently being afraid to venture on such difficult ground.

The use of Art as thought-expression without attention to technique at the start was defended by the Principal, who argued that children when they start do not know that anything is difficult, and would undertake to draw a flock of angels for a Christmas card just as readily as they would draw a chair. When they discover their need of technique they get it, but not before. He was very

much opposed to over-stimulation, over-strain. "We will do it when we get to it " were his words.

He was opposed to too much interference by the teacher with the possibilities of the child. "We surround the child with the thing that will stir him up to do something that we want him to do, and let him come out himself rather than pull him out."

SECTION 4: SCHOOL OF INDUSTRIAL ART, TRENTON, N. J.

This is a model type of institution for a comparatively small city (96,815). It was established in 1898 under the State Industrial Education Act of 1881 and is housed in a beautiful 5 story building donated as a memorial; land and building are worth $140,000. It is managed by a Board of Trustees and an Advisory Board of 8 representives of manufacturing, railway, financial, ceramics, silverware and artistic interests. The staff comprises a Director and 20 artists, designers, chemists, electricians and craftsmen.

Day and Evening Courses : Frechand Perspective, required of all candidates for Fine Art diploma; Light and Shade; Elementary and Advanced Antique; Painting; Elementary Art; Designing; Modeling; Figure Composition; Artistic Anatomy; History of Art; Mechanical Perspective; Sketching Costumed Model; Bookbinding and Metal Working.

Juvenile Day Classes supplement children's work in public schools; the course extends over 8 years, each year devoted to some one branch of Art.

The Bookbinding Department has enlarged its scope to cover elementary bookmaking, portfolio work, boxmaking, etc.

The Metal Working is in copper, brass, silver and German silver. Elementary work in flat or repoussé, raised or bowl forms, etching, piercing, hard and soft soldering, is followed by advanced work in enameling, engraving, stonesetting and craft jewelry working, including fobs, buckles, stick-pins, pendants, etc. Craft classes are organized as necessary.

Evening Classes cover the same ground as the Day Courses, excepting juvenile work and some minor classes.

The school believes no training is so necessary for the architect, designer and modeler as drawing from life; but students are required to prepare for this, which they generally do by spending two years (two nights weekly) in the Antique Class.

The Ceramic Design Course, in co-operation with modeling, enables the students to design forms, turn them, apply decoration in relief, make moulds, etc., and apply glazes. The school operates its own kilns. Silverware Design is also taught in this class.

Building Construction, planned primarily for carpenter and mason apprentices and journeymen, is treated practically; it includes drawing of cellar, floor and framing plans and details of construction, and instructions in laying out work. Class-room is equipped with carpenter's bench and tools, and practical demonstrations supplement the drawing. Blueprints are much in use.

Mechanical Drawing Course, carefully planned, embraces use of instruments, lettering, principles of projection, intersections and development of surfaces, and their application to practical problems. When the student's progress warrants, the course is extended and enriched with special reference to his daily vocation, including also mechanism and machine design.

Architectural Drawing and Design cover study of plans and elevations, and full-size details of construction.

Thorough training is given in *Arithmetic* as applied to shop work and building trades; an advanced course covers algebra, geometry and trigonometry.

Commercial Illustration and Ornament are thoroughly studied.

The Chemical Course includes lectures, experiments, recitations and individual laboratory work on principles, laws, formulas, etc.; analysis; study of clays, glazes, oils, iron, steel, chemistry of photography, etc., with such research work as students' abilities and equipment permit.

Course in Electricity supplements daily work of men engaged in electrical trade. Much attention is given to the use of architectural drawings in laying out wiring for houses, etc., with wiring diagrams.

Ceramic Chemistry deals with ceramic raw materials and their chemical constituents, body making, raw materials of glazes, glaze making, manufacture of ware, drying, decorating and burning, kilns, fuel, ceramic formulas, terra cotta, earthenware, majolica, porcelain, bone and spar china, etc.

English Composition is taught so as to enable men to handle correspondence and prepare intelligent and readable reports of investigations.

Household Art Course covers dressmaking, millinery and home decoration.

This school prepares teachers of drawing for public schools by courses in drawing, painting, designing and modeling, while the State Normal School, located in Trenton, gives them the science and art of teaching. Those completing this four years' course receive public school teaching certificates good for ten years, renewable or exchangeable for life certificate after two years of successful teaching.

Museums and Exhibitions contain special collections of china. Besides reading room and good working library the city public library is very strong in fine art section. Numerous prizes are offered to students.

All students pay enrolment fee, $2; $10 per year additional for day classes.

SECTION 5: RHODE ISLAND SCHOOL OF DESIGN, PROVIDENCE, R.I.

The population of Providence is 225,000, chiefly manufacturing.

The objects of this School are:—

(1) The instruction of Artisans in Drawing, Design and Modeling, to enable them to apply the same; (2) The training of students in the Practice of Art; (3) The advancement of Art education by means of exhibitions, lectures, etc.

Day and evening classes are held, and a Saturday morning class for children aged from 6-16.

The school is supported by voluntary effort, and is entirely separate from the Public Schools. The City of Providence gives 75 Scholarships for evening

classes, amounting to $500 in all, and the State of Rhode Island gives $2,000 annually in Day Scholarships. Other Scholarships are furnished by private individuals, Art Clubs, etc., and several of the large manufacturing firms give Scholarships to their employees.

The local manufacturers heartily co-operate with the school and give it their support in every way.

The attendance at the evening classes is larger than that in the day time—workmen from the various jewelry and other firms coming to improve themselves in their special branches. Diplomas are given in 8 departments of the evening classes to those pupils who satisfactorily complete the course. All branches of industry are represented—printers, advertising men, jewelry workers, mechanical men, workers in textile mills, weavers, designers, etc. The Textile Department is well equipped with hand and other looms, and special attention is given to textile and weaving designing and color. Designing and color are also studied in the Jewelry and Architectural Departments. The majority of the men in the modeling class are jewelers and stone-cutters. The House Construction class is composed of plumbers, carpenters, bricklayers, plasterers, etc.

The Normal Art (Day) Class has grown from 4 students 4 years ago to 17. Courses are given in Drawing, Design, History of Education and Psychology (at Normal School), Wood and Metal work, Basketry, Weaving and other Public School subjects. These students aim to be teachers in private or High Schools.

Saturday Classes for Teachers are held (1) in Drawing and Painting for Public School work; (2) Lectures by Miss Cleves, Art Supervisor of Boston, who has wonderful methods.

Principal Elliott wants graduates from the Departments of Design and Architecture to have at least the High School Diploma, but the Committee objected that this might hamper poor students, for whom the school is intended.

The school has a very fine Museum, containing classic casts, jewelry, etc., which is found a valuable adjunct to school work, and also helps to interest the public in the school. Included in this is the Pendleton Collection of Colonial Furniture, comprising a complete house furnished to show the 18th century style of furniture, decoration, wall paper, pictures, carpets, etc. This school has the only Art Gallery in Providence.

SECTION 6: PENNSYLVANIA MUSEUM AND SCHOOL OF INDUSTRIAL ART, PHILADELPHIA, PA.

The aim of this School is to make Art industrial. The school was opened after the Centennial Exposition in 1876 by citizens, without State or City aid. South Kensington (London) methods were copied, but found impossible in the United States without the national conditions existing in Great Britain. Principal Miller took charge soon after, but the school was without precedent, and with no public confidence that Industrial Art could be taught that would be attractive as Art and yet practical in relation to Industry. Mr. Miller took

his cue from "industries as we should see them," especially from machine shops, showing how Drawing was taught there from the view point of designer as well as mechanical draftsman; also from the great textile industry of Philadelphia.

Mr. Miller has developed an Art school in which industrial purpose shall be continually kept before the pupil by visible representations, good craftsmen, and by a little group of shops in which the crafts themselves can be taught. These crafts are: leather work, metal and wood work, plaster—using clay in teaching modeling—"for the Art school never designs to do anything in plaster, it always does its work in clay and then turns it over to the factory to do in plaster." The essential thing is that students make casts, learn to make moulds, and learn to work in plaster as in clay. From plaster it is very easy to work in wood. The school has a kiln for firing cement specimens, so that the student "has continually the craftsman's point of view while studying Art."

How the School is Financed.

After showing Philadelphia how the school influenced its industries, and showing the State how pupils came from all parts of it, the school receives annual grants: from the city of Philadelphia, $20,000; State of Pennsylvania, $40,000; tuition fees, $25,000,—total $85,000. The school costs $100,000, and has a small endowment. There are 42 teachers, nearly all of whom teach both day and evening.

Students number 1200, more than half being at evening classes. On the Art side the students are mostly women; on the Technical mostly men. The school does not want students under 16; they enter on examination in English and Drawing. Large classes of Public School teachers come for Normal work.

Graduation represents qualification, without reference to length of course. Students from other schools may get the diploma in a year; the vast majority require 4 years.

Specializes in Textiles.

In *Textiles*, this is the first school in America. Principal Miller found that practical designing involved grasp of the technique of textile manufacturing; students cannot stop even at the weaving, but must learn jiggers and how to punch them; how to work and adjust loom; how to make head motion, etc.; also the essential thing—*dyeing*. "So we worked gradually back into the industries themselves, until we took a ball of wool, or a hide of leather, or a plank from a lumber yard, or cement from the oven, and all that sort of thing. That is our scheme. We have gone on working backwards to the sources of the industries."

Textile work is thoroughly practical; the men turned out are trained superintendents as well as designers. "Textile design as understood by the trade or the textile manufacturer is not a thing for women. Millions of designs are made in schools of design that would be applicable to printed stuff; but that is not textile design."

Textile School work includes preparing material and worsted spinning. This school makes more cloth than all the textile schools of England

and certainly more than others in America—not in quantities of goods, but in numbers of samples.

Students study the thing itself; its atmospheric conditions; the regulation of all things on which success in the conduct of a mill depends. Machinery is kept running, and studied as to effective planning and good delivery of fibre.

Manufacturers and Trades Unions Friendly.

Local manufacturers let their fibre run through the school mill, paying a little for engine service and a few operatives to keep it always going. The school can deliver merchantable yarn as fine as the manufacturers could get anywhere, which is the highest test; and students get the benefit of all this work. The school can save the manufacturer enough money on operation to pay for haulage of fibre and finished article.

Trades Unions are friendly and send their fine artisans. The school turns out men only, not cloth products. It is training men all down the line from captains of industry, sons of mill-owners, men from mills, who want to increase wages; weavers wanting to be loom fixers; loom fixers wanting to be boss of loom work department; card stampers to be designers; dyers wanting to learn the science of their trade. "That is perfectly legitimate and right, and the only proper guide for directing those men's education," said Mr. Miller, "We must all of us go shy of getting up in the clouds and talking. That is the trouble with all this Manual Training in the Public Schools; it is the trouble with all the educators' point of view in this matter; they all get off on the high horse about the teaching, as if the best way to forward industrial education ought to be by everything else except industrial education. You say, 'What we want is to make them citizens, and when we get hold of them we are going to teach them the science of government and the economic history of this thing and that!' Well, the boys who go to sleep don't know or care anything about this thing; there is no reason why they should care about it. They want to know how to do the job that is right ahead of them, and they want it practical, and they get it or else they don't come. You can't get them to evening schools, or day schools either, unless you give them something that they want."

American vs. German Methods.

Mr. Miller points with pride to the record of the men who have come as common weavers and spinners and who have now got their own establishments; who went out first as foremen and that like, then superintended a mill, then got their own mill. Mr. Miller says there is always capital lying around waiting to be put into the thing, if capitalists see that a man has the stuff in him to carry it on. He told of a graduate of the Crefeld (Germany) School who said, "Apparently we did those things ourselves, but really we did not; the warp was already drawn in and the whole thing was explained thoroughly to us; perhaps we could shove the shuttle a few times; but I see your boys do everything."

VISIT TO SCHOOL WITH DR. MILLER.

In the *Art School* emphasis is laid on " Art in its application to Industries, but yet Art." The motive of instruction is artistic, hence appeals to young women, who outnumber the young men.

Everything in the School makes students think of Art in the terms of Industry. The school identifies art with the life of the people.

The *Technical School* (in separate wing) does not overlap the work of the Art School very much. Students in both sections draw, but textile students are occupied largely with technical problems—dyeing, chemistry in application to dyeing and bleaching, etc.

Life Class work is distinctly different from Art Academy methods. "These Indian boys pose in actual life, but with a view of using them in an industrial way. It is not less life-class work, but there is a distinct industrial purpose, an attention to details, an adjustment with relation to decorative effect, that gives it an industrial character." The student is made to feel that he is in the presence of an industrial problem. He poses and dresses the model with a view to developing its decorative possibilities. He thinks of it as if it were to be a curtain for a glass window or a door. This scene is made not only for success as such, but with a view of getting the designer's attitude towards drawing things from nature.

"The little things in shops that people call Art (with a capital A) are only a few blossoms at the top of the tree. We must have the tree. They have it in Italy and elsewhere; they always had it in France. We get the blossoms, but we have them without the tree."

"You should think of the study of modeling and drawing from life always with the idea of doing something with it—applying it for illustration pretty directly, as shown here. I want students to see that potentially that thing is present whenever they design a piece of wall paper, calico or anything. Another feature is that they must make the thing; they must know enough about the material to be able to think in terms of wood or metal in order to design in wood or metal."

Students can do metal work in the blacksmith shop so that they can learn design "in terms of metal."

"Here is a student who has made his little hinges in his own original way; he has made his iron fixtures, as well as getting out from the plank his piece of furniture. He has done his own carving and his own joinery and all that. It is not studied at all with the product as an end, but as a means to teach the students to think in terms of material.

Class, studying decoration of wall, was taking cue from room itself and working out designs and color schemes for wall, window glass, prints, overmantels, panels, etc.

Students were making sketches, to be afterwards developed into full-sized working drawings for woodwork. Nothing but planks from lumber yard are brought into the school. Girls saw and draw them—women work the same as men, but with saws closed in, so that skirts will not be caught. Girls become teachers, and must know these things.

There is a Saturday class for Public School pupils to learn design. Pupils of the Public School of Industrial Art (age 14-16), after taking very elementary work there, come here for higher work.

This school has always about 50 students sent from Public and High Schools, the School Board paying their fees; but they ought to have been started in the High School before coming here, in Mr. Miller's opinion.

Teachers' Course requires 4 years for certificate. The school refuses to give them shorter courses. Teachers must be certified "to having gone through this whole thing and shown a fair amount of proficiency in all these things, so that when he or she tackles the question of Drawing or Design he knows what woodwork is; he has done something that means artistic work in wood. It shall never degenerate into mere Manual Training or technical training or anything of that sort; it must be artistic; it must have the artistic element applied in a practical way, worked out and expressed in terms of material, and real things that go into people's houses. We take the cue from the house—from the habitation. Students make great numbers of these designs for the interiors of rooms. They have to learn to draw well enough to put it in perspective, and make the color-effects, and then they must carry the working out of those details into some required direction before they go out. We see that they make some chairs, some tables, steps, benches, chests—something."