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SHORT-UNIT COURSES FOR WAGE EARNERS  
AND A FACTORY SCHOOL EXPERIMENT



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## SHORT-UNIT COURSES FOR WAGE EARNERS, AND A FACTORY SCHOOL EXPERIMENT.

### PART I.—SHORT-UNIT COURSES FOR WAGE EARNERS IN PART-TIME AND EVENING SCHOOLS.

BY W. A. O'LEARY AND CHARLES A. PROSSER.

#### PLAN AND SCOPE OF THE WORK.

This Bulletin contains a list of short-unit courses in various trades and occupations, and a discussion of their application to trade-extension work in part-time and evening schools.<sup>1</sup> These courses are not short cuts to the trade; they are a device for effectively meeting the needs of certain groups of workers already in the trade.

<sup>1</sup> Acknowledgments are due the following persons for material contributed to this Bulletin. In most instances this material has been modified to meet the requirements of the Bulletin. The writers are responsible for the form in which it is here printed. Boot and shoe manufacturing, E. C. Swaysland, director of instruction in boot and shoe manufacturing, Northamptonshire, England; carpentry, Oliver H. Gardner, industrial school, New Bedford, Mass.; concrete construction, M. M. Sloan, architectural engineer, Philadelphia, Pa.; electrical work, Henry C. Fellman, Industrial School for Boys, Boston, Mass.; estimating for building construction, E. M. Bassett, estimator and engineer, Philadelphia, Pa.; farming, L. S. Hawkins, specialist in agriculture, State department of education, Albany, N. Y.; furniture making, C. A. Zuppann, president Industrial Science and Arts Association, Grand Rapids, Mich.; laundry chemistry, Abraham Henwood, head chemistry department, Drexel Institute, Philadelphia, Pa.; machine-shop drafting, Chester B. Hammond, industrial school, New Bedford, Mass.; machine-shop mathematics, J. Gould Spoford, principal industrial school, Quincy, Mass.; machine shopwork, Ezra Morse, principal industrial school, Somerville, Mass., and Lewis H. Haight, Industrial School for Boys, Boston, Mass.; mining, Millard B. King, expert assistant for industrial education, State department of public instruction, Harrisburg, Pa.; miscellaneous courses, Alfred P. Fletcher, assistant superintendent public schools, Rochester, N. Y.; outline of courses, New York City evening schools; pattern making, Frederick Turner, Mechanic Arts High School, Boston, Mass.; power-machine operating, Lucy Osborne, Worcester Girls' Trade School, Worcester, Mass.; printing, Egbert C. MacNary, principal industrial school, Springfield, Mass.; sheet-metal pattern drafting, Ellsworth Longfield, New Bedford, Mass.; steam engineering, H. Percy Arnold, industrial school, New Bedford, Mass.; steam fitting, Fred Earle, New Bedford, Mass.; textile manufacturing, Henry Nichols, textile school, New Bedford, Mass.; women's work, Iris Prouty, head girls' department, Boardman Trade School, New Haven, Conn.

The short-unit or brief course is an intensified form of instruction which is intended to serve in a limited number of lessons a specific need of a particular group. Each unit deals with one part of the trade and is complete in itself. The subject matter is selected with reference to the need of the group rather than its relation to other parts of the trade. Many evening school courses in mathematics, for example, admit to the same class machinists, carpenters, printers, and anyone else who wants the subject. They begin with arithmetic, and include a series of topics progressively arranged, ending, perhaps, with elementary trigonometry. The course usually extends over several terms, and the subject is taught with reference to its general application to shopwork. Under the unit system, instead of the general course just described, a separate course would be given in mathematics for the carpenter, another course for the machinist, and a third course for the printer, each course aiming to meet the special needs of a particular group.

The last census shows that more than seven millions of people are wage earners in this country, the large majority of them being engaged in productive industry. The problem of reaching these workers and training them for increased industrial efficiency is the great task of the industrial school. While some of these workers can be reached by the all-day school, most of them must be trained for their work, if at all, after they have left the schools to become bread winners.

It is with the training of this latter group, through part-time and evening schools, that this Bulletin is especially concerned. This discussion therefore has nothing to do with the day industrial and trade school or with the attempt to train, through evening schools, persons for employment in industries which they have not yet entered. Neither is it concerned with the selected artisan who because of superior capacity and unusual ambition finds himself well able to take an extended course of training.

The large body of people engaged in industry are employed in a variety of occupations which differ greatly as to the skill and knowledge demanded of the worker. As individuals, they also represent the greatest possible variety of interest, mental aptitude, manual dexterity, ambition, previous schooling, and all the other qualities and conditions that must be taken into consideration as factors in any attempt to reach them with vocational training.

This great variety of employment and of individual capacity makes impossible any scheme of vocational training which attempts to deal with all workers in industry in the mass. Only by studying the workers and classifying them into particular groups according to their needs can they be effectively trained.

The short-unit course plan herein proposed has already proved successful in reaching such groups of workers as the following.

1. Specialized machine hands who while running one machine wish to learn how to operate another, as the planer hand who wants to learn to operate the universal grinder. Courses of this kind are in operation in the evening classes of the Newton (Mass.) Trade School.

2. Skilled workmen, who, because of the progress of their trade, find themselves lacking in a small but necessary body of knowledge required to meet the newer demands of their trade, as the printer who needs instruction in how to match colors and how to "doctor" ink, or the piano tuner who wishes to learn the construction and mechanism of the player piano. The Murray Hill Evening Trade School, New York City, is offering instruction of this character to piano tuners.

3. Operatives or workers in the low-grade skilled and unskilled occupations where there is a small body of knowledge of "tricks of the trade" and best ways of doing things which is not common to the shop. This information is often small in quantity, direct in character, and therefore special. It must be given, if at all, in a brief course. The training given chocolate dippers in the school of the candy factory of the Walter Lowney Co., Boston, is an example of instruction given by the short-unit course in a low-grade skilled industry.

4. Workers on specialized jobs desiring instruction to meet the requirements of the next job in line of promotion, as for example, the cleaner or finisher in the dress and waist industry who wishes to be fitted to be an examiner or a cloth inspector. The unit courses in rod making in the furniture industry given to machine hands to qualify them to become cabinetmakers also illustrate this type of work. Such courses are given in the evening trade school of Grand Rapids, Mich.

5. Groups of men in a skilled occupation who are desirous of taking training brief and direct in character, but who can not be induced to take long and continuous courses. The question involved here is not what is the best method of training the man but rather how shall you reach him at all. The evening courses for steam engineers given in the industrial school at New Bedford, Mass., consisting of 40 lessons each, are of this type.

Out of a study of the needs of the worker will doubtless come numerous methods of meeting such needs. Some of the methods already in use, particularly those dealing with the more ambitious, better prepared, and more able workers engaged for the most part in highly-skilled trades, have long stood the test of experience.

This Bulletin will have accomplished its purpose if it succeeds in directing attention to the specific trade needs of those great bodies of workers whose needs are not now being met, and in bringing about a

larger use of the short-unit course as a means of reaching these workers with trade-extension instruction.

### GENERAL EVENING INDUSTRIAL SCHOOLS.

There has grown up in this country a type of evening school which aims to meet the needs of trade workers, which, for want of a better name, we might call the general evening industrial school. This school is usually conducted under the auspices of the public-school authorities, as will be most of the organized instruction for the wage earner.

This general evening industrial school is to a very great extent an evening high school, giving what is, after all, instruction of a secondary grade in general mathematics, general science, and general mechanical drawing, which are the three subjects that have been traditionally regarded as affording knowledge of the kind used in manufacturing pursuits. Usually the classes in these subjects are open to every one over 14 years of age, and the membership of a given class is frequently made up of such varied elements as high-school boys with particular interest in general subjects, clerks seeking change of work, young men with interest in and talent for drawing or who are taking the course as a means of recreation, and a few workers in the trade. While it seems a misnomer to call such a school an industrial school, the fact remains that it is so termed.

Of late, many of these general evening industrial schools have added as practical work, shop courses in such subjects as general woodwork, general metal work, and general electrical work. In some cases an instructor is employed who has had actual and adequate experience in some phase of the shopwork which the course covers, as for example, when a carpenter is employed to teach a class which includes, in addition to some carpentry work, the making of furniture. In too many instances, however, this general shopwork is given by the manual-training instructor of the general day school, who has had some experience in all the lines in which he is giving instruction, but not enough to command the respect of the trade worker.

The experience of the most successful industrial schools goes to show that the lack of efficiency of many general evening industrial schools is largely due to such reasons as the following: (1) Failure to understand the kind of pupil that comes from the industry; (2) neglect to study the needs of the trade worker; (3) disregard of the limited time the school can hold the pupil; (4) inefficient methods of organization and administration; (5) failure to adapt its teaching methods to the needs and ability of the pupil. It is the aim of this Bulletin to discuss these factors from this point of view and suggest

methods of organization and teaching better adapted to the type of trade worker herein discussed.

### KIND OF PUPILS.

The evening industrial school pupil is frequently a wageworker who has a family to support. Economic necessity presses hard upon him and forces him to increase to the utmost his earning capacity. He comes to the school to get something on which he can realize in his trade. He is there to buy certain instruction, as it were, exactly as he goes to the store to purchase a new and improved tool. Unless the school is prepared to do what the store does—that is, sell him the thing he wants—the school is going to fail of its purpose so far as the wage earner is concerned, and he will go to the correspondence school or some other institution which he thinks can supply his want.

The time of the trade worker is limited, and the school must not waste it. In many industries he still works more than eight hours a day, and in others he is frequently called upon for overtime. He often lives at a distance from his work and the school, and loses much time in coming and going. The school, therefore, ought to conserve his time in every possible way. This it can do only by eliminating from the course all subjects not necessary as a means of increasing the pupil's trade efficiency, by so organizing the work that he can easily get what he needs, and by employing the most direct and efficient methods of teaching it can command.

The pupil who comes from the trade is generally a mature worker, and the mature worker usually knows his needs. A pupil ought not to be admitted to the school until he is 17 years of age. He is seldom accepted in the industry until he is 16, and at least one year in the trade is necessary in order to acquire sufficient experience and knowledge of his needs to enable him to profit by the instruction of the evening school. If the pupil is admitted at 17, this will make the average age of those in most schools about 23 or 24 years. He has "knocked around" more or less from one shop to another and has learned by hard experience what the trade demands of him and what are his trade deficiencies. He knows what things are assets and what are not; and he has been "up against" varying industrial conditions and has learned what he must do to meet them. At 24 he is no longer an adolescent; he is a mature man. His maturity and experience have developed his judgment, which, with a knowledge of his needs, qualifies him to select from the work of the school the courses that best meet his wants. This places upon the school the responsibility of offering practical courses adapted to the demands of the trade.

The man in the trade is extremely skeptical of the value of the work of the general evening industrial schools. This appears to be particularly true in the case of the trade worker who, as a boy, has had high-school training in such subjects as algebra and general science, and who now comes to the school in search of instruction he can use in his trade. If he is given the same kind of training he received in the high school he loses interest, because he has not found any practical use for what the school has already taught him and he is of the opinion that his need is not to be met by giving him more of the same thing. The worker who has not received high-school training is also doubtful of the ability of the school to help him. He looks upon the schoolmaster as lacking in practical knowledge, and thinks that while the instruction given by the general evening industrial school may be all right so far as theory is concerned, it has no practical value.

The mechanic is lacking in formal schooling; he is seldom a grammar-school graduate, and frequently has never gone further than the sixth or seventh grade. This lack of schooling, together with the fact that such schooling as he has had is too remote to be easily recalled, makes it impossible for the average worker to meet the scholarship standards of the regular school. Therefore, evening courses based upon regular school standards, or those which require the passing of an ordinary school examination, automatically shut out most workers. They not only can not pass such an examination, but will not make the attempt. Standards of this character, moreover, do not determine a man's fitness to profit by trade instruction, and they ought not to be put up as requirements for admission to a school whose aim is to give trade extension instruction.

On account of his lack of schooling the mature worker is sensitive. He knows he can not meet the academic tests which the regular school imposes and which younger pupils can readily pass. At the same time he may be a man of standing in his trade. He has reached a point where he wants to know certain things which he can not learn in the industry and he comes to the school to get them. To place such a man in a class with young boys and force him to meet the academic standards of the regular school is to humiliate him and wound his self-respect. This the school ought not under any circumstances to do.

The trade worker can not think in abstract terms. Whatever thinking power he possesses has been gained through practical experience; his thinking in connection with his work is in terms of the tools and processes of his trade and not in terms of abstract principles. Even his thinking in concrete matters not related to his trade is often done in the terms of his trade. Even if he could absorb abstract knowledge, it would be of no value to him because

he could not adapt it to the practical processes of his trade. To do that appears to be difficult for even the selected graduate of the best engineering schools. It is evident, therefore, that if the worker is to be trained to greater thinking power the approach must be made through trade processes with which he is already familiar and not from the viewpoint of abstract subject matter which may have in it the possibility of adaptation to the trade.

The worker advances in his trade because of his practical knowledge and not because of general academic training. The trade insight and mastery of trade processes necessary to advance come only through study and practice of the trade itself; general academic training can directly contribute little. Doubtless there are men of academic training who are holding responsible trade positions, but this is because they are selected men and not primarily because of their academic training. If the school is to train the worker to advance in his trade it must shape its instruction from the standpoint of the practical requirements of the trade and not from the standpoint of an academic school.

#### LIMITATION OF ATTENDANCE.

Experience goes to show that the usual evening industrial school does not hold the majority of its pupils longer than a year, and that many of them it does not hold for that length of time. The reasons for this have been touched upon at various points in this discussion. It should be noted in this connection, however, that the trade worker represents a shifting body of people. Many workers, like those of certain nationalities in the textile industry, are migratory by instinct and habit; others, as for example, mechanics in the building trades, shift with the demand of the labor market. Whatever may be the cause of the failure of the school to hold its pupils, in view of the fact that it does fail, it is clearly a mistake to organize the work for such artisans into continuous courses extending over several years.

The limited time the school can hold the pupil, even under the most favorable circumstances, is one of the fundamental reasons why the worker who has not had experience in the trade in which he seeks instruction should not be admitted to trade classes. In many communities evening-school instruction is maintained only 20 weeks of the year. For the majority of men attendance for more than three evenings a week is a hardship and in many cases a physical impossibility. Should the pupil continue for four years, the entire time would amount to only 480 hours, or 48 working days of 10 hours each. It is doubtful whether this amount of instruction will enable the ordinary unskilled adult to gain entrance into a skilled trade except as an apprentice.

### NEEDS OF THE WORKERS.

It has already been pointed out that the worker in the trade needs instruction he can use as an asset in his calling; greater expertness in order to hold his job; knowledge of how to operate a machine other than the one on which he is employed, as, for example, how to run a milling machine when he is running a planer, in order to provide himself with another job should this one give out; knowledge of some specific process, like that of figuring an indicator card, that he may be able to cut down his fuel consumption; a more extended knowledge of trade materials, as, for example, the knowledge of a new material, like vanadium steel. Again, the need is of an entirely different character, as the need of giving the instruction through a foreign language; or, still again, it is a need arising from the industry, but which in itself is not directly a trade asset, as, for instance, the need of the woman millworker for instruction in cooking.

The industrial school, to be efficient, must study the specific needs of both the individual and the industry. To learn the needs of the industry the school officers must consult the employer, visit various industries, see them in operation, and observe the conditions under which they are carried on. In this work both the employee and the employer can be of great assistance. To understand the specific needs of the worker, in addition to visiting the place of employment, conferences between prospective pupils and the instructors of the school are necessary. This can be accomplished by means of a preliminary registration, which is discussed in another part of this Bulletin. In every case the needs of the worker, the local practices of the trade, and the conditions surrounding the industry should be carefully considered before proposed courses are formulated. As new groups and new needs appear, courses should be revised and new courses organized to meet these needs.

It is a weakness of many of the general evening industrial schools that they have made no systematic study of the needs of their pupils.

### FAULTS OF ORGANIZATION, COURSES, METHODS, ETC.

In such matters as the formulation of courses, arrangement of programs, standards of admission, records of work and attendance, methods of promotion, and the like, the general evening industrial school has in many cases followed altogether too closely the practice of the regular day school. The courses, for example, are frequently organized from the standpoint of the subject as a whole and arranged in a series of logical steps. Promotion from course to course sometimes depends upon the ability of the pupil to meet certain requirements which have nothing whatever to do with his trade efficiency. Such methods of organization, it must be repeated, obscure the aim

of the work and disregard both the needs and the experience of the pupil the school is attempting to train.

From the standpoint of organization the inefficiency of many general evening industrial schools is, to a large extent, unquestionably due to the vagueness of their aim. They often make no distinction, for instance, between trade-extension courses and trade-changing courses. Trade-extension courses are intended for men who have had experience in the trade in which the course offers instruction and who wish to supplement their trade knowledge or skill with additional trade knowledge for use in the practice of their trade. Only men who are experienced in the trade and who wish this training for trade purposes should be admitted to trade-extension courses. Trade-changing courses are designed for men who wish to change from the trade or occupation they now follow to some other which, they believe, promises greater success, but in which they have had no experience or training. The evening industrial school, for reasons that need not be here discussed, has not yet found a satisfactory method of giving these men effective trade training and it is doubtful if it can find one. Such men ought not to be admitted to trade-extension classes. Nevertheless, it has been the practice of many of the general evening industrial schools not only to accept them, but to place them in the same class with experienced tradesmen.

Sometimes the general evening industrial school maintaining courses for women is confused as to the purpose of its work because it makes no distinction between courses in home making and trade courses for women. Courses in home making, such as cooking and sewing, should be formulated from the standpoint of the needs and the practices of the home, but at the same time should be taught wherever possible with the thoroughness usually required by trade classes. Trade courses for women, on the other hand, like trade courses for men, should be organized and taught from the standpoint of the needs of the trade worker and the requirements of the industry. A course in sewing that would be adapted to home use might entirely fail to meet the requirements of trade work. To clarify the aim in the case of instruction for women, as well as that for men, the various groups to be taught should be segregated and organized on the basis of the purpose for which the instruction is intended.

The trade experience of the worker is also a factor in efficient organization. It is clear that satisfactory teaching can not be done in a class which is not organized on the basis of a common trade experience. It would be impossible, for example, for an instructor to teach efficiently a class in machine-shop practice to which were admitted machinists, chauffeurs, engineers, and pattern makers, for the reason that the trade experience of these men has been so varied

that there is no sound teaching basis. For similar reasons it is not good practice to admit to the same class young boys who have had little or no experience in the trade and mature men who have already mastered many parts of it. In organizing trade classes the evening school should place in the same group only those pupils who have had essentially the same trade experience. The reasons for organizing the group in this way from the standpoint of teaching are discussed in detail at a later point in this Bulletin. It is to be noted here, however, that proper group organization as a factor in efficient administration is often not recognized by general evening industrial schools.

In matters of organization the industrial school should follow business methods rather than those of the regular day school. In many respects the industrial school is a business quite as much as it is a school. It maintains shops which, from the standpoint of equipment, methods of handling work, and product turned out, resemble more closely the commercial shop than those of the manual training or the technical school; it deals with workmen who are regularly employed in industrial plants, and it has a variety of trade contacts entirely unknown to the regular school. Under these conditions the "unit" method whereby the school is organized into a number of "unit" schools according to the trades to be taught, and in which a responsible head is placed in charge of each unit, has been found to be efficient. The head of each "unit" school bears essentially the same relation to the general director of the whole school as that of a department superintendent to the general superintendent of a manufacturing establishment. This is essentially a business method of organization and has the advantage of fixing responsibility for results to a degree that can not be attained under usual school methods or organization.

The unwillingness to adopt aggressive methods of advertising is a further reason for the failure of some evening industrial schools to reach any large extent of the trade. They have commonly assumed that to reach pupils they need only make a statement in the newspaper or school department circular that certain courses are to be offered. They have seldom taken the point of view that they had education to sell, and that if they were going to do business they would have to adopt the methods of publicity employed by successful business concerns. Some of these methods are discussed elsewhere in this Bulletin.

It is a mistake for the evening industrial school to administer its work on the theory that the layman has nothing to contribute. This point of view has prevented many schools from getting into sympathetic contact with the community. As a matter of fact, the layman has a large contribution to make to the work of the school that will

greatly increase its efficiency. This is particularly true of the employer and men already in the trades. Such men can be of great service in keeping the school in touch with the community and the industries; helping it to find out the trade needs of its pupils; assisting it to shape its courses of study; searching out teachers; obtaining quarters and equipment; giving suggestions as to effective forms of business administration; and checking up the results of the instruction. Such service, it should be noted in passing, ought to be purely advisory and should have nothing to do with the executive details of the administration of the school.

One method of securing the assistance and advice of practical men is that of organizing an advisory board for each trade taught in the school. This board should be made up of practical men actually engaged in the trades taught and might well have represented on it the employer, the foreman, and the employee. From time to time it should meet with the director of the school and the instructors in the trade for which it is organized for the purpose of consultation and advice upon matters affecting the interest of the work. Once or twice a year these various advisory boards should be brought together in a general meeting. The success of the advisory board as an agency for promoting the interests of the school will depend to a large extent upon the ability of the school authorities to secure the right type of men as members and to discover effective ways and means of using their services.

Many evening industrial schools have too often been obliged to do business without proper equipment. They have frequently had to get along with only that of the regular day school, which is often not at all adapted to trade work. It is true that in some subjects effective instruction can be given to the trade worker without extensive equipment; but no instruction can be made as efficient as it ought to be without the proper kind of equipment. In order to get the best results the equipment of the evening industrial school should be of the same standard, both as to quality and capacity, as that used in the best plants engaged in commercial work of the kind for which instruction is being given. It should be sufficient, both in variety and quantity, to enable the school to give instruction in all the trade processes required to meet the needs of its pupils. The usual manual training equipment, which is the only equipment possessed by many schools, is inadequate for this purpose.

More important than equipment is the question of the qualifications of the teacher. The teacher in the evening industrial school should be selected from the industry and not from the general day school. He should be a master of his trade and in good standing among his

fellow craftsmen. He should be a man of good personality and in vigorous health. He should be experienced in handling men and should know how to reach them. Unless such a teacher can be obtained, the school ought not to attempt to give trade instruction. The instructors of the evening industrial school when selected, as they frequently are, from the ranks of teachers in the general day school are skilled in the regular school methods of teaching, but they are not usually familiar with the methods that must be employed to teach efficiently in the industrial school, nor are they acquainted with the problems and practices of such a school. Moreover, they are usually lacking in a practical knowledge of the trade, without which they can neither teach successfully nor command the respect of the trade worker.

Preliminary registration for determining the needs of the pupil and his fitness to profit by the instruction of the school has already been suggested as a necessity in evening industrial school work. A week before the opening of the session may well be given to this work, each course being scheduled for registration on a definite night. Applicants for admission should be required on registering to interview the instructor in charge of the course they wish. In this interview such facts as the pupil's previous trade experience and training, the purpose for which he wishes the work, his probable fitness to undertake the course, and certain additional data similar to that listed at the end of this Bulletin might well be determined in detail. This information should be entered on cards especially prepared for the purpose and filed for future reference. The preliminary registration as a means of determining the pupil's fitness for admission is an administrative device which the general evening industrial school has seldom employed.

Efficient teaching in the evening industrial school, it has already been noted, requires that the knowledge to be imparted should be taught with reference to the worker's practical experience and trade interest. To do this it is necessary, unless individual instruction is to be given, that pupils should be organized into groups, all the members of which have had about the same trade experience. The subject matter should be carefully selected from the standpoint of its practical value and should be organized and taught, as nearly as possible, in the practical form in which it is encountered by the pupil in the practice of his trade. How groups of this character can be organized has already been discussed as a question of administration. The material to be taught and the form in which it is organized, it is evident, must be practical rather than theoretical in character, because the pupil, having had little or no training in trade theory, has been limited in his experience to practice and has not developed the capacity to acquire knowledge unless it is related to his practical

experience. For this reason the textbooks and methods of some evening industrial schools, being adapted as they are to the teaching of abstract knowledge, fail to make the necessary contacts with the worker's experience and are therefore of little or no value in teaching the pupil in trade-extension classes. Furthermore, to select and organize in practical form the subject matter to be taught requires a teacher who has had the practical experience which the instruction in such classes is designed to give.

The worker should be taught from the standpoint of direct and immediate values. Instruction given from the standpoint of deferred value means present preparation for future need and deals with abstractions and repetitions instead of practical application. It means preparation for more preparation for still more preparation. The average worker is not fitted either by experience or by academic training to acquire knowledge by the process of continuous preparation. Moreover, he comes to the school for the purpose of meeting a present, not a future, need, and he will not submit to the preparatory drill which always accompanies teaching from the standpoint of deferred values. However well this method may be adapted to instruction in high-school subjects, it is not adapted to the work of the evening industrial school.

At an earlier point in this Bulletin the short-unit course was defined. How this type of course can be used to meet the need of the trade worker is further pointed out in the following pages.

### ADVANTAGES OF SHORT-UNIT COURSES.

The short-unit course puts up a trade asset; it includes only what has been passed upon by men in the trade and found to be of practical value. The material thus selected is taught by a practical teacher and with reference to its adaptability to the trade needs of the particular group for whom the course is intended. The various courses in machine-shop mathematics, given at a later point in this Bulletin, illustrate how courses in this subject, under the short-unit system, can be made of practical value to the worker. It is to be understood that these courses need not be used in exactly the form in which they are given here, but can be modified to meet the specific requirements of the group in question.

Courses organized as short units economize the time of the pupil. This is done by eliminating all unnecessary preparatory work, and all work that does not apply to the specific topic to be taught, and by arranging a flexible program that will permit the pupil to break into the work at the point of his greatest need. If he is a draftsman and wants to understand the meaning and use of formulas, it does not first require him to take a general course in algebra.

The worker in the trade who has had a limited academic training and is therefore unable to meet general academic requirements is not excluded from the short-unit course on account of his lack of schooling. Instead of making an academic requirement a test of fitness to take the work the pupil is admitted to the course on trial on the basis of his previous experience, the nature of his need, and his probable ability to profit by the instruction. These are determined by a conference between the prospective pupil and the instructor. This does not mean that all requirements for admission to every course are entirely eliminated. Certain courses in this Bulletin, for example, presuppose the experience represented by other courses. This experience, however, may be gained either in the school or in the trade, and is to be tested not by formal examination but by conference and trial as to the pupil's ability to do the work.

It has already been pointed out that one weakness of some general evening schools is the fact that their courses are laid out to cover three or four years, whereas only a very few pupils remain in the school long enough to complete the course, and that by dropping out of a continuous course the pupil loses much of the value of the work he has already taken. The short course recognizes this situation and meets the difficulty (1) by making the unit so small that the pupil will be able to complete it within the time the school can probably hold him, and (2) by dealing with one specific thing in each course. Organizing the course as a short unit makes the instruction complete as far as it goes and therefore more effective. If the unit course is laid out for 10 lessons the pupil who remains through the course gets all the school has to offer upon the specific topic, which is probably much more than he would get from the first 10 lessons in a course on the same subject laid out to cover a year. By limiting the course to one specific thing the effort of the pupil is concentrated on one subject instead of being dissipated among several, as it would be in the general course. This results in more regular attendance, in more intensive work, and a corresponding gain in efficiency.

By putting up a series of short-unit courses in the same subject experience goes to show that when one is completed the pupil is likely to return for the next one, and thus remains in the school longer than he would if the same work were laid out in the form of a continuous course.

The content of the course is first determined by going to the industry and there finding out what are the needs of that industry. Before opening the course, by means of a preliminary registration, the specific needs of each pupil are discovered and a group is formed, based upon a common need. The content of the course is defined in terms of the specific need of the group and the number of lessons and the method of approach are then determined by the need. Instead

of a general course in cooking, for example, in one course would be given eight lessons in bread making for beginners and in another five lessons in bread making for the experienced housekeeper. Or, again, an Italian-speaking group would be segregated from the rest of the class and placed under a teacher who could speak the language of the group.

Variation in need would be met by the formation of a new group. If the variation were so great that enough pupils having a common need could not be found to form a new group smaller groups could be formed within the main group and run either in parallel or in series, but if that were not feasible individual instruction could be given.

The method of dividing the work into short units is especially adapted to the needs of the mature worker. As previously stated, the mature worker because of his judgment and his experience in the trade usually knows his needs. The short-unit system, by offering a variety of courses based on the demands of the industry and in a language he readily understands, gives him an opportunity to make a selection that will meet his needs.

The chaotic state of the work in some of the evening industrial schools, it has already been noted, has been due to the fact that the school has not clearly understood the purpose of the work. Many schools have regarded the evening work for women, for example, as uplift work; they have failed to realize that the fundamental aim of evening work for women should be to increase their efficiency as workers, either in the trade or in the home. Or, again, they have not understood the purpose because they have not known what factors in any given case enter into efficiency. In work for men they have failed to distinguish between courses that are an integral part of the trade and those that have only an incidental relationship to it, as, for example, courses in motor construction for the machinist and courses in the same subject for electricians. All this is primarily a failure to comprehend the aim of the work and is mainly due to the fact that the school has not studied the needs of the worker. The unit course, by determining the specific need of each group before the course is organized and then defining the work in terms of this need, clarifies the aim and gives point and purpose to the instruction.

Courses organized under the unit system enable the school to discover new groups to be served. In every community there is always a great deal of vagueness as to what the school is doing. Many people whom the school should serve are never reached because the courses have been advertised in such general terms that people do not understand what they are for.

If, instead of general courses, unit courses are offered in terms of probable group needs and advertised in language that is readily

understood among the people they are intended to serve, new groups will be discovered whose existence heretofore has been unknown.

The unit system is flexible; it meets the needs both of the person who wishes help on some particular point, but who can not take an extended course, and the person who wishes a complete course. The pupil can break into the work at the point of his need, get the help he wants and then withdraw; if he has other needs, to satisfy them he has only to repeat the process. By taking units enough he can get a well-rounded training.

The unit course also makes possible a flexible school program. Units may be arranged in series,<sup>1</sup> in parallel, alternately, or in groups, and may be repeated as many times as the facilities of the school will allow. This flexibility of program works to the advantage of the pupil who can attend only at irregular intervals, or for a short period of time.

The flexibility of the unit system as compared with the regular school course is illustrated by the grouping of letters given below. If the letters A, B, C, D represent progressive steps in the usual school course, there is only one point at which the pupil can enter; that is at A. If he wishes to enter at C he must pass an examination in A and B.

If these letters each represent a unit course, it is seen that by the flexible organization of these units, a pupil may enter at any position of A, B, C, or D for the desired instruction, and still, if he wishes, complete an entire course equal in practical content to the regular school course.

A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

In discussing experience and need as affecting organization, it was pointed out that these two factors are at the basis of sound teaching method. It was shown that in order to utilize the principles of apperception and interest, the group to be taught must have a common experience and a common need. Given a group so organized, there are several devices that can be employed in the short-unit course to relate the instruction to the pupil's interest and experience.

The question-and-answer method is effective. Under this method practical questions asked by members of the group and by classes of former years are collected and prepared in the form of lesson sheets, in which the instruction is given by printing the question

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<sup>1</sup> One difficulty of organizing short-unit courses in series can be overcome by having a given class meet only one night a week.

and immediately after it the answer. These sheets serve as a basis for class discussion, and are retained by the pupils for future reference. By repeating the same question in various forms on different sheets the pupil approaches the subject from various angles and a variety of contacts are established. Allowing the pupil to retain his papers provides him with a fairly complete discussion on each topic in a form he can easily understand. In work involving mathematical calculations the lesson sheet should contain a large number of examples worked out in considerable detail and accompanied by an explanation of each step in the process.

The success of this method depends upon selecting questions that the pupil wishes to have answered; carefully working out the answers with reference to their practical application; clearly stating them in the language of the trade; discussing the questions and answers in the class; and at frequent intervals repeating the questions on other sheets. This device is especially useful in preparing pupils for license examinations.

Another form of the question-and-answer method is the device of placing in the pupil's hands diagrams and drawings accompanied by practical questions to be answered by an examination of the drawings. This can be varied by substituting for the drawings models and parts of the job itself. Still another variation of the same device is to use partially completed diagrams, which, in answer to questions on the lesson sheets, are to be completed by the pupil.

The use of lesson sheets is especially applicable to a group formed under the short-unit system, because the material can be drawn from the common experience of the group and represent questions whose answers every pupil wants to know.

Another method of relating the instruction to the pupil's experience and interest is that of preparing lesson sheets, each of which deals with one simple unit, as, for example, a lesson in roof framing on methods of finding the length of a valley rafter. This sort of lesson sheet should include a variety of diagrams illustrating different cases carefully worked out. It should eliminate all related theory and should confine itself to examples, illustrations, statements of facts, and such explanations as may be necessary to make the meaning clear.

A modification of this device is to increase the size of the unit and extend it over a number of lessons. Instead of figuring the length of a valley rafter the pupil is given a framing plan and required to lay out all the rafters on the plan. Just which method should be used in any given instance depends upon the need and experience of the group.

The use of sections of various forms of pipes, valves, parts of the machines, etc., cut away to show the construction is valuable not simply because the pupil can be most readily taught through the eye,

but because he has a practical interest in examining these things. Equipment of this kind can frequently be obtained from the manufacturer if he understands the purpose for which it is wanted. Manufacturers will also send their experts to the school to demonstrate its use. Where it is impossible to obtain this sort of material from the manufacturer, some of it can easily be constructed within the school itself. In many classes the stereopticon can also be used to advantage.

In teaching subjects like mathematics, an especially valuable device is that of taking typical cases, arbitrarily giving the rules necessary for the required solution, and teaching the pupil how to apply the rules. This work has to be supplemented by a great deal of careful explanation. It is especially effective with the type of pupil being discussed, because he is interested in the process rather than the reasons that underlie it, and because it gives him at once the information he wants.

In the case of courses which are intended to prepare the pupil to pass an examination, such as those required in some States for an engineer's license, it is well to organize the instruction with the examination itself as a unit, rather than some topic of the subject covered by the examination. Experience shows that men with a limited academic background find it difficult to retain instruction long enough to enable them to pass an examination unless there is frequent review of the material on which they are to be examined. One method of overcoming this difficulty is to take for the unit those phases of the trade that are included in the examination and prepare lesson sheets that shall cover in a spiral all of these phases.

### SUMMARY OF PLANS FOR EVENING INDUSTRIAL SCHOOLS.

1. To sum up what has already been said, the best evening industrial school for the types of worker discussed in this Bulletin should contain the following features:

(a) *Preliminary study.*—A preliminary study to determine the needs of the industry and of the workers.

(b) *Teachers.*—The teacher of practical subjects in every case should have had experience in the trade; he should have teaching ability and should be able to organize his work into teaching units; he should be acceptable both to the employers and the employees; he should be paid for his services, and the pay should range from \$2 to \$5 an evening.

(c) *Help of practical men.*—The assistance of practical men should be obtained in such matters as securing proper quarters, selecting qualified instructors, obtaining buildings and equipment, passing upon the value of proposed courses, advertising the work

of the school, finding out the needs of industry, checking up results, and obtaining the assistance of various organizations.

(d) *Advisory board.*—The assistance of the layman can best be obtained through an advisory board. There might well be one board, consisting of from three to five members, for each trade taught in the school. The advisory board should have no executive power and should act only by advising and suggesting.

(e) *Publicity.*—The school should advertise extensively in the newspapers and by means of placards and circulars distributed in shops, clubrooms, recreation centers, and public places where men are accustomed to congregate. The circulars should state clearly, in simple language, such facts as the location of the school, schedule of its work, the nature and length of the courses, and the groups for whom these courses are intended. Lantern talks and addresses before various social and industrial organizations, including trades-unions, on the purposes and work of the school should be given wherever a hearing can be obtained.

(f) *Preliminary registration.*—Before the school opens there should be a preliminary registration. At this time the school should find out in detail the specific needs of each pupil. Applicants might well be required to register on a card calling for such data as the following: Name, address, age, occupation, name and address of employer, experience in trade, purposes for which work is required, previous industrial-school attendance, references as to ability to profit by the work desired, and any other data the school may find necessary. This card should be kept as a permanent record and on it should be entered from time to time such additional data as the following: Character and quality of the pupil's work in the school, time and cause of his leaving the school, changes of employment, and the effect of his school work upon his employment so far as this can be ascertained.

(g) *Qualifications for admission.*—The pupil should be admitted to the school on trial on the basis of his experience and need, and should be at work in the trade in which he wants instruction, or else he should be able to give evidence that he has had experience in a related trade that will qualify him to profit by the work he desires. He should be at least 17 years of age and in good health.

(h) *Home preparation.*—In general the school ought not to require home preparation. In classes where such preparation is found possible it may be encouraged and credit may be given for it in the school work. In certain classes—as, for example, sewing—work can be done at home and brought into the school for examination and approval.

(i) *Cooperation of the employer.*—Efforts should be made to obtain the cooperation of the employer. The best way to do this is

to train the employees efficiently. The school authorities should frequently visit the plant of the employer and should study the employer's needs. It is well to notify the employer whenever any of his employees register in the school and to consult him at intervals as to their progress and needs.

(j) *Organization of program.*—The units of the program might well be arranged in series, so far as possible, and subjects scheduled to come on alternate nights. If the demand for a certain course is large and the facilities of the school will admit, courses may be arranged in parallel.

(k) *Equipment and building.*—For the best work the equipment should be up to date and of first-class quality. There should be sufficient variety to meet the needs of the pupils. If new equipment can not be obtained, second-hand equipment may be made to answer. If the school does not have an adequate shop, a vacant commercial shop will serve the purpose.

(l) *Analysis of work.*—Before offering courses the subjects to be taught should be analyzed in terms of the probable needs of the industry as shown by a preliminary study. This analysis should be made by the instructors, and lesson plans should be prepared based on the analysis.

(m) *Attendance.*—The pupil should be held to regular attendance and required to give explanation for absence. Absence without satisfactory reason for more than two successive nights should automatically remove the pupil from membership. Owing to irregularity of attendance due to sickness, demands of the home and the employer, it is frequently advisable to send personal letters to pupils who fail to meet this requirement. When the number of applications for any course is larger than the school can easily accommodate, a waiting list will steady the attendance. In certain cases a deposit, to be refunded if attendance is satisfactory, has been found to be helpful. It is desirable that classes be limited to not more than 15 pupils to each instructor in the case of shop classes and not more than 20 in other classes.

(n) *Short-unit courses.*—The work should be offered in the form of short-unit courses; the course should be long enough to meet the needs of the worker; efficiency, of course, is independent of the length.

2. The success of the evening industrial school depends on—

- (a) A practical and efficient course.
- (b) A teacher who is skilled in teaching and experienced in the trade he is to teach.
- (c) A group of workers with common experience who want the work and for whom the instruction is a step forward in their calling.

3. To reach the worker—

(a) You must not wound his self-respect; he must be put into a group of men like himself, who have had about the same hard knocks in the world, about the same amount of schooling, and who have about the same amount of ability and about the same amount of skill on the job.

(b) You must not waste his time; you must have goods to deliver which he wants, and you must deliver them immediately and directly.

### **APPLICATION OF THE SHORT-UNIT COURSE TO THE PART-TIME SCHOOL.**

From the standpoint of this Bulletin a general continuation school will be regarded as a school where the pupil who has already become a wage earner gives a part of his working time to the school for the purpose, on the whole, of continuing his general education, making for better and more intelligent citizenship.

The part-time industrial or trade school is a school operated during the day where the pupil who has already become a wage earner is drawn out of the industry for a part of his working time for the purpose of increasing his efficiency in the occupation or trade he is following or of preparation for another. This school may be of two different types, part-time trade extension or part-time trade preparatory. The part-time trade extension school as here considered is a school for increasing the trade efficiency of the worker in the trade or occupation in which he is employed. The part-time trade preparatory school is a school which prepares the worker for a calling other than the one in which he is employed.

This Bulletin is concerned only with the application of the short-unit course to the part-time trade extension school and has nothing to do with the continuation school nor with the part-time trade preparatory school.

### **USUAL METHOD OF ELEMENTARY PART-TIME INSTRUCTION.**

In any part-time plan the school's part in the work is usually confined to classroom instruction, which is commonly one or the other of two rather distinct types. Sometimes it is organized as a general course in such subjects as general mathematics, general science, and mechanical drawing, which it is felt the worker should know. This course is commonly carried on in the same way as the general course in a regular high school. Not infrequently these general courses are given under the high-school roof by regular high-

school teachers. A school of this kind, though called a part-time school, is essentially a continuation school, and need not be here discussed. Usually, the part-time course consists of a modified form of the general course, and is determined by eliminating from it those topics that have no application to trade work, and giving more attention to topics which do apply to the trade. Instead of teaching all of the general subject of algebra, for instance, such subjects as the binomial theorem and permutations are omitted, and the instruction is centered on fundamental processes and on topics like formulas and simple equations, which it is assumed have general application to a variety of trades. These topics, however, are not usually taught from the standpoint of the needs of the worker in any given trade.

### **CORRELATION BETWEEN CLASSROOM AND SHOP.**

The weakness in the customary method of organizing the classroom work in the part-time school is that it does not, for reasons already discussed, admit of effective correlation between shop experience and classroom work. To give efficient industrial training requires a close interweaving of practice and theory. Practice lays the basis for the understanding of theory and fixes it when taught. Theory gives meaning and direction to practice. The closer that "doing and thinking about the doing" can be related, the more efficient will be the instruction. To accomplish this requires close correlation between shop experience and classroom teaching. For example, to teach most effectively the boy in the classroom how to index a milling machine by the continued fraction process requires that the boy shall actually be doing a milling machine job in the shop that makes it necessary for him to know how to use this method.

Correlation is the only way in which the pupil can be trained to real power by the work of the classroom. Only by intimately relating the abstract work of the book to the concrete processes of the shop can the book work be made intelligible to the pupil.

Unless the pupil can be taught to think in connection with the job he is doing, there is great danger that the work of the shop will become mere mechanical manipulation. To teach him to think requires an interweaving of classroom and shop work in such manner as to utilize the subjects of the classroom such as drawing, mathematics, and applied science to enlighten the processes of the shop.

### **DIFFICULTIES OF CORRELATING CLASSROOM AND SHOP.**

It is clear that correlation between the classroom and the shop is necessary to efficient teaching in the part-time school. Certain conditions, however, make this correlation extremely difficult, and

to a large extent impossible, save where the short-unit course method is used. This is true for the following reasons:

1. The school can not control the work of the shop. The shop of the part-time school, like any other commercial shop, must take its work as it comes. The character and quantity of the work depend entirely upon its business. Under these conditions it is extremely difficult to organize shopwork to meet the needs of the pupil. He must rather adapt himself to the requirements of the shop. Even where it might be possible to adjust the shopwork to the needs of the boy, it has not yet appeared that very many manufacturers are interested enough in the problem of training the boy for the industry to make the necessary sacrifice to do this. The school must therefore adapt itself to the industry, and it can do so only by using the device of the short-unit course.

2. Variation in the time of admitting the pupil to the part-time school makes it difficult to secure effective correlation. The time when the boy enters the school is usually determined by the minimum age at which he can enter the industry. Unless the school confines its dates for accepting pupils to once or twice a year, they will be entering the class at various points in the progress of the work. In some places this difficulty is met by accepting pupils only at stated intervals, as in the regular schools. This practice is open to the objection that it throws the boy back either into the regular school or into a dead end employment until the part-time school will receive him, and neglects his instruction during the interval before the opening of a new term of school.

By breaking the classroom work into short units sufficient flexibility is given to the program to permit the school to accommodate the boy at any time when he enters the industry.

3. In smaller industrial centers, at least, the fact that a part-time class must usually contain small groups of boys from several different trades which vary widely in their content and practice presents a special problem which is discussed at the close of this part of the Bulletin.

4. The extreme specialization in large shops and factories, and even in many skilled industries, has tended more and more to make the usual workman a machine hand having a high degree of knowledge of and skill at the machine which he operates, and little or no experience or opportunity to get experience at other machines and processes in his trade.

To give such a wageworker the range of training necessary to make him a competent all-round workman, it is becoming increasingly clear that the part-time school must supplement the narrow opportunity which the commercial shop affords by maintaining at

least a modest school shop for the purpose of giving him additional instruction in shop practice at new machines.

It is very doubtful whether a part-time class organized on any other than a short-unit basis will meet the needs of the specialized machine hand. A part-time course made up of general topics, fails to take into consideration the immediate shop needs of the worker and for purposes of instruction is not at all concerned with the character and extent of his shop experience. On the other hand, the short-unit course aims to meet the immediate trade requirements of the worker, and is itself the result of a close analysis of the opportunity afforded by the commercial shop for trade training, which must of necessity reveal the deficiencies to be met by supplementary shop practice under the school roof.

When supplementary instruction at new machines or in various shop processes denied the worker in his daily employment is given by the school, it must necessarily be organized into a series of short units, each consisting of shop practice at a specific machine or process, as, for example, when a boy employed in operating an engine lathe is given instruction by the school in operating a turret lathe, a boring mill, a planer, or a milling machine.

When the school shop has been so organized as to provide the machine worker with a series of experiences at different machines or processes, the part-time class enjoys an exceptional opportunity to correlate the work of the classroom and the work of the school shop. It can control the time and character of any given activity, both in the shop and in the class, so as to make the training of each help that of the other.

#### CONDITIONS NECESSARY TO CORRELATION.

To secure effective correlation requires a reversal of the usual methods of teaching and involves the following considerations:

1. Deferring the subject to be taught until the need for it appears in the related subject; for example, deferring the teaching of decimal fractions to the machine-shop pupil until he needs to use the micrometer.

2. Deferring the subject to be taught until there is an adequate basis of concrete experience in the related subject. To repeat the example just given, deferring the teaching of decimal fractions as required for use in the machine shop until the pupil has had some shop experience.

3. Preceding drill and theory by the practical application of the topic to be taught. For example, giving the pupil in carpentry a practical problem in roof framing involving the hypotenuse of the

right triangle and deferring drill work upon the method of finding the hypotenuse until a later point in the course.

4. Where this procedure is not possible, making practical application of the topic studied as soon as it is taught.

5. Acquiring power by doing a real and not an imaginary job. Most of the so-called practical problems of the textbooks fail to develop power in the pupil because they deal with conditions which to him are usually imaginary in that they are commonly not related to his experience.

It seems obvious, for reasons already given, that none of these aims can be efficiently realized in a part-time class, save by the use of some device such as the short-unit course.

### **THE SHORT-UNIT COURSE AND THE MIXED CLASS.**

One of the most difficult problems the part-time school has to face is that of meeting the trade needs of young workers drawn from several different trades where it is necessary to teach them at the same hour in the same class. It goes without saying that wherever circumstances permit, classes should be so organized as to group together workers from the same trade, so that each class can devote its attention to the problems of that one trade, as when a part-time school consists of a class for machinists, a class for carpenters, and a class for plumbers.

Sometimes, however, particularly in small cities, pupils from a number of different trades must be grouped for purposes of instruction in the same class. The usual method of handling such a class is to organize the instruction into topics, each of which has, as far as possible, general and common application to all the trades represented. This method is commonly adopted because it appears to the instructor to be the only method of handling the mixed group confronting him.

It has already been pointed out why this is not a good way to train young workers, and why the short-unit course offers a far better method. Admittedly, the proposal to use the short-unit course in a class made up of pupils from different trades presents both administrative and teaching difficulties. Under these conditions several plans are possible, however, which will reduce, if not entirely remove, the difficulties, and will at the same time secure more efficient teaching by the use of the short-unit course than can be obtained by any other method.

Wherever possible, homogeneous groups should be secured, because the short-unit course works best with such a group. To accomplish this several devices are feasible:

1. Groups representing each of the various trades may be isolated and taught separately, each group being given fewer hours of instruction than would be given to the whole class if this separation were not made. For example, if a class contains pupils from four different trades, and eight hours are allotted to mathematics, the class might be divided into four groups and two hours' instruction given to each group. The time during which the members of a given group are not in the class of mathematics can be used for additional work either at home or in the school. Under this plan the program would be arranged in the same way as that of the regular high school, with separate recitations for each group.

2. Another method is that of dividing a class into groups according to trade and teaching the groups thus formed simultaneously. To employ this method successfully requires close observance of the following considerations:

(a) The material to be taught must be well prepared and carefully graded. Lesson sheets, each designed to cover one specific topic and written with abundant directions and simple explanations, accompanied by examples, clearly worked out, illustrating the principles and processes to be taught, are absolutely necessary.

(b) The subject matter must be selected and arranged according to the trade to which it is related, a separate lesson sheet being prepared for each topic, even when that topic has general application to several trades.

(c) The groups to be taught must be separated from each other and treated as distinct units throughout the instruction. Placing the various groups in adjoining rooms or different parts of the same room for this purpose is advisable. Wherever drill work is necessary, as, for example, for the purpose of fixing certain fundamental processes which have already been taught in separate groups, several groups may be brought together and treated as one. This can also be done to a greater or less extent in checking up work.

(d) A large amount of supplementary material in the form of blue prints for individual use and wall charts and diagrams are essential.

(e) To adapt the work to the pupil's needs, and to check up his progress it is necessary before starting the class to make a careful analysis of each trade in order to determine just what topics are to be taught. A record should be kept of the amount of time a pupil spends on each topic, and the quality of his work, and as soon as he has satisfactorily completed a required unit it should be checked up to his credit.

The success of the device of separate groups within the same class depends somewhat upon the ability of the instructor to use his more

advanced pupils as assistants to give individual instruction to various members of the different groups.

3. A third device which may be used with either of the above-mentioned plans is that of the paid pupil-teacher who serves as an assistant to the instructor in charge of the class while learning how to teach. Under the first plan the pupil-teacher would be given a separate group which he would teach with such assistance and direction as the instructor might be able to give him. Under the second plan he would assist the instructor in the preparation of lesson sheets, revision and correction of work, and would help him in the class, either by giving individual instruction or handling within the class one of the class groups.

The success of any of these devices depends in large measure, as does any teaching device, upon the practical knowledge of the instructor and his skill in organizing material and in teaching and his ability to handle boys.

From the foregoing discussion it is evident that the part-time school depends for its success upon its ability to meet the trade needs of the pupil, and that to meet these needs close correlation between classroom and shop is required, such as can be secured only by the use of the short-unit course.

## LISTS OF COURSES.

### LIMITATIONS IN USE OF COURSES.

The courses in the following list are intended to be suggestive only. They are given to show the way in which analyses of various trades can be worked out, and not for the purpose of providing a school with ready-made courses. They are the contributions, on the whole, of men and women in different trades who have had a certain definite experience in some one or more establishments where they have gained familiarity with the trade and its processes under conditions peculiar to the shops where they have worked.

These conditions may not always be customary or usual in the trade. Therefore the courses and analyses here given, while they are applicable to shops working under these conditions, may not be applicable to the work of the same trades as practiced under different conditions. For example, a course for the machinist in "making fits," while it would meet the needs of the worker in a job shop, would not be applicable to a factory in which the work is highly specialized. A course in generator practice for mill electricians would have no place in those cities where mills obtain all their power from a central station. The courses in this list for dressmakers are, on the whole, adapted only to those communities where the trade is not so highly

specialized as to require special designers, waist drapers, and sleeve makers. It will therefore be necessary for schools intending to offer short-unit courses in the trades analyzed in this Bulletin before organizing their work to make careful study of the conditions under which these trades are practiced, and to consult local tradesmen of recognized standing in order to determine what modifications, if any, must be made to meet the needs of local workingmen.

### SHORT-UNIT COURSES OF EVENING SCHOOLS OF SPECIFIED CITIES.

A partial list of short-unit courses offered in the evening schools of various cities, taken from the returns of the school authorities, is given below. These courses show an enrollment of approximately 10,000 pupils.

#### SHICKSHINNY, PA.

##### *Mechanical and electrical.*

Course.	Lessons.	Course.	Lessons.
Use of mathematical tables.....	6	Mensuration .....	15
Fractions .....	15	Mechanics of gear wheels, pumps, and steam engines.....	20
Ratio and proportion applied to pulleys and gearing.....	5	Electricity.....	20
Square root .....	6		

##### *Mining.*

FIRST QUARTER.		SECOND QUARTER.	
English .....	20	English .....	20
Mine mathematics (areas, propor- tion, roots to 5th, right triangle, etc.) .....	20	Mine mathematics.....	20
Mine laws.....	20	Mine laws.....	20
Gases .....	20	Mine ventilation and problems per- taining to same.....	20

#### ELLSWORTH AND COKESBURG, PA.

##### *Household arts.*

Serving .....	4	Soups .....	4
Household economy.....	7	Marmalades .....	1
Preserving .....	1	Candy .....	2
Canning .....	2	Left overs.....	1
Desserts.....	5	Sewing .....	10
Pickling .....	2	Preparation of meals.....	10
Salads .....	3	Baking .....	10
Spicing .....	1	Cereals .....	2
Jelly .....	2	Vegetables .....	5
Fish .....	3	Meats .....	5

## TITUSVILLE, PA.

*Cooking.*

Course.	Lessons.	Course.	Lessons.
Raised bread and rolls, quick bread -----	2	Salads -----	3
Meats -----	9	Table setting and serving -----	1
Vegetables -----	8	Cooking for infants and invalids -----	1
Cake -----	2	Simple family meals -----	1
Desserts -----	8	Fish and shellfish -----	2
Fireless-cooker and paper-bag cooking -----	1	Poultry -----	1
		Meat substitutes -----	1

## SHAMOKIN, PA.

English -----	100	Course for mothers in home sanitation -----	25
Sewing for domestic use -----	75	Mining -----	100

## SCRANTON, PA.

*Drawing.*

(Lessons common to all trades.)

Lettering -----	2	Tracings -----	8
Graded exercises teaching use of instruments -----		Free-hand working sketches -----	8
Geometrical problems, dimensioning -----	29	Talks on drafting-room practice -----	3
		Reading working drawings -----	5

*Machine drawing.*

(Special course for machinists, molders, pattern makers, and blacksmiths.)

Screw threads (standard) -----	3	Mechanical drawing of pulley made from sketches -----	4
Flat-link chain (designed from formula) -----	4	Mine car wheel (section view only given to complete drawing) -----	4
Crane hook (designed from tables) -----	4	Pedestal box (to be designed) -----	5
Sketches of pulley wheel (made from object, dimensions taken, etc.) -----	1		

*Architectural drawing.*

(For carpenters, cabinetmakers, and all woodworkers other than pattern makers.)

Framing (studs, sill, pitch, etc.) -----	3	Framing (doors, windows, etc.) -----	4
Stair detail or mine-shaft timbering -----	6	First-floor plan city house or cabinet drawing -----	6
Architectural lettering -----	1	Second-floor plan city house or window and door detail -----	5

## SCRANTON, PA.—Continued.

*Drawing for plumbers.*

Course.	Lessons.	Course.	Lessons.
Pipe tee.....	3	Bathroom layout.....	4
Drawing of trap (sketches made from object).....	5	Piping drawing, two-family house..	9
		Cellar diagram.....	4

*Drawing for masons.*

Brick bond.....	8	Fireplace design.....	7
Hollow tile.....	4	Foundation plan for house.....	6

*Drawing for sheet-metal workers.*

Two-part elbow.....	4	Roof cap.....	5
Four-part elbow.....	5	Cornice.....	6
Tapered elbow.....	5		

*Cooking.*

Cereals.....	2	Candy.....	2
Cooked fruits.....	4	Meats.....	2
Vegetables.....	6	Soups.....	1
Raised bread and biscuits and rolls..	6	Fish and shellfish.....	2
Omelets.....	1	Sauces.....	3
Desserts.....	6	Beverages.....	2
Cake.....	3		

*Pattern making.*

Reading drawings.....	7	Shrinkage on patterns.....	5
Free-hand sketching.....	8	Draft on patterns.....	5
Foundry terms and practice.....	15	Making patterns.....	25
Allowance on patterns.....	5	Making core boxes.....	10

*Machine-shop mathematics.*

Fractions.....	8	Foundry work.....	4
Ratio and proportion.....	7	Pulley speeds and belts.....	8
Square root.....	4	Foundry work (cupola mixture)..	2
Mensuration.....	8	Tapers.....	2
Figuring weight.....	3	Threads.....	6
Micrometer.....	5	Gearing for threads (simple and compound).....	6
Vernier.....	2	Gear calculations.....	12
Percentage.....	3		

*Sewing for domestic use.*

Making stitches, hems, seams, but- tonholes.....	5	Making kimono.....	5
Making underwear.....	10	Making shirt waist.....	8
		Making cotton dress.....	12

*Dressmaking.*

Cotton dress.....	7	Woolen dress.....	10
Tailored skirt.....	5	Silk dress.....	13
Fancy waists.....	5		

SCRANTON, PA.—Concluded.

*Machine-shop practice.*

<p>Lathe work :</p> <p>    Turning parallel between centers.</p> <p>    Turning tapers—</p> <p>        Offset tail stock.</p> <p>        Compound rest.</p> <p>        Taper attachment.</p> <p>    Church work—Boring and facing.</p> <p>Thread cutting :</p> <p>    Internal and external.</p> <p>    Right and left hand.</p> <p>Milling-machine operations :</p> <p>    Plane milling.</p> <p>    Gear cutting.</p> <p>    Milling cutters (plane and angular).</p> <p>    Fluting.</p> <p>    Boring.</p>	<p>Shaper and planer work :</p> <p>    Plane surfacing.</p> <p>    Side cuts.</p> <p>    Cutting bevels.</p> <p>Universal grinder :</p> <p>    Grinding between centers, parallel and taper.</p> <p>    Grinding cutters (plane and angular).</p> <p>Drill press :</p> <p>    Location and drilling of holes.</p> <p>    Use of jigs.</p>
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WILLIAMSPORT, PA.

VOCATIONAL SCHOOL.

*Electricians.*

Course.	Lessons.	Course.	Lessons.
Practical units.....	10	Generators.....	8
Ohm's law.....	12	Motors.....	12
Power measurement.....	8	Meters.....	10
Measurement of resistance.....	10		

*Class for foundrymen.*

Pattern making and foundry work.....	15
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*Machinists.*

Mensuration and weights of solids.....	12	Gearing for screw cutting.....	8
Pulleys, belts, and speeds.....	10	Taper.....	10
Speeds of pulleys, shafts, and gears.....	8	Regular.....	6
Cutting speed and feed.....	6	Differential and compound indexing.....	6
The micrometer.....	2	Shop sketching.....	16
Thread proportions.....	3		

*Woodworkers.*

Board measure and estimating....	15	Brickwork, stonework, and excavation.....	12
Simple stair building and simple framing.....	10	General construction.....	15
Roof framing.....	12	Sketching and reading drawings..	16
Shingling, lathing, and plastering..	10		

*Household arts.*

Breakfasts.....	4	Salads.....	4
Lunches.....	4	Desserts.....	6
Dinners.....	6	Table setting and serving.....	2
Raised bread, biscuits, rolls....	4	Cooking for infants and invalids..	2
Cakes and cookies.....	4		

## MONTROSE, PA.

*Cooking (evening courses).*

[NOTE.—The following short-unit courses were given in the evening from Jan. 19 to Mar. 2.]

Course.	Lessons.	Course.	Lessons.
Food values.....	3	Fireless cooker.....	2
Feeding growing children.....	3	Fuels.....	2
Meats.....	3		

*Courses for farmers (evening courses).*

[NOTE.—The following courses were given two evenings per week during the winter to a group of farmers living from 1 to 3 miles from town.]

Soil management.....	6	Fertilizers.....	6
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## TROY, PA.

Fertilizers.....	2	Feeding dairy cows.....	3
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[NOTE.—These courses were given during a period of seven weeks, extending from Jan. 12 to Mar. 1, and were given to those not regularly enrolled in the schools as students.]

Day courses.	Lessons.	Day courses.	Lessons.
Soils and soil management.....	10	Rotation of crops.....	5
Soils and fertilizers.....	10	Orcharding:	
Feeding dairy cows.....	6	Propagation.....	5
Care and management of dairy cows.....	6	Cultivation.....	3
Breeding dairy cows.....	6	Spraying.....	6
Composition and testing of milk.....	6	Farm management.....	7
Farm crops.....	10	Vegetable gardening.....	5

## ROCHESTER, N. Y.

*Cooking.*

Bread, biscuits and muffins, salads.....	12	Left overs.....	12
Soup stock and soups, meats and vegetables, and marketing.....	12	Invalid dishes, infant feeding, and children's diets.....	12
Desserts, pastry and puddings, cake making.....	12	Candy making, canning and preserving, and waitress course.....	6
Luncheon dishes, breakfast dishes, and supper dishes.....	12	Chafing-dish cookery.....	6
School lunches and lunches for the dinner pail.....	12	Italian dishes.....	6
Simple family meals.....	12	Fish, oysters, and poultry.....	6
		French cooking.....	6
		Lunch-room training.....	12

*Design.*

Courses.	Lessons.	Courses.	Lessons.
House decoration.....	12	Costume design.....	36
Applied design for garment decoration.....	12	Embroidery design.....	6

## TECHNICAL AND TRADE COURSES FOR MEN—concluded.

*Dressmaking and plain sewing.*

Courses.	Lessons.	Courses.	Lessons.
Mending, patching, darning, remodeling, and renovating of wearing apparel	12	Children's garments	24
Household linens, sheets, pillow slips, hemming towels, damask hemming, marking and repairing linen	12	Fancy neckwear, jabots, collars, berthas	12
Plain sewing, aprons, undergarments	36	Advanced dressmaking, fitting and making of waists, gowns, and coats	36
Shirt waists	12	Buttonhole and eyelet making, sewing on buttons, hooks and eyes	12
Shirt-waist suits and one-piece cotton dresses	24	Power-machine operating	12
Layettes (with home work)	12	Skirt making	24
		Drafting system	36

*Embroidery.*

Wearing apparel	12	Lettering	12
Fancy articles	12		

*Millinery.*

Drafting and blocking of buckram shapes	12	Ribbon flowers, novelties, etc	12
Covering and trimming of buckram frames	12	Wire frames, sewing braid, and trimming	24
Making of buckles, cabochons, etc	12	Children's millinery	12
		Renovating and remodeling old hats and trimmings	12

*General home making.*

Household chemistry and sanitation	72	Household appliances	36
Public sanitation	12	Home nursing and care of children	12
Pure foods and pure-food laws	12	Laundering and house care	6

## TECHNICAL AND TRADE COURSES FOR MEN.

*Cabinetmakers.*

Blue-print reading	12	Millwork	24
Drawing and layout work	12	Assembling	12
Estimating	12	Finishing	12
Furniture design	24		

*Carpenters.*

Blue-print reading	12	House framing	12
Architectural drawing	24	Roof framing	12
Perspective drawing	6	Shop mathematics	24

## ROCHESTER, N. Y.—concluded.

## TECHNICAL AND TRADE COURSES FOR MEN—continued.

*Electricians.*

Courses.	Lessons.	Courses.	Lessons.
Blue-print reading.....	12	General electric theory.....	12
Estimating.....	12	Theory of lighting.....	12
Drawing of Bell telephone and telegraph circuits.....	36	Theory of motors and dynamos..	24
Drawing of light distribution....	12	Theory of batteries.....	12
Motor generator and switchboard drawing.....	24	Theory of transformers.....	12

*Machinists.*

Blue-print reading.....	12	Shop mathematics.....	24
Machine design.....	24		

*Opticians and lens makers.*

Theory of light waves, properties and laws of light reflection and refraction and dispersion.....	6	Combination and correction of lenses, properties of mirrors and lenses, various lens instruments, polarization of light.....	66
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*Pattern makers.*

Blue-print reading.....	12	Applied mechanics.....	12
Machine detail.....	24	Draft and shrinkage of metals....	6

*Plumbers.*

Joint wiping.....	12	Study of ventilation.....	12
Blue-print reading.....	12	Theory of pumps.....	6
Theory of water supply.....	6	Theory of hydraulics.....	6
Study of drainage systems.....	12	Theory of pneumatics.....	6

*Printers.*

Composition.....	12	Design.....	24
Presswork.....	12	Estimating.....	12
Layout and make-ready work....	12		

*Sheet-metal workers.*

Pattern making.....	12	Shop mathematics.....	12
Blue-print reading.....	12		

*Steam fitters.*

Hot-water circulation:		Study of boilers.....	12
Single-pipe systems.....	6	Boiler testing.....	6
Double-pipe systems.....	6	Power-plant maintenance.....	36
Pressure system and forced circula- tion.....	6		

## PREPARATORY COURSES FOR MUNICIPAL CIVIL-SERVICE EXAMINATIONS.

Subjects.	Lessons.	Subjects.	Lessons.
Trench and sewer inspector.....	36	Rodman.....	36
Inspector of public improvements..	36	Chainman.....	36
Draftsman.....	36	Patrolman.....	36
Junior draftsman.....	36	Driver.....	36

## ROCHESTER, N. Y.—Concluded.

## PREPARATORY COURSES FOR MUNICIPAL CIVIL-SERVICE EXAMINATIONS—concluded.

Subjects.	Lessons.	Subjects.	Lessons.
Fireman .....	36	Bookkeeper .....	36
Court stenographer .....	36	Stenographer .....	36
General clerk .....	36	Janitor in charge of steam boilers .....	36
Junior clerk .....	36	Janitor in charge of furnaces .....	36

## YONKERS, N. Y.

	Units.		Units.		Units.
Pattern making .....	5	85	Architectural drawing .....	8	110
Carpentry .....	18	90	Applied mathematics .....	12	60
Plumbing .....	9	90	Sign painting .....	11	132
Electrical building construction .....	8	110	Blacksmithing .....	8	110
Electrical machine operation and installation .....	8	130	Gas engine .....	9	74
Power plant .....	10	121	Embroidery .....	3	23
Machine .....	15	228	Sewing .....	7	60
Mechanical drawing .....	6	200	Millinery .....	18	100
			Cooking .....	26	60
			Dressmaking .....	7	60

## ALBANY, N. Y.—NORMAL COLLEGE.

Cabinetmaking .....	18	Machine-shop practice .....	18
Pattern making .....	18		

In Massachusetts short-unit courses for women have been conducted in the following subjects:

Bread making.	Shirt-waist suits.
Meats and vegetables.	Skirt making.
Desserts.	Cotton dresses.
Simple family meals.	Woolen dresses.
Breakfasts.	Cutting and fitting, draping.
Dinners.	Children's dresses.
Luncheons.	Damask hemming, fine darning.
Suppers.	Sheets, pillow slips, aprons, etc.
Biscuit, hot cakes.	Wire-frame making.
Cake making.	Velvet hats.
Pastry and puddings.	Straw hats.
Soup stock and soups.	Trimming of hats.
Poultry.	Remodeling of hats.
Salads.	Buttonhole and eyelet work.
Serving of meals.	Kensington work.
Washing and ironing.	Colored work.
Mending, patching, darning.	Scalloping.
Remodeling clothing.	Punch work.
Undergarments.	French solid embroidery.
Shirt-waist making.	

Each of the following cities has conducted one or more of the courses given above:

*Boston.*—Trade school for girls and in various grammar-school buildings.

*Cambridge.*—In various grammar-school buildings.

*Everett.*—Evening industrial school.

*Lawrence.*—Evening industrial school.  
*Lowell.*—Evening industrial school.  
*Methuen.*—In a grammar-school building.  
*Fall River.*—In two grammar-school buildings.  
*Natick.*—In the high school and a grammar-school building.  
*New Bedford.*—Evening industrial school.  
*Newton.*—Evening vocational school.  
*Quincy.*—Evening industrial school.  
*Somerville.*—Evening vocational school for girls.  
*Taunton.*—Evening industrial school.  
*Wakefield.*—In high-school building.  
*Watertown.*—In high-school building.  
*Walpole.*—In high-school building.  
*Worcester.*—Girls' trade school and in various grammar-school buildings.

#### YOUNG MEN'S CHRISTIAN ASSOCIATIONS.

Most of the instruction in the evening schools of the Young Men's Christian Associations throughout the country is organized in brief courses of from 5 to 25 lessons. During the year 1913, 94,400 pupils were reported in these courses.

#### TYPICAL SHORT-UNIT COURSES.

The number of lessons to be given in any course primarily depends upon the needs of the pupil. This will obviously vary with the aptitude of the pupil, the efficiency of the teaching, the facilities of the school, and the general conditions under which the work is given. The number of lessons stated for certain courses in this list represents, on the whole, what experienced instructors believe to be, under normal conditions, a desirable minimum. Each of these lessons is assumed to be two hours long.

Each course in the list is numbered, usually under one general division of the subject, and this number is used as a cross reference to the analyses given at the end of this list. Only those courses which are starred (\*) are further analyzed.

#### FARMING.

##### A. Orcharding.

Lessons.	Lessons.
1. Systematic pomology----- 1-10	*10. Harvesting ----- 2-10
*2. Orchard setting----- 2-6	*11. Marketing----- 2-10
*3. Orchard cultivation----- 2-10	12. Orchard management----- 5-10
*4. Propagation ----- 5-10	13. Soils, fertilizers, and mulches ----- 5-40
*5. Pruning ----- 3-10	14. Orchard cropping ----- 2-10
6. Orchard protection----- 1-5	15. Fillers----- 1-5
8. Diseases injurious to fruits. 2-20	16. Accounting ----- 2-10
7. Orchard insects----- 2-20	
*9. Sprays and spraying----- 5-15	

FARMING—continued.

*B. General cropping.*

	Lessons.		Lessons.
1. Conditions for growth and development .....	2-4	6. Diseases and treatment.....	2-15
2. Soils, fertilizers, and manures.....	5-40	7. Harvesting .....	1-5
3. Seed selection and varieties..	5-40	8. Storing, transportation, and marketing .....	1-5
4. Planting or sowing.....	2-10	9. Cost accounting.....	2-10
5. Management of growing crops .....	2-10	10. Crop rotation.....	1-5

*C. Truck farming.*

1. Conditions determining kinds of crops.....	2-4	6. Cold frames.....	1-5
2. Soils, fertilizers, and manures.....	5-40	7. Insect pests and control....	5-40
3. Seed selection and plant breeding.....	5-15	8. Plant diseases and control..	2-20
4. Plant propagation.....	5-10	9. Cultivation .....	2-10
5. Hothouse management .....	2-20	10. Marketing .....	2-5
		11. Cost accounting.....	2-10
		12. Management .....	1-10

*D. Grape growing.*

1. Classification of grapes.....	1-10	8. Insects injurious to grapes..	2-10
2. Propagation .....	5-10	9. Sprays and spraying.....	5-15
3. Location .....	1-5	10. Cultivation .....	2-10
4. Soils, fertilizers, and mulches .....	5-40	11. Protection .....	1-5
5. Planting and successive treatment.....	2-10	12. Harvesting .....	2-10
6. Pruning and training.....	2-10	13. Marketing .....	2-10
7. Grape diseases.....	2-40	14. Wine making.....	5-20
		15. Vineyard management.....	2-10
		16. Accounting .....	2-10

*E. Small-fruit raising.*

1. Origin .....	1-3	7. Planting methods.....	2-6
2. Varieties .....	2-10	8. Trimming or pruning.....	1-5
3. Seasonal production.....	1-3	9. Protection .....	1-4
4. Soil type most favorable....	1-4	10. Renewing .....	1-5
5. Climatic range .....	1-3	11. Picking and marketing.....	2-10
6. Manuring and fertilizing... 5-20			

*F. Poultry keeping.*

*1. Poultry houses and yards..	5-15	8. Exhibiting .....	1-5
*2. Breeds and breeding.....	10-20	*9. Marketing .....	2-10
*3. Feeds and feeding.....	5-10	*10. Diseases, parasites, and enemies .....	3-6
4. Egg production and meat production .....	1-4	*11. Poultry appliances.....	5-15
5. Embryology .....	2-10	12. Poultry management.....	3-20
*6. Incubation .....	5-21	13. Killing and picking.....	2-4
*7. Brooding .....	5-30	14. Accounting and recording..	2-10

## FARMING—concluded.

*G. Dairying (including the dairy cow).*

	Lessons.		Lessons.
1. Cow judging	10-20	*10. Butter making	2-10
2. Feeding dairy cattle	10-20	*11. Cheddar cheese making	2-10
3. Breeding dairy cattle	3-5	*12. Fancy cheese making	1-5
4. Care and management of dairy cattle	5-20	13. Dairy management	5-15
5. Diseases of cattle	3-5	14. Dairy by-products	2-10
*6. Milk composition and testing	5-15	15. Creamery management	3-10
7. Milk ferment and fermentation	1-5	16. Accounting	2-10
8. Market milk	5-10	17. Dairy buildings and equipment	5-10
9. Cream—Separation, ripening, and churning	2-10	18. Cleanliness in handling milk	1-5
		19. Production of certified milk	1-5

*H. Swine raising*

1. Choosing and judging	5-10	4. Care and management	10-15
*2. Feeding	5-10	5. Diseases	2-6
*3. Breeds and breeding	10-20	6. Buildings and equipment	5-10

*I. Sheep raising.*

*1. Breeds	5-10	6. Shearing	2-5
2. Judging	2-10	7. Sheds and barns	5-6
*3. Feeding	5-10	8. Lambs	5-6
4. Fattening	3-6	9. Diseases	2-6
*5. Breeding	5-10	10. Care and management	5-10

*J. Horse husbandry.*

1. Judging	5-10	5. Care and management	3-8
*2. Feeds and feeding	5-10	6. Diseases	2-6
*3. Breeds and breeding	5-10	7. Horse showing	1-5
4. Barns and equipment	2-8	8. Raising and training colts	3-6

## FURNITURE MAKING.

*A. Stock and machine work.*

Course for prospective stockmen:		Courses for machine hands, apprentices—Continued.	
Grading lumber, kinds of lumber, uses	—	Surfacer or planer work, care of machine	—
Course for prospective kiln men:		Miter-saw and circular-saw work, and care	—
Seasoning lumber, management of dry kilns	—	Jig-saw and band-saw work, and care	—
Courses for machine hands, apprentices:		Sticker work, care of machine	—
Stock sawing and matching	—	Shaper work, care of machine	—
Ripsawing, hand and railroad	—	Mortiser and boring machine	—
Band sawing	—		
Buzz planer and jointer work, care of machine	—		

FURNITURE MAKING—continued.

A. *Stock and machine work*—Concluded.

Courses for machine hands, apprentices—Continued.	Lessons.	Courses for machine hands, apprentices—Concluded.	Lessons.
Hand turning .....	—	Box miter work, and care...	—
Lathe, care, and knife making.....	—	Router and friezer work, and care.....	—
Scraper, and care of knives.....	—	Tenoner, double and single.....	—
Triple-drum sanders.....	—	Lock machines and Moore machines .....	—
Belt sanders .....	—	Veneering, cutting, jointing, tapping, use of presses....	—
Open-drum, disk, and oscillating-spindle sanders....	—		
V jointer or chain jointer.....	—		
Dovetail-machine work, and care.....	—		

B. *Cabinetmaking*.

Courses for machine-hands, apprentice, cabinetmakers in—

1. Tools, uses and care.....	—	5. Gluing—Making glue, preparing stock, testing glue.....	—
2. Joints—Uses, advantages, methods of construction...	—	6. Drawer-fitting, door hanging.....	—
3. Construction of frames.....	—	7. Trimming and glazing.....	—
4. Construction of tables, chairs, cases—Assembling .....	—	8. Lining and simple inlay.....	—

C. *Finishing*.

Courses for apprentices, finishers, and those employed on one operation wishing to learn other operations, in—

1. Tools, brushes—Quality, care of.....	—	6. Simple methods and formulas for making stains, filler removers, polishers, etc.; chemistry for finishers....	—
2. Mixing and applying stains, fillers .....	—	7. Colors, toning, finishes used on different kinds of wood, and for different styles....	—
3. Varnishing, rubbing, polishing—Kinds of varnish.....	—		
4. French polishing.....	—		
5. Stains, water, oil, and spirit—Advantages and uses, preparation of solid stock and veneer for different stains, wood qualities as applicable to finishing.....	—		

Courses for salesmen, designers, all connected with furniture making, in period styles and modern adaptations.

1. Fittings and decorations for styles.....	—
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Courses for student designers.

1. Methods of construction.....	—	5. Elementary furniture design.....	—
2. Geometric drawing.....	—	6. Perspective, mechanical, and free-hand.....	—
3. Orthographic projection.....	—	7. Advanced design.....	—
4. Free-hand drawing.....	—		

## FURNITURE MAKING—concluded.

*C. Finishing*—Concluded.

Courses for student designers, machine men, cabinetmakers.

	Lessons.		Lessons.
1. Rod making .....	—	2. Making stock bills .....	—

Course for all apprentices.

1. Reading details and rods .....

*D. Miscellaneous.*

Course for student designers, stock keepers, in—

1. Hardware, furniture trimmings, and accessories—Kinds on market, advantages, cost .....

Courses for foremen, prospective foremen, mechanics, clerks, in—

	Lessons.		Lessons.
1. Factory costs and overhead expenses, sequence of operations and machines, most advantageous operations on different machines—Systems of checking .....	—	2. Carvers' apprentices—Hand carving .....	—

Course for spindle carvers' apprentices in—

1. Spindle carving .....

Course for apprentice pattern makers, in—

1. Pattern making for furniture work .....

Course for apprentice filers and sharpeners, in—

1. Filing and sharpening .....

Course for apprentices and machine men, in—

1. Knife making and tempering .....

Course for apprentice caners, in—

1. Caning .....

Course for all stockmen, machine men, clerks, in—

1. Shop mathematics—Board measure, pulleys, belts, gears, cutting speeds.

*E. Upholstering.*

Courses for apprentice upholsterers, upholsterers wishing to learn new processes in—

	Lessons.		Lessons.
1. Tools and accessories .....	—	5. Cushions .....	—
2. Slip seats, pad seats, pad backs .....	—	6. Leather tufting, or Turkish leather work, bun or square biscuit, and diamond tuft ..	—
3. Springing up, webbing .....	—	7. Old English work .....	—
4. Stitching edges, pillow edge, bridle edge, spring edge, double stuffing .....	—	8. Stock, distinguishing kinds and qualities, advantages ..	—

## MACHINE DRAFTING.

## Courses for draftsmen and apprentices, in—

	Lessons.		Lessons.
1. Simple detailing .....	—	6. Miter gears.....	—
2. Complex detailing.....	—	7. Bevel gears.....	—
3. Assembling.....	—	8. Spiral gears.....	—
4. Spur gears.....	—	9. Free-hand detail sketching ..	—
5. Worms and worm gearing...—	—		

## MACHINIST'S TRADE.

## A. Shop practice.

## Courses for foremen, journeymen, apprentices, in—

*1. Making fits.....	—	14. Planer .....	—
*2. Babbitting.....	—	15. Shaper.....	—
*3. Screw cutting.....	—	16. Jigs and fixtures.....	—
*4. Lapping and scraping.....	—	17. Gauges.....	—
*5. Tool grinding.....	—	18. External grinding.....	—
*6. Universal grinding.....	—	19. Spur gearing .....	—
*7. Casehardening and tem- pering.....	—	20. Bevel gearing.....	—
*8. Soldering.....	—	21. Screw cutting, lathe.....	—
*9. Brazing .....	—	22. Screw cutting, milling ma- chine.....	—
*10. Indexing .....	—	23. Automobile repairing.....	—
*11. Boring mill.....	—	24. Bench lathe work.....	—
*12. Laying out cams.....	—	25. Forging .....	—
13. Scraping .....	—	*26. Drill press .....	—

## B. Machine-shop mathematics.

## Courses for foremen, journeymen, apprentices, in—

1. Use of mathematical tables..	—	*14. Shop trigonometry.....	—
2. Fractions.....	—	15. Laying out geometrical fig- ures.....	—
*3. Ratio and proportion.....	—	16. Spur gearing .....	—
*4. Square root.....	—	17. Bevel gearing.....	—
*5. Mensuration.....	—	18. Worm gearing .....	—
6. Figuring weights .....	—	19. Spiral gearing.....	—
*7. Thread cutting .....	—	20. Feeds and speeds of twist drills.....	—
*8. Simple and compound gear- ing.....	—	21. Calculation of size of drills..	—
9. Pulleys, speeds, and belting..	—	22. Formulas .....	—
*10. Regular indexing .....	—	*23. Applications of the right triangle .....	—
*11. Differential indexing.....	—		
*12. Compound indexing.....	—		
13. Logarithms.....	—		

## BLACKSMITHING.

## Courses for foremen, journeymen, and apprentices, in—

1. Making and care of fires...—	—	11. Making wrenches .....	—
2. Forging shapes .....	—	12. Welding tubing.....	—
3. Twisting iron.....	—	13. Oil tempering .....	—
4. Fluxes .....	—	14. Casehardening.....	—
5. Chain welding.....	—	15. Gas forges .....	—
6. Making rings.....	—	16. Power hammers .....	—
7. Sharpening tools.....	—	17. Calculating stock .....	—
8. Machine-shop tools.....	—	18. Laying out angles.....	—
9. Annealing.....	—	19. Free-hand sketching.....	—
10. Working angle iron.....	—		

PRACTICAL ELECTRICITY AS APPLIED TO TELEPHONE WORK, ELECTRIC LIGHTING, POWER-PLANT CONSTRUCTION AND OPERATION.

Courses for telephone men, in—

A. House installation.

	Lessons.		Lessons.
Wiring:		Circuits:	
1. Wiring rules and methods .....	—	5. Drawing circuits .....	—
2. Building construction .....	—	6. Blue prints .....	—
3. Making joints .....	—		
Instruments:			
4. Construction and use of instruments .....	—		

B. Branch exchange installation.

- |                             |   |                                       |
|-----------------------------|---|---------------------------------------|
| 1. Hotel installation ..... | — | 2. Apartment-house installation ..... |
|-----------------------------|---|---------------------------------------|

C. Central office installation, magneto installation.

- |                                    |   |   |
|------------------------------------|---|---|
| 1. One-position boards .....       | — | 4. Maintenance of gravity batteries ..... |
| 2. Multiple switchboards .....     | — |   |
| 3. Central office protection ..... | — |   |

D. Central office installation, common battery.

- |                              |   |   |   |
|------------------------------|---|---|---|
| 1. Distributing frames ..... | — | 6. Layout of board .....                | — |
| 2. Relay racks .....         | — | 7. Test boards .....                    | — |
| 3. Switchboard cabling ..... | — | 8. Location of trouble in circuit ..... | — |
| 4. Forming .....             | — | 9. Reading blue prints .....            | — |
| 5. Testing .....             | — | 10. Locating switchboard trouble .....  | — |

E. Central energy installation.

- |                                   |   |                                     |
|-----------------------------------|---|-------------------------------------|
| 1. Care and use of machines ..... | — | 4. Central-energy switchboard ..... |
| 2. Types of telephones .....      | — | 5. Trunking system .....            |
| 3. Ringing circuits .....         | — |                                     |

F. Intercommunicating systems.

- |                     |   |
|---------------------|---|
| 1. Installing ..... | — |
|---------------------|---|

G. Electric lighting.

Courses for electricians, in—

- |   |   |  |   |
|---|---|--|---|
| 1. Two and 3 wire systems .....         | — | 4. Armored conductor .....                   | — |
| 2. Alternating and direct current ..... | — | 5. Conduit wiring .....                      | — |
| 3. Greenfield conduit .....             | — | 6. Practical problems in above systems ..... | — |

H. Course for electricians and signal men, in—

- |                             |   |
|-----------------------------|---|
| *1. Primary batteries ..... | — |
|-----------------------------|---|

PRACTICAL ELECTRICITY AS APPLIED TO TELEPHONE WORK, ELECTRIC LIGHTING, POWER-PLANT CONSTRUCTION AND OPERATION—concluded.

I. Course for armature winders, power men, general repair men, and mill electricians, in—

	Lessons.
*1. Armature winding -----	—

J. Course for general construction men, armature winders, power men, general repair men, mill electricians, and central energy telephone men, in—

\*1. Direct-current generator and motor-----

K. Course for switchboard-construction men, switchboard-repair men, power-plant men, mill electricians, in—

\*1. Switchboards-----

L. Courses for linemen and power-plant men, in—

*1. Transformers-----	—
-----------------------	---

*2. Line construction for transmission of power-----	—
--	---

M. Course for power men, in—

\*1. Transmission of power-----

N. Course for fire-alarm men, power-plant men, telephone men, garage men, and electricians in—

\*1. Storage batteries -----

O. Courses for power-plant men and mill electricians in alternating currents.

	Lessons.		Lessons.
*1. Machines—Generators-----	—	*3. Transformers-----	—
*2. Motors-----	—		

CARPENTRY.

Courses for foremen, journeymen, and apprentices, in—

A. *Stair building.*

*1. Back stairs-----	—	*4. Developing rails for circular stairs-----
*2. Platform stairs-----	—	
*3. Circular stairs-----	—	

B. *Inside finish.*

*1. Wainscoting-----	—	*3. Constructing mantels-----	—
*2. Hanging doors-----	—	*4. Constructing china closets--	—

C. *Roof framing.*

*1. Figuring rafters-----	—	*3. Construction of roofs-----
*2. Use of framing square-----	—	

D. *Drawing and mathematics.*

1. Blue-print reading-----	—	3. Perspective drawing-----	—
2. Architectural drawing-----	—	4. Shop mathematics-----	—

E. *House framing.*

1. Framing walls and floors-----

## CABINETMAKING.

Courses for foremen, journeymen, and apprentices in—

	Lessons.		Lessons.
1. Blue-print reading .....	—	5. Millwork .....	—
2. Drawing and layout work .....	—	6. Assembling .....	—
3. Estimating .....	—	7. Finishing .....	—
4. Furniture design .....	—		

## PAINTING.

Courses for foremen, journeymen, and apprentices in—

1. Estimating services .....	—	4. Fresco and stenciling .....	—
2. Paint composition and mixing paints .....	—	5. Graining .....	—
3. Color harmony .....	—	6. Hardwood staining .....	—
		7. Finishing .....	—

## PATTERN MAKING.

Courses for apprentices, journeymen, and foremen in—

1. Reading drawings .....	—	10. Fillets, dowels, plates, and letters .....	—
2. Free-hand sketching .....	—	11. Finishing patterns .....	—
3. Foundry terms and practice .....	—	12. Types of patterns .....	—
4. Allowance on patterns .....	—	13. Core prints .....	—
5. Special bench tools .....	—	14. Construction of patterns .....	—
6. Machine tools .....	—	15. Core boxes .....	—
7. Layouts and templates .....	—	16. Skeleton patterns .....	—
8. Materials .....	—	17. Sweeps .....	—
9. Glue and gluing .....	—		

## PLUMBING.

Courses for foremen, journeymen, and apprentices in—

*1. Drainage and ventilation .....	—	*4. Installing traps and fixtures .....	—
*2. Joint wiping .....	—	5. Estimating .....	—
*3. Hot and cold water supply systems .....	—	6. Blue-print reading .....	—

## SHEET-METAL WORK.

Courses for foremen, journeymen, and apprentices in—

*A. Sheet-metal pattern drafting.*

*1. (a) Cornice work .....	—	*5. (b) Heating and ventilat- ing .....	—
*2. (b) Cornice work .....	—	*6. (c) Heating and ventilat- ing .....	—
*3. Skylights .....	—	*7. Automobile parts .....	—
*4. (a) Heating and ventilat- ing .....	—		

*B. Shopwork.*

1. Pattern making .....	—
-------------------------	---

SHEET-METAL WORK—concluded.

*C. Drawing and mathematics.*

	Lessons.			Lessons.
1. Blue-print reading -----	—		2. Shop mathematics -----	—

STEAM ENGINEERING.

*A. License work.*

Course for third-class engineers in—

1. Work to prepare for second-class license-----

Course for second-class engineers in—

2. Work to prepare for first-class license-----

Course for third-class firemen in—

3. Work to prepare for second-class license-----

Course for second-class firemen in—

4. Work to prepare for first-class license-----

Course for first-class firemen in—

5. Work to prepare for third-class engineer's license-----

*B. Arithmetic.*

Course for engineers and firemen in—

1. Boiler-room calculations-----

*C. Boiler-room chemistry.*

Courses for engineers, in—

	Lessons.			Lessons.
1. Gas analysis-----	—		3. Oils-----	—
2. Feed waters-----	—			

*D. Steam-plant management.*

Courses for operating engineers in—

1. Management of power plant_	—		4. Heat and evaporation-----	—
2. Boilers-----	—		5. Simple engines-----	—
3. Pumps -----	—		6. Compound engines -----	—

*E. Gasoline engines.*

Courses for engineers and firemen in—

1. Ignition—Jump spark-----	—		4. Assembling and disassembling-----	—
2. Ignition—Make and break---	—		5. Carbureters and mixing valves-----	—
3. Locating trouble-----	—			

STEAM FITTING.

Courses for foremen, journeymen, and apprentices in—

*A. High-pressure work.*

1. Injectors.....	—	Lessons.
-------------------	---	----------

*B. Traps.*

	Lessons.		Lessons.
1. Bucket.....	—	3. Expansion.....	—
2. Ball.....	—		—

*C. Condensers.*

1. Surface.....	—	3. Buckley.....	
2. Jet.....	—		

*D. Pumps, regulators, etc.*

1. Feed pumps.....	—	3. Economizers.....	
2. Damper regulators.....	—		4. Separators.....

*E. Valves.*

1. Gate valves.....	—	4. Blow-off valves.....	—
2. Globe valves.....	—		5. Automatic boiler stops.....
3. Check valves.....	—		

*F. Pipe.*

1. Brass, customary use, feed lines.....	—	3. Wrought iron, Reading, Co-hoes, Byers.....	
2. Steel, commercial, full weight, extra heavy, ammonia piping, step-bearing XXX.....	—		4. Cast-iron, blow-off line, condenser piping, feed piping.....
		5. Joints, screwed, flanged, expansion.....	

*G. Low-pressure work.*

1. Boilers, flue, water tube....	—	4. Boiler testing.....	—
2. Vacuum system.....	—		5. Power-plant maintenance....
3. Valves.....	—		

STONE AND GRANITE CUTTING.

Courses for foremen, journeymen, and apprentices, in—

1. Monument design.....	—	4. Figuring stones.....	—
2. Lettering.....	—		5. Reading drawings.....
3. Geometry as applied to stone-cutting.....	—	6. Molding work.....	

COTTON MANUFACTURING.

*A. Carding and spinning.*

Course for boss of picker room, second hands, and overseers of card rooms, in—

1. Openers and pickers.....	—
-----------------------------	---

COTTON MANUFACTURING—continued.

*A. Carding and spinning—Concluded.*

Course for boss grinders and second hands and overseers of card rooms, in—	Lessons. —
2. Cards-----	—
Course for third hands on draw frames and second hands and overseers of card rooms, in—	
3. Draw frames-----	
Course for third hands on roving frames and second hands and overseers of card rooms, in—	
4. Roving frames-----	
Course for third hands on ring frames and second hands and overseers of card rooms, in—	
5. Ring frames-----	
Course for mule spinners, third hands on mules, and second hands and overseers of mule rooms, in—	
6. Mules-----	
Course for third hands on twisters and second hands and overseers of ring spinning, in—	
7. Twistlers-----	
Course for designers, superintendents, assistant superintendents, cotton samplers, in—	
8. Cotton sampling-----	
Course for above-mentioned groups, in—	
9. Draft calculations-----	

*B. Warp preparation and weaving.*

Courses for second hands and overseers of warping room, in—

	Lessons.		Lessons.
1. Spoolers-----	—	2. Warpers-----	—
Course for slasher tenders and second hands and overseers of slashing room, in—			
3. Slashers-----			
Courses for weavers, loom fixers, second hands and overseers of weaving, in—			
	Lessons.		Lessons.
4. Plain looms-----	—	6. Dobbies-----	—
5. Automatic looms-----	—	7. Jacquards-----	—

*C. Designing.*

Course for groups given above under A-4, 5, 6, 7, in—

1. Elementary designing and cloth analysis-----	
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## COTTON MANUFACTURING—concluded.

*C. Designing—Concluded.*

Course for superintendents and assistant superintendents, in—

- |   |                 |
|---|-----------------|
| 2. Elementary designing and cloth analysis----- | Lessons.<br>--- |
|---|-----------------|

Course for designers and assistant designers, in—

- |                                   |  |
|-----------------------------------|--|
| 3. Design and cloth analysis----- |  |
|-----------------------------------|--|

## TERRA-COTTA WORK.

Courses for terra-cotta workers, in—

*A. Terra-cotta architectural drafting.*

- |  |                                  |
|--|----------------------------------|
| 1. Stone and marble shop drafting.     | 4. Sheet-metal pattern drafting. |
| 2. Architectural terra-cotta drafting. | 5. Plan reading.                 |
| 3. Fireproof construction.             |                                  |

*B. Terra-cotta model making.*

- |  |  |
|--|--|
| 1. Reading drawings for moldings, arches, balustrades, pilasters, columns, window and cornice effects. | 2. Making models from drawings of above. |
|  | 3. Making molds of models from drawings. |

## WOOD MILLWORK.

Courses for foremen, journeymen, apprentices, in—

- |                          |                      |
|--------------------------|----------------------|
| *1. Window-frame making. | *4. Door making.     |
| *2. Sash making.         | *5. Wainscot making. |
| *3. Doorframe making.    |                      |

## SIGN PAINTING.

Courses for foremen, journeymen, apprentices, in—

- |   |                               |
|---|-------------------------------|
| 1. Handling and care of tools.                        | 5. Use of driers.             |
| 2. Mixing and blending colors.                        | 6. Gilding on wood and glass. |
| 3. Preparation of various surfaces for sign purposes. | 7. Use of "lettering pencil." |
| 4. Coating of wood, metal, etc.                       | 8. Use of "fitches."          |
|   | 9. Practice in lettering.     |

## SHOW-CARD WRITING.

Courses for journeymen, apprentices, in—

- |                                     |                               |
|-------------------------------------|-------------------------------|
| 1. Handling and care of tools.      | 4. Use of "lettering pencil." |
| 2. Mixing and blending colors.      | 5. Practical lettering.       |
| 3. Preparation of various surfaces. |                               |

## PROOF READING AND COPY EDITING.

Courses for proof readers, in—

*A. Theory—Lectures.*

- |                                    |                               |
|------------------------------------|-------------------------------|
| 1. Proof reader's marks.           | 8. Simplified spelling.       |
| 2. Punctuation.                    | 9. Rules of geographic board. |
| 3. Reference marks.                | 10. Synonyms and antonyms.    |
| 4. Capitalization.                 | 11. Orthography.              |
| 5. Division of words.              | 12. Homonyms.                 |
| 6. Compounding.                    | 13. Grammatical construction. |
| 7. Abbreviations and contractions. |                               |

## PROOF READING AND COPY EDITING—concluded.

*B. Practical work.*

- |                           |                               |
|---------------------------|-------------------------------|
| 1. Galley reading.        | 5. Advertisement revising.    |
| 2. Galley revising.       | 6. Page reading.              |
| 3. Reading with copy.     | 7. Final and foundry reading. |
| 4. Advertisement reading. | 8. Editorial reading.         |

Courses for copy editor, in—

*Editing.*

- |                  |                              |
|------------------|------------------------------|
| 1. Copy editing. | 2. Preparation of manuscript |
|------------------|------------------------------|

## PRINTING.

Courses for foremen, journeymen, and apprentices, in—

- |                              |                                  |
|------------------------------|----------------------------------|
| *1. Make-ready for pressman. | *7. Composition.                 |
| *2. Register.                | *8. Cutting stock.               |
| *3. Ink.                     | 9. Design and printing.          |
| *4. Papers.                  | 10. Punctuation and proof marks. |
| *5. Up-to-date styles.       | 11. Spelling.                    |
| 6. Cost system.              |                                  |

## PLAYER-PIANO-ACTION MECHANICS.

Courses for repair men and workmen, in—

*A. Player-action construction.*

- |                                |  |
|--------------------------------|--|
| 1. Principles of construction. | 6. Regulating.                           |
| 2. Repairing bottom actions.   | 7. Testing.                              |
| 3. Motors and governors.       | 8. General factory work.                 |
| 4. Timing.                     | 9. General outside work.                 |
| 5. Repairing top actions.      | 10. Trying out player actions in pianos. |

*B. Installation.*

1. Player-action installation.

## MINING.

Courses for mine firemen and mine steam engineers, in—

*A. Boilers.*

- |   |   |
|---|---|
| 1. Types of boilers.                                      | 9. Feed-water heaters.                      |
| 2. Construction of boilers and materials of construction. | 10. Feed-water pumps and injectors.         |
| 3. Combustion of fuel.                                    | 11. Removal and prevention of boiler scale. |
| 4. Size and construction of chimneys.                     | 12. Pressure gauges.                        |
| 5. Smoke prevention.                                      | 13. Boiler explosions.                      |
| 6. Methods of firing.                                     | 14. Safety appliances.                      |
| 7. Cleaning and banking fires.                            | 15. Boiler testing.                         |
| 8. Boiler fittings.                                       |   |

*B. Steam engines.*

- |   |                                       |
|---|---------------------------------------|
| 1. Calculation of horsepower.   | 5. Indicators and indicator diagrams. |
| 2. Types of engines.  | 6. Condensers.                        |
| 3. Valve gears.   | 7. Lubricants.                        |
| 4. Construction of engine foundation and footings to prevent vibration. |                                       |

## MINING—concluded.

*C. Pumps and air compressors.*

- |   |                                 |
|---|---------------------------------|
| 1. Construction and operation of various types. | 2. Electrically operated pumps. |
|---|---------------------------------|

*D. Practical electricity and electrical machines.*

- |   |  |
|---|--|
| 1. Simple and branched circuits.              | 5. Precautions to be taken in mines where electricity is used. |
| 2. Care and uses of storage cell.             | 6. Care and operation of electrical machinery.                 |
| 3. Incandescent light and electric lighting.  |  |
| 4. Transmission of electrical power in mines. |  |

*E. Reports and accounts.*

- |  |  |
|--|--|
| 1. Making out daily reports of boiler and engine room. | 2. Weather conditions affecting efficiency of plant. |
|--|--|

## Courses for mine workers, in—

*A. Mine gases.*

1. Origin, occurrence, behavior, and detection of gases common to mines.

*B. Mine ventilation.*

- |   |   |
|---|---|
| 1. Principles of mine ventilation.  | 4. Ventilating appliances.                                |
| 2. Air currents.  | 5. Advantages and disadvantages of various kinds of fans. |
| 3. Distribution of air currents by splitting, doors, stoppings, and regulators. | 6. Problems in mine ventilation.                          |

*C. Timbering, haulage, and pumping.*

- |   |  |
|---|--|
| 1. Advantages and disadvantages of various haulage systems. | 3. Keeping of time, cost, and progress sheets.                               |
| 2. Arrangement and operation of pumps.                      | 4. Making out bills of lading and estimates for quantity of material needed. |

*D. Mine calculations.*

## MOTION-PICTURE MACHINE OPERATING.

## Courses for motion-picture machine operators, in—

- |   |                                  |
|---|----------------------------------|
| 1. Current capacity.                        | 9. Functions of machine parts.   |
| 2. Testing circuits.                        | 10. Threading film.              |
| 3. Connecting machines—Direct current.      | 11. Connecting up machine.       |
| 4. Connecting machines—Alternating current. | 12. Operating.                   |
| 5. Rheostats, economizers.                  | 13. Protecting circuits.         |
| 6. Testing for grounds and short circuits.  | 14. Protecting films.            |
| 7. Arc lamps.                               | 15. "Troubles."                  |
| 8. Locating machine parts.                  | 16. Rewinding films.             |
|   | 17. Construction of booths.      |
|   | 18. Fire.                        |
|   | 19. Installation rules and laws. |

## JANITOR WORK.

Courses for janitors and janitors' helpers, in—

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>*1. Relationships.</li> <li>*2. Cleaning.</li> <li>*3. Repairs.</li> <li>4. Rules of the sanitary code.</li> <li>*5. Fire escapes.</li> <li>*6. Heating systems.</li> <li>*7. Gas.</li> <li>*8. Electric bells and lights.</li> <li>*9. Elevators.</li> <li>*10. Telephone service.</li> <li>*11. Sanitary appliances.</li> </ul> | <ul style="list-style-type: none"> <li>*12. Roofs.</li> <li>*13. Water supply.</li> <li>14. Doors.</li> <li>15. Dumb-waiters.</li> <li>16. Speaking tubes.</li> <li>17. Air shafts.</li> <li>*18. Care of mail matter.</li> <li>*19. Telegrams and express delivery.</li> <li>20. Renting and collecting.</li> <li>21. Use and care of tools.</li> </ul> |
|--|--|

## LAUNDRY CHEMISTRY.

Courses for laundry foremen and workmen, in—

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>*1. Water.</li> <li>2. Alkalies.</li> <li>3. Solvents for fat or grease.</li> <li>*4. Detergents.</li> <li>5. Bleaches.</li> <li>6. Rinsing.</li> </ul> | <ul style="list-style-type: none"> <li>7. Drying.</li> <li>8. Starch.</li> <li>9. Stains.</li> <li>10. Textile fibers.</li> <li>11. Dyes.</li> </ul> |
|--|--|

## CONCRETE CONSTRUCTION.

Courses for draftsmen, builders, clerks, inspectors, and field men, in—

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>*1. Materials of concrete construction.</li> <li>*2. Principles of reinforced concrete.</li> <li>3. Systems of reinforcement.</li> <li>*4. Practical features of reinforced concrete design and construction.</li> <li>5. Steel reinforcement.</li> <li>6. Conduct of work in the field.</li> </ul> | <ul style="list-style-type: none"> <li>*7. Superintendence.</li> <li>8. Specifications.</li> <li>9. Designing for reinforced concrete.</li> <li>10. Tests on reinforced concrete.</li> <li>11. Cost data relating to reinforced concrete.</li> </ul> |
|--|--|

## ESTIMATING FOR GENERAL BUILDING CONSTRUCTION.

Courses for estimators and contractors' clerks, in—

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>1. Units of measure and methods of classifying work.</li> <li>*2. Taking off quantities from plans in accordance with specifications and tabulating.</li> </ul> | <ul style="list-style-type: none"> <li>*3. Compiling general contractor's estimate for complete structure.</li> </ul> |
|--|---|

## BOOT AND SHOE MANUFACTURING.

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>*1. Pattern cutting and clicking.</li> <li>*2. Fitting and machining.</li> <li>*3. Sole-leather cutting, stock fitting.</li> <li>4. Lasting and attaching.</li> <li>5. Finishing.</li> <li>6. Last making and pattern cutting.</li> </ul> | <ul style="list-style-type: none"> <li>7. Clicking and closing.</li> <li>8. Sole-leather cutting and lasting.</li> <li>9. Finishing, machine operating.</li> <li>10. Design.</li> <li>11. Management.</li> </ul> |
|--|--|

## NURSING.

## Courses for trained attendants, in—

Lessons.	Lessons.
1. Care of sick room and bed, including bed making with and without patient in bed. —	6. Elimination through kidneys and bowels, including catheterization, external genita and douches, enemata, and suppositories. —
2. Bones and bandaging. —	7. Contagion and disinfection. —
3. Temperature, pulse, respiration, making out charts. —	8. Care of newborn. —
4. Bathing, including bathing in bed, bathing without uncovering patient, alcohol baths. —	9. Sick children. —
5. Massage. —	10. Infant feeding. —
	11. Applications. —
	12. Diets (liquid and light), special diets, feeding in convalescence, tray service. —
	13. Emergencies. —

## COOKING.

## Courses for housekeepers, in—

*A. General.*

1. Meats.	15. Poultry.
2. Vegetables.	16. Cookies and wafers.
3. Cream soups.	17. Sandwiches.
4. Stock soups and stews.	18. Candy.
5. Yeast bread, biscuits, and rolls.	19. Canning and preserving.
6. Baking-powder biscuits, breakfast cakes.	20. Breakfasts.
7. Cake.	21. Dinner-pail lunches.
8. Frostings and fillings.	22. Lunches for school children.
9. Pastry.	23. Sunday night suppers.
10. Hot desserts.	24. Fireless-cooker and paper-bag cooking.
11. Cold desserts.	25. Simple family meals.
12. Ice creams and ices.	26. Left overs.
13. Salads.	27. Cooking for infants and invalids.
14. Fish and shellfish.	

*B. Courses for nurses.*

Lessons.	Lessons.
1. Broths and gruels. —	2. Cooking for convalescents. —

## DOMESTIC ECONOMY.

*A. Courses for housekeepers.*

1. Removing spots and stains, fine starching, and ironing. —	4. Upholstering. —
2. Family washing and ironing. —	5. Cleaning and repairing. —
3. Food adulteration and preservation. —	6. Feeding growing children. —
	7. Emergencies. —
	8. Home nursing. —

DOMESTIC ECONOMY—concluded.

Courses for mothers, in—

*B. Feeding and care of infants and young children.*

Lessons.	Lessons.
1. Children's diseases — Symptoms, precautions, and prevention..... —	5. Feeding infants — Modified milk, top-milk method, sterilizing, care, and selection of nipples..... —
2. Home care of sick children... —	6. Feeding young children— Twelfth to fifteenth month, third to sixth year, after sixth year..... —
3. Making infants' and children's clothing..... —	
4. Laundering infants' and children's clothing..... —	

MILLINERY.

Courses for makers, in—

1. Drafting and blocking buckram shapes..... —	7. Renovating and remodeling old hats and trimmings... —
2. Making fabric hats, such as velvet, cloth, silk, etc..... —	8. Sewing braid and trimming... —
3. Making of buckles, cabochons, ornaments..... —	9. Making hats of lace, net, chiffon, etc..... —
4. Ribbon flowers, novelties, etc. —	10. Making straw-braid hats... —
5. Wire frames..... —	11. Mourning millinery..... —
6. Children's millinery..... —	12. Bow making..... —

SEWING FOR DOMESTIC USE.

1. Making underwear..... —	8. White embroidery..... —
2. Making shirt waists..... —	9. General mending and repairing..... —
3. Making unlined dresses..... —	10. Renovating and making over..... —
4. Making fancy waists..... —	11. Fancy neckwear..... —
5. Making skirts..... —	
6. Tailoring..... —	
7. Fine hand sewing..... —	

Courses for mothers.

1. Making baby clothes..... —	2. Making clothes for small children..... —
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Course for housekeepers.

1. Making table and bed linen..... —
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WAITRESS WORK.

Courses for waitresses, in—

*1. Care of dining room..... —	6. Canapés..... —
2. Washing and ironing table linen..... —	*7. Preparation and serving of beverages..... —
*3. Setting of table and serving... —	8. Carving..... —
*4. Care of pantry..... —	*9. Personal appearance..... —
*5. Bread, butter, and sandwiches..... —	

## DRESSMAKING.

## Courses for dressmakers, in—

Lessons.	Lessons.
1. Waist making ----- —	6. Drafting and pattern making_ —
2. Waist draping ----- —	7. Costume design and color
3. Sleeve making ----- —	harmony ----- —
4. Skirt making ----- —	8. Up-to-date methods ----- —
5. Tailoring ----- —	

## POWER-MACHINE OPERATING.

## Courses for the operator who can do plain operating, in—

1. Felling ----- —	7. Embroidery - machine operat-
2. Hemming ----- —	ing ----- —
3. Gathering and ruffling ----- —	8. Hemstitch-machine operating_ —
4. Tucking ----- —	9. Two, three, and five needle
5. Two-needle tucking ----- —	machine operating -----
6. Buttonhole - machine operat-	
ing ----- —	

## ANALYSIS OF COURSES.

No attempt has been made in this Bulletin to work out an exhaustive analysis of any of the trades represented, nor has an attempt been made to present an analysis which, from the point of view of the materials, tools, or processes of the trade, shall be consistent. In actual practice it may be desirable to analyze some of the trade units to be taught in greater detail than the analysis here given. In other cases it may be found desirable to combine into one unit several of the units given in this list. The practice to be followed must, in every instance, depend upon the needs of the pupils and of the trade.

## FARMING.

*Course A-2.—Orchard setting.*

<p>A. Selection of stock:</p> <ol style="list-style-type: none"> <li>1. Permanents.</li> <li>2. Semipermanents.</li> <li>3. Fillers.</li> </ol> <p>B. Planting:</p> <ol style="list-style-type: none"> <li>1. Pruning before setting.</li> <li>2. Fall and spring planting.</li> </ol>	<p>B. Planting—Concluded.</p> <ol style="list-style-type: none"> <li>3. Distances for planting.</li> <li>4. Planting tables.</li> <li>5. Preparation of ground for planting.</li> <li>6. Planting trees.</li> </ol>
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*Course A-3.—Orchard cultivation.*

<p>A. Objects of cultivation.</p> <p>B. Methods of cultivation.</p> <p>C. Cover crops:</p> <ol style="list-style-type: none"> <li>1. Management.</li> <li>2. Some cover crops.</li> <li>3. Amount of seed.</li> </ol>	<p>D. Intercropping a young orchard.</p> <p>E. Sod management.</p> <p>F. Mulches.</p> <p>G. Drainage.</p>
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## FARMING—continued.

*Course A-4.—Propagation.*

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|--|--|
| <ul style="list-style-type: none"> <li>A. Seedage.</li> <li>B. Layerage.</li> <li>C. Cuttage:             <ul style="list-style-type: none"> <li>1. Requirements of cuttings.</li> <li>2. Formation of roots.</li> <li>3. Heat, moisture, and soil.</li> <li>4. Kinds of cuttings—Tuber, root, stem, leaf, etc.</li> </ul> </li> <li>D. How a woody stem grows.</li> </ul> | <ul style="list-style-type: none"> <li>E. Graftage:             <ul style="list-style-type: none"> <li>1. Advantages and disadvantages.</li> <li>2. Budding.</li> <li>3. Whip grafting.</li> <li>4. Cleft grafting.</li> <li>5. Cutting grafting.</li> <li>6. Double grafting.</li> <li>7. Inarching.</li> <li>8. Grafting waxes.</li> </ul> </li> <li>F. Nursery management.</li> </ul> |
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*Course A-5.—Pruning.*

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Trees which stand pruning.</li> <li>B. Fruit buds and pruning.</li> <li>C. Healing of wounds:             <ul style="list-style-type: none"> <li>1. The cambium layer.</li> <li>2. When to cut branches.</li> <li>3. How to cut.</li> <li>4. Dressings for cuts.</li> <li>5. Treatment of old wounds.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>D. Shaping the tree.</li> <li>E. Top pruning.</li> <li>F. Root pruning.</li> <li>G. Heading-in.</li> <li>H. Water sprouts.</li> <li>I. When to prune.</li> <li>J. High and low heads.</li> </ul> |
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*Course A-9.—Sprays and spraying.*

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|--|---|
| <ul style="list-style-type: none"> <li>A. Principal fungus diseases.</li> <li>B. Insect pests.</li> <li>C. Spraying machinery:             <ul style="list-style-type: none"> <li>1. Power sprays.</li> <li>2. Barrel pumps.</li> <li>3. Syringes.</li> <li>4. Three principles of spray nozzles.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>D. Spray solutions:             <ul style="list-style-type: none"> <li>1. Bordeaux.</li> <li>2. Lime sulphur.</li> <li>3. Arsenate of lead.</li> <li>4. Soluble oils.</li> <li>5. Combined insecticides and fungicides.</li> </ul> </li> <li>E. The spray calendar.</li> </ul> |
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*Courses A-10 and A-11.—Harvesting and marketing.*

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|---|--|
| <ul style="list-style-type: none"> <li>A. Picking.</li> <li>B. Sorting.</li> <li>C. Barrel packing.</li> <li>D. Box packing:             <ul style="list-style-type: none"> <li>1. Wrapping fruit.</li> <li>2. Styles of pack.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>E. Other packages.</li> <li>F. Storage.</li> <li>G. Marketing.</li> </ul> |
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*Course F-1.—Poultry houses and yards.*

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|---|--|
| <ul style="list-style-type: none"> <li>A. Location and situation:             <ul style="list-style-type: none"> <li>1. Location for market and fancy poultry.</li> <li>2. Where to place houses.</li> <li>3. Soil factor.</li> <li>4. Water supply.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>B. Poultry quarters:             <ul style="list-style-type: none"> <li>1. Styles of houses.</li> <li>2. Parts of the house.</li> <li>3. The colony plan.</li> <li>4. Model poultry house.</li> <li>5. Ventilating system.</li> </ul> </li> </ul> |
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## FARMING—continued.

*Course F-2.—Breeds and breeding.*

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|------------------------|---------------------------------|
| 1. Breeds of fowls.    | 5. Line breeding.               |
| 2. What to select.     | 6. Importance of vitality.      |
| 3. Law of inheritance. | 7. Vitality and productiveness. |
| 4. Utility breeding.   | 8. Egg production.              |

*Course F-3.—Feeds and feeding.*

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1. Feed, and quantity of eggs.   | 6. Care of laying hens.         |
| 2. Composition of eggs.          | 7. Mash, dry and wet.           |
| 3. Composition of poultry feeds. | 8. Green feeds.                 |
| 4. Nutritive ratio.              | 9. Grit.                        |
| 5. Winter eggs.                  | 10. Grain, ground and unground. |

*Course F-6.—Incubation.*

- |                                   |                           |
|-----------------------------------|---------------------------|
| A. Structure of egg.              | E. Artificial incubation: |
| B. Development of egg.            | 1. Incubators.            |
| C. Care of eggs for hatching.     | 2. Temperature.           |
| D. Natural incubation:            | 3. Moisture.              |
| 1. How to set hens.               | 4. Air.                   |
| 2. Food and care of sitting hens. | 5. Turning the eggs.      |
| 3. Testing eggs.                  | 6. Hatching.              |

*Course F-7.—Brooding.*

- |                            |                              |
|----------------------------|------------------------------|
| 1. Importance of brooding. | 5. Weaning chicks.           |
| 2. Types of brooders.      | 6. Teaching chicks to roost. |
| 3. Making the brooder.     | 7. Separating the sexes.     |
| 4. Feeding young chicks.   | 8. Culling the stock.        |

*Course F-9.—Marketing.*

- |   |   |
|---|---|
| A. Eggs:                                  | B. Poultry:                               |
| 1. Sorting eggs.                          | 1. Selecting for market.                  |
| 2. Preparation for market.                | 2. Preparation for killing.               |
| 3. Market preference.                     | 3. Killing.                               |
| 4. When to sell eggs.                     | 4. Picking.                               |
| 5. Shipping eggs to commission merchants. | 5. Packing for shipment.                  |
| 6. Preservation of eggs.                  | 6. Commission merchants and family trade. |
|   | 7. Cold storage.                          |

*Course F-10.—Diseases (health and sanitation).*

- |                              |                               |
|------------------------------|-------------------------------|
| A. Prevention of disease:    | B. Diagnosis of ailments.     |
| 1. Care.                     | C. Disinfection.              |
| 2. Quarantine.               | D. Injurious habits or vices. |
| 3. Isolation of ailing fowl. |                               |

*Course F-11.—Poultry appliances (fixtures and devices).*

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|--------------------------------|------------------------------|
| A. Interior fixtures:          | B. Mills and food machinery: |
| 1. Roosts.                     | 1. Bone and meat grinders.   |
| 2. Dropping boards.            | 2. Food choppers.            |
| 3. Nests.                      | 3. Grit machines.            |
| 4. Devices for feeding.        |                              |
| 5. Fountains and water supply. |                              |
| 6. Doors and windows.          |                              |

## FARMING—continued.

*Course G-6.—Milk composition and testing.*

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>A. Composition of milk :           <ul style="list-style-type: none"> <li>1. Fats.</li> <li>2. Nitrogen compound.</li> <li>3. Sugars, salts, and gases.</li> </ul> </li> <li>B. Standards of milk.</li> <li>C. Milk products.</li> <li>D. Methods of sampling milk.</li> </ul> | <ul style="list-style-type: none"> <li>E. The Babcock test :           <ul style="list-style-type: none"> <li>1. Whole milk.</li> <li>2. Cream.</li> <li>3. Skim milk, whey, butter, etc.</li> </ul> </li> <li>F. Acidity test.</li> <li>G. Bacterial test.</li> <li>H. Specific-gravity test.</li> <li>I. Adulterations and tests.</li> <li>J. Commercial testing and scoring.</li> </ul> |
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*Course G-10.—Butter making.*

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>A. Creaming :           <ul style="list-style-type: none"> <li>1. Cause.</li> <li>2. Processes—               <ul style="list-style-type: none"> <li>(a) Gravity methods.</li> <li>(b) Centrifugal methods.</li> </ul> </li> </ul> </li> <li>B. Ripening of cream :           <ul style="list-style-type: none"> <li>1. Object.</li> <li>2. Temperature.</li> <li>3. Time.</li> <li>4. Starters.</li> </ul> </li> <li>C. Sweet and sour cream :           <ul style="list-style-type: none"> <li>1. Comparative values.</li> <li>2. Acid tests.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>D. Churning :           <ul style="list-style-type: none"> <li>1. Temperature.</li> <li>2. Character of butter fat.</li> <li>3. Acidity of cream.</li> <li>4. Richness of cream.</li> <li>5. Amount of cream.</li> <li>6. Churning process.</li> <li>7. Types of churn.</li> </ul> </li> <li>E. Gathering.</li> <li>F. Washing.</li> <li>G. Working.</li> <li>H. Salting.</li> <li>I. Packing.</li> </ul> |
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*Courses G-11 and G-12.—Cheese making.*

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|--|--|
| <ul style="list-style-type: none"> <li>A. Composition of cheese.</li> <li>B. Quality of milk needed.</li> <li>C. Value of fat in cheese making.</li> <li>D. Care of milk for cheese making.</li> <li>E. Ripeness of milk.</li> <li>F. Starters.</li> <li>G. Use of rennet.</li> <li>H. Cheddar cheese :           <ul style="list-style-type: none"> <li>1. Setting.</li> <li>2. Cutting.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>H. Cheddar cheese—Concluded.           <ul style="list-style-type: none"> <li>3. Heating.</li> <li>4. Cheddaring.</li> <li>5. Grinding.</li> <li>6. Salting.</li> <li>7. Curing.</li> <li>8. Quality.</li> </ul> </li> <li>I. Hard and soft cheeses.</li> <li>J. Cream cheeses.</li> <li>K. Fancy cheeses.</li> </ul> |
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*Courses H-2; I-3; J-2.—Farm animals (feeds and feeding).*

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Uses and composition of foods.</li> <li>B. Function of food materials.</li> <li>C. Digestion of food.</li> <li>D. Maintenance rations and productive rations.</li> <li>E. Nutritive ratio.</li> <li>F. Balanced ration.</li> <li>G. Special feeding :           <ul style="list-style-type: none"> <li>1. Requirements.</li> <li>2. Regularity.</li> <li>3. Amount, kind, and cost.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>H. Feeding the dairy cow :           <ul style="list-style-type: none"> <li>1. Effect of food on composition of milk.</li> <li>2. Summer feeding.</li> <li>3. Winter feeding.</li> <li>4. Concentrated feeds.</li> <li>5. Dry forage.</li> <li>6. Silage.</li> <li>7. Roots.</li> </ul> </li> <li>I. Feeding young animals.</li> </ul> |
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## FARMING—concluded.

*Courses H-3; I-1; I-5; J-3.—Breeds and breeding.*

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>A. Types.</li> <li>B. Breeds.</li> <li>C. Score-card judging.</li> <li>D. General characteristics.</li> <li>E. Variations.</li> <li>F. Heredity.</li> <li>G. Prepotency.</li> </ul> | <ul style="list-style-type: none"> <li>H. Systems of breeding:               <ul style="list-style-type: none"> <li>1. Purposes of breeding.</li> <li>2. Cross breeding.</li> <li>3. Line breeding.</li> <li>4. Inbreeding.</li> </ul> </li> <li>I. Grades and thoroughbreds.</li> </ul> |
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## MACHINIST'S TRADE.

*Shop practice.**Course A-1.—Making fits.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. Straight bore fit:           <ul style="list-style-type: none"> <li>1. Straight turn fit.</li> <li>2. Running fit.</li> <li>3. Tight fit—               <ul style="list-style-type: none"> <li>(a) Shrink.</li> <li>(b) Force.</li> </ul> </li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>B. Taper fit.</li> <li>C. Thread fit:           <ul style="list-style-type: none"> <li>1. Square thread.</li> <li>2. V-thread.</li> <li>3. Pipe thread.</li> <li>4. Cup thread.</li> </ul> </li> </ul> |
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*Course A-2.—Babbitting.*

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>A. Preparation of mold.</li> <li>B. Handling metal:           <ul style="list-style-type: none"> <li>1. Keeping clean.</li> <li>2. Correct temperature.</li> <li>3. Proper grade of metal.</li> </ul> </li> <li>C. Simple bearings:           <ul style="list-style-type: none"> <li>1. Solid.</li> <li>2. Half.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>D. Two bearings in line.</li> <li>E. Scraping in and oil grooving.</li> <li>F. Automobile babbitting:           <ul style="list-style-type: none"> <li>1. Crank shaft.</li> <li>2. Connecting rods.</li> </ul> </li> <li>G. Generators and motors.</li> </ul> |
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*Course A-3.—Screw cutting.*

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|---|---|
| <ul style="list-style-type: none"> <li>A. Grinding tools.</li> <li>B. Setting tools.</li> <li>C. Change gears.</li> </ul> | <ul style="list-style-type: none"> <li>D. Manipulation of machines:           <ul style="list-style-type: none"> <li>1. Finishing threads.</li> </ul> </li> </ul> |
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*Course A-4.—Lapping and scraping.*

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>A. Making fits.</li> </ul> | <ul style="list-style-type: none"> <li>B. Lapping mandrils.</li> </ul> |
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*Course A-5.—Tool grinding.*

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>A. Drills.</li> <li>B. Lathe tools.</li> <li>C. Planer tools.</li> </ul> | <ul style="list-style-type: none"> <li>D. Thread tools.</li> <li>E. Scrapers and chisels.</li> </ul> |
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*Course A-6.—Universal grinding.*

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Handling machine.</li> <li>B. Internal grinding.</li> <li>C. External grinding.</li> </ul> | <ul style="list-style-type: none"> <li>D. Magnetic grinding.</li> <li>E. Surface grinding.</li> </ul> |
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## MACHINISTS' TRADE—SHOP PRACTICE—CONCLUDED.

*Course A-7.—Casehardening and tempering.*

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|--|---|---|
| <p>A. Casehardening, pack hardening, ordinary heating and cooling process:</p> <ol style="list-style-type: none"> <li>1. Mottling.</li> <li>2. Cold chisels.</li> <li>3. Cutters.</li> </ol> | } | <p>A. Casehardening, pack hardening, ordinary heating and cooling process—Concluded.</p> <ol style="list-style-type: none"> <li>4. Taps.</li> <li>5. Reamers.</li> <li>6. Hammers.</li> </ol> |
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*Course A-8.—Soldering.*

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|--|---|---|
| <p>A. Ordinary soft soldering.</p> <p>B. Hard soldering.</p> | } | <p>C. Use of fluxes.</p> <p>D. Composition of fluxes.</p> |
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*Course A-9.—Brazing.*

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|---|---|---------------------------------------|
| <p>A. By using gas torch.</p> <p>B. Oxyacetylene process.</p> | } | <p>C. Various metals as spelters.</p> |
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*Course A-10.—Indexing.*

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|--|---|---|
| <p>A. Simple indexing.</p> <p>B. Compound indexing.</p> <p>C. Compound gearing with continued-fraction process.</p> <p>D. Differential indexing.</p> | } | <p>E. Cutting unequally spaced reamers to prevent chatter.</p> <p>F. Cutting angular cutters with angular cutters.</p> <p>G. Cutting spirals.</p> |
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*Course A-11.—Boring mill.*

- A. Taper turning with special reference to head-striking work.

*Course A-12.—Laying out cams.*

- |   |   |   |
|---|---|---|
| <p>A. Drum cams.</p> <p>B. Uniform-motion cams.</p> <p>C. Nonuniform-motion cams.</p> | } | <p>D. Reciprocating-motion cams.</p> <p>E. Cams for automatic machines running in vertical plane.</p> |
|---|---|---|

*Course A-26.—Drill press.*

- |  |   |                                    |
|--|---|------------------------------------|
| <p>A. Line drilling.</p> <p>B. Template.</p> | } | <p>C. Angular.</p> <p>D. Vise.</p> |
|--|---|------------------------------------|

*Machine-shop mathematics.**Course B-3.—Ratio and proportion.*

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|---|---|--|
| <p>A. As applied in sizing pulleys.</p> <p>B. As applied in sizing gears.</p> <p>C. Finding speeds of pulleys.</p> <p>D. Finding speeds of gears.</p> <p>E. Finding weights of stock.</p> | } | <p>F. As applied to triangles.</p> <p>G. As applied to the capacity of cylinders.</p> <p>H. Computing wages.</p> |
|---|---|--|

*Course B-4.—Square root.*

- |                          |   |                                    |
|--------------------------|---|------------------------------------|
| <p>A. Solving areas.</p> | } | <p>B. Solving right triangles.</p> |
|--------------------------|---|------------------------------------|

## MACHINE-SHOP MATHEMATICS—continued.

*Course B-5.—Mensuration.*

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|--|--|
| <ul style="list-style-type: none"> <li>A. Area of right triangles.</li> <li>B. Area of oblique triangles having type given.</li> <li>C. Area of oblique triangles having three sides given.</li> <li>D. Area of square.</li> <li>E. Area of circle.</li> <li>F. Area of hexagon.</li> <li>G. Area of ellipse.</li> </ul> | <ul style="list-style-type: none"> <li>H. Area of octagon.</li> <li>I. Volume of cube.</li> <li>J. Volume of rectangular block.</li> <li>K. Volume of cone.</li> <li>L. Volume of pyramid.</li> <li>M. Volume of cylinder.</li> <li>N. Volume of frustrum of cone or pyramid.</li> <li>O. Volume of sphere.</li> </ul> |
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*Course B-7.—Thread cutting.*

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|--|--|
| <ul style="list-style-type: none"> <li>A. Details for cutting V thread.</li> <li>B. Details for cutting U. S. thread.</li> <li>C. Details for cutting Whitworth St. thread.</li> <li>D. Details for cutting woven thread.</li> </ul> | <ul style="list-style-type: none"> <li>E. Details for cutting acme thread.</li> <li>F. Details for cutting buttress thread.</li> <li>G. All details to make thread tools for cutting threads.</li> </ul> |
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*Course B-8.—Simple and compound gearing.*

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|---|--|
| <ul style="list-style-type: none"> <li>A. Simple gearing as used in cutting common thread on standard lathe.</li> <li>B. Method assuming one gear.</li> <li>C. Method assuming both gears.</li> </ul> | <ul style="list-style-type: none"> <li>D. Compound gearing where simple gearing is impossible:               <ol style="list-style-type: none"> <li>1. Assuming one gear.</li> <li>2. Assuming all gears but one.</li> <li>3. Train of six gears.</li> <li>4. Cutting fraction of threads.</li> <li>5. Cutting of worm threads according to diametrical pitch.</li> <li>6. Proving various cases.</li> </ol> </li> </ul> |
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*Course B-10.—Regular indexing.*

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|---|---|
| <ul style="list-style-type: none"> <li>A. Divisions factors of 40.</li> <li>B. Divisions which give a whole number and a fraction.</li> </ul> | <ul style="list-style-type: none"> <li>C. Spacing given distances on circumference of circles.</li> <li>D. Indexing for angular measure.</li> <li>E. Cutting and trimming bevel gears.</li> </ul> |
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*Course B-11.—Differential indexing.*

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| <ul style="list-style-type: none"> <li>A. Indexing for divisions not possible to obtain by regular indexing and not practicable to execute by compound.</li> </ul> | <ul style="list-style-type: none"> <li>B. Includes sections C, D, and E of regular indexing.</li> <li>C. Methods for milling heart-shaped cam for uniform motion; variable motion.</li> </ul> |
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*Course B-12.—Compound indexing.*

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| <ul style="list-style-type: none"> <li>A. Indexing for divisions not possible to obtain by regular indexing.</li> </ul> | <ul style="list-style-type: none"> <li>B. Includes C, D, and E of regular indexing.</li> </ul> |
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*Course B-14.—Shop trigonometry.*

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| <ul style="list-style-type: none"> <li>A. Rules and ratios of triangles.</li> <li>B. Trigonometric tables.</li> <li>C. Solution of right triangles.</li> </ul> | <ul style="list-style-type: none"> <li>D. Spacing off any number of divisions on circle.</li> </ul> |
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## MACHINE-SHOP MATHEMATICS—concluded.

*Course B-23.—Right triangles.*

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| <p>A. Distance across flats—Plane figure, even size.</p> <p>B. Distance from center to flat—Plane figure, even size.</p> <p>C. Setting over tail stock to cut No. 4 Morse taper, stock 15" long.</p> <p>D. Angle to set compound rest to turn No. 2 Morse taper.</p> | <p>E. Angle to set milling-machine head to cut 60° blank angular cutter, 20 teeth, with 60° angular cutter and have parallel bands.</p> <p>F. Problems in setting up work :<br/>1. Drill, milling machine, shapes, boring mill.</p> <p>G. Swivel to cut 47° angle, both horizontal and vertical feed in use.</p> |
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## PRACTICAL ELECTRICITY.

*Course H-1.—Primary batteries.*

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| <p>A. Voltaic cells—Cells not employing chemicals.<br/>1. Depolarizer—Zinc ammonium, chloride carbon cell.</p> <p>B. Cells having a liquid depolarizer :<br/>1. Grow cell.<br/>2. Bunsen.<br/>3. Nitric acid.<br/>4. Iron cell.<br/>5. Zinc and sulphuric cell.</p> <p>C. Bichromate cells :<br/>1. Bichromate depolarizer.<br/>2. Fuller cell.<br/>3. Daniell cell.<br/>4. Crowfoot cell.</p> | <p>D. Cells having solid depolarizer :<br/>1. Leclanche.<br/>2. Lalende cell.<br/>3. Dry cells.<br/>4. Harrison cell.<br/>5. Chloride cells.</p> <p>E. Standard cells :<br/>1. Clarke.<br/>2. Carhart.<br/>3. Clarke standard cell.<br/>4. Western cadmium cell.<br/>5. Daniell standard cell.</p> <p>F. Application—Connections.</p> <p>G. Testing—Tests on open and closed circuit cells.</p> |
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*Course I-1.—Armature winding.*

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| <p>A. Right to left handed windings.</p> <p>B. Spacing of the conductors, pitch of winding.</p> <p>C. Tables.</p> <p>D. Developed winding diagrams.</p> <p>E. Ring winding, lap winding, wave winding.</p> <p>F. Grouping conductors :<br/>1. Parallel grouping—<br/>    (a) Lap winding—Drum.<br/>    (b) Ring winding.<br/>2. Series parallel grouping—<br/>    (a) Wave-winding drum.<br/>    (b) Series ring winding.</p> <p>G. Duplex winding, doubly reentrant ring.</p> <p>H. Condition of reentrancy.</p> | <p>I. Types of winding in use :<br/>1. Duplex lap.<br/>2. Simplex doubly reentrant lap.<br/>3. Simplex singly reentrant lap.<br/>4. Simplex trebly reentrant lap.<br/>5. Duplex singly reentrant lap.<br/>6. Duplex doubly reentrant lap.<br/>7. Triplex singly reentrant lap.<br/>8. Duplex trebly reentrant lap.</p> <p>J. Lap winding, wave winding, two layer.</p> <p>K. Drum winding, drum-winding series.</p> <p>L. Grouping, Fritsche's oblique wave winding.</p> <p>M. Triplex-wound drum.</p> <p>N. Disk windings.</p> <p>O. Four-pole wave winding—Derrozier's six-pole disk windings.</p> |
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## PRACTICAL ELECTRICITY—continued.

*Course J-1.—Direct-current generator and motor.*

## A. Armature:

1. Action of the armature.
2. Losses in armature.
3. Core losses, Eddy currents.
4. Hysteresis losses.
5. Slotted armatures.

## B. Armature winding.

## C. The magnetic circuit:

1. Density—Excitation.
2. Method of connecting—
  - (a) Series winding.
  - (b) Shunt winding.
  - (c) Compound winding.

## D. Open and closed coil windings.

## E. Unipolar dynamos.

## F. Electromotive force and power:

1. Sparking and commutation.
2. Heating.
3. Reactions in armature.

## G. Construction of armature:

1. Core and spider shaft bearings.
2. Winding commutators.

## H. Action of motor:

1. Counterelectromotive force.
2. Efficiency.
3. Reaction.
4. Torque.

## I. Types of motors:

1. Series—Shunt—Compound.

## J. Regulation of motors.

## K. Rheostats and starting boxes.

## L. Care and operation of motors:

1. Commutator brushes—Armatures.
2. Coils—Defects in coils.
3. Testing.

*Course K-1.—Switchboards.*

## A. Instruments needed in a circuit.

## B. Windings of generators and motors.

## C. Connections of instruments.

## D. Placing of board.

## E. Simplex circuits.

## F. Balancing system.

## G. Operations and parallels.

## H. Types of switches.

## I. Arrangement of instruments and switches:

1. Simple switchboard.
2. Fuses.
3. Boards for two generators.
4. Combination of machines.

## I. Arrangement of instruments and switches—Concluded.

5. Generator for three-wire system.

## J. Types of boards:

1. Switches for elevator service.
2. Arc-light switchboards.
3. Direct-current boards.
4. Alternating-current boards.
5. Single-phase switchboard.
6. Two-phase switchboard.
7. Three-phase switchboard.
8. High-tension switchboard.
9. Oil-break switches.
10. Power-factor meters.

*Course L-1.—Transformers.*

## A. Theory.

## B. Resistance effects on primary and secondary coils.

## C. Magnetic effects.

## D. Core losses and effects.

## E. Management of transformers.

## F. Connection of transformers.

## G. Construction of transformers.

## H. Types of transformers.

## PRACTICAL ELECTRICITY—continued.

*Course L-2.—Electric transmission—Line construction.*

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|---|--|
| <p>A. Conductors—Copper, aluminum:</p> <ol style="list-style-type: none"> <li>1. Gauges—Weights and different types of wire—             <ol style="list-style-type: none"> <li>(a) Rubber covered.</li> <li>(b) Weatherproof.</li> <li>(c) Slow burning.</li> </ol> </li> </ol> <p>B. Overhead construction—Poles and cross arms:</p> <ol style="list-style-type: none"> <li>1. Sizes and specifications of poles.</li> <li>2. Pins and insulators.</li> <li>3. Setting of poles—             <ol style="list-style-type: none"> <li>(a) Holding power of coils.</li> <li>(b) Concrete bases.</li> </ol> </li> </ol> | <p>B. Overhead construction—Poles and cross arms—Concluded.</p> <ol style="list-style-type: none"> <li>3. Setting of poles—Concluded.             <ol style="list-style-type: none"> <li>(c) Guying and bracing poles.</li> <li>(d) Splicing and running wires.</li> </ol> </li> </ol> <p>C. Underground construction:</p> <ol style="list-style-type: none"> <li>1. Trenches—Conduit manholes.</li> <li>2. Distribution centers.</li> <li>3. Edison underground tube system.</li> <li>4. Carrying capacities.</li> </ol> <p>D. Tests.</p> |
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*Course M-1.—Transmission of power.*

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|--|---|
| <p>A. Direct current—Calculations, two and three wire systems.</p> <ol style="list-style-type: none"> <li>1. Distribution centers.</li> <li>2. Balancing of loads.</li> </ol> <p>B. Alternating current:</p> <ol style="list-style-type: none"> <li>1. Single phase.</li> <li>2. Two phase.</li> </ol> | <p>B. Alternating current—Concluded.</p> <ol style="list-style-type: none"> <li>3. Three phase.</li> <li>4. High and low tension.</li> <li>5. Insulators.</li> <li>6. Balancing loads.</li> <li>7. Distributing centers.</li> </ol> |
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*Course N-1.—Storage batteries.*

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|--|---|
| <p>A. Batteries and accumulators:</p> <ol style="list-style-type: none"> <li>1. Different types.</li> <li>2. Construction.</li> </ol> <p>B. Efficiency of storage batteries.</p> <p>C. Installation and care of storage batteries:</p> <ol style="list-style-type: none"> <li>1. Setting up.</li> <li>2. Electrotype.</li> <li>3. Charging.</li> </ol> | <p>C. Installation and care of storage batteries—Concluded.</p> <ol style="list-style-type: none"> <li>4. Discharging.</li> <li>5. Automobile systems.</li> <li>6. Fire-alarm systems.</li> </ol> <p>D. Appliances for storage batteries:</p> <ol style="list-style-type: none"> <li>1. Busters and cell switches.</li> </ol> |
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*Course O-1.—Alternating-current machines—Generators.*

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|---|---|
| <p>A. Generators.</p> <p>B. Wave forms and values.</p> <p>C. Self-induction.</p> <p>D. Capacity.</p> <p>E. Resistances.</p> <p>F. Alternators:</p> <ol style="list-style-type: none"> <li>1. Single-phase machines—             <ol style="list-style-type: none"> <li>(a) Construction.</li> <li>(b) Electromotive force of alternators.</li> <li>(c) Field excitation.</li> </ol> </li> </ol> | <p>F. Alternators—Concluded.</p> <ol style="list-style-type: none"> <li>1. Single-phase machines—Con.             <ol style="list-style-type: none"> <li>(d) Revolving field.</li> <li>(e) Inductor alternator.</li> </ol> </li> <li>2. Polyphase machines—             <ol style="list-style-type: none"> <li>(a) Two-phase machines.</li> <li>(b) Three-phase machines.</li> <li>(c) Star and delta connected.</li> <li>(d) Armature windings.</li> </ol> </li> </ol> |
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## PRACTICAL ELECTRICITY—concluded.

*Course O-2.—Motors.*

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|---|--|---|
| <ul style="list-style-type: none"> <li>A. Synchronous.</li> <li>B. Induction motors:           <ul style="list-style-type: none"> <li>1. Single phase—               <ul style="list-style-type: none"> <li>(a) Starting.</li> <li>(b) Connection.</li> </ul> </li> </ul> </li> </ul> |  | <ul style="list-style-type: none"> <li>B. Induction motors—Concluded.           <ul style="list-style-type: none"> <li>1. Single phase—Concluded.               <ul style="list-style-type: none"> <li>(c) Operation.</li> <li>(d) Repulsion type.</li> </ul> </li> <li>2. Three-phase types.</li> <li>3. Rotary connectors.</li> </ul> </li> </ul> |
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*Course O-3.—Transformers.*

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|---|--|---|
| <ul style="list-style-type: none"> <li>A. Theory.</li> <li>B. Resistance effects on primary and secondary coils.</li> <li>C. Magnetic effects.</li> <li>D. Colosses and defects.</li> </ul> |  | <ul style="list-style-type: none"> <li>E. Management of transformers.</li> <li>F. Connection with transformers.</li> <li>G. Construction of transformers.</li> <li>H. Types of transformers.</li> </ul> |
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## CARPENTRY.

*Stair building.**Course A-1.—Back stairs.*

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|---|--|--|
| <ul style="list-style-type: none"> <li>A. Laying out.</li> <li>B. Figuring rise.</li> </ul> |  | <ul style="list-style-type: none"> <li>C. Building.</li> </ul> |
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*Course A-2.—Platform stairs.*

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|---|--|--|
| <ul style="list-style-type: none"> <li>A. Laying out.</li> <li>B. Figuring rise.</li> </ul> |  | <ul style="list-style-type: none"> <li>C. Building.</li> <li>D. Developing rails.</li> </ul> |
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*Course A-3.—Circular stairs.*

(Same analysis as for A-1.)

*Course A-4.—Developing rails for circular stairs.*

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|---|--|---|
| <ul style="list-style-type: none"> <li>A. Quarter circle.</li> <li>B. Half circle.</li> </ul> |  | <ul style="list-style-type: none"> <li>C. Straight stair with turnout at top and overease at bottom.</li> </ul> |
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*Inside finish.**Course B-1.—Wainscoting.*

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|---|--|---|
| <ul style="list-style-type: none"> <li>A. Designing.</li> <li>B. Laying out.</li> <li>C. Putting up wainscoting in various types of rooms.</li> </ul> |  | <ul style="list-style-type: none"> <li>D. Putting up wainscoting for stairs.</li> </ul> |
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*Course B-2.—Hanging doors.*

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|---|--|---|
| <ul style="list-style-type: none"> <li>A. Trimming.</li> <li>B. Inside door.</li> </ul> |  | <ul style="list-style-type: none"> <li>C. Outside door.</li> <li>D. Sliding doors.</li> </ul> |
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*Course B-3.—Constructing mantels.*

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|---|--|--|
| <ul style="list-style-type: none"> <li>A. Designing.</li> <li>B. Laying out.</li> </ul> |  | <ul style="list-style-type: none"> <li>C. Building.</li> <li>D. Papier-mâché trimmings.</li> </ul> |
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## CARPENTRY—concluded.

*Course B-4.—Constructing china closets.*

- |                |  |              |
|----------------|--|--------------|
| A. Designing.  |  | C. Building. |
| B. Laying out. |  |              |

*Course C-1.—Figuring rafters.*

- A. Lengths, bevels, and backing of common, hip, jack, cripple, and valley rafters.

*Course C-2.—Use of framing-square.*

- |                                   |  |                       |
|-----------------------------------|--|-----------------------|
| A. Laying off lengths of rafters. |  | B. Laying off bevels. |
|-----------------------------------|--|-----------------------|

*Course C-3.—Construction of roofs.*

- A. Building hip, gambrel, French, and bell-top roofs.

## PLUMBING.

*Course 1.—Drainage and ventilation.*

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|--|--|--|
| A. Names and uses of tools and material.   |  | C. Pipe-practice job, soil pipes, ventilation pipes, house drains, waste pipes, etc. |
| B. Best methods of installing different systems, proper sizes of pipes, fittings, etc. |  | D. Repair-practice jobs on old faucets, valves, tanks, burst pipes, etc.             |

*Course 2.—Joint wiping.*

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|--|--|--|
| A. Preparation of lead pipe and other metals for wiping. |  | D. Joint-wiping practice—Round joints, branch joints, upright joints, wall joints, floor flanges, etc. |
| B. Solder—Preparation, testing, purifying.               |  |  |
| C. Wiping cloths—Cutting, folding, preparation for use.  |  |  |

*Course 3.—Hot and cold water supply systems.*

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|--|--|---|
| A. High-pressure and tank-pressure systems.        |  | C. Proper placing of valves, shut-offs, air chambers. |
| B. Connections with range boilers and gas heaters. |  | D. Hot-water circulation.                             |

*Course 4.—Installing traps and fixtures.*

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|---|--|--|
| A. Construction work on skeleton houses, representing different types of building, installing traps, fixtures, etc. |  | B. Laying out plumbing work or plans and specifications. |
|   |  | C. Drawing of plans conforming to board of health rules. |
|   |  | D. Theory of traps and fixtures.                         |

## SHEET-METAL PATTERN DRAFTING.

*Course A-1.—(a) Cornice work.*

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|---------------------------------|--|--|
| A. Butt miters, three cases.    |  | G. Patterns for elliptical vase.             |
| B. Return miters, two cases.    |  | H. To construct a ball:                      |
| C. Panel miters.                |  | 1. In zones.                                 |
| D. Trimmings on mansard roofs.  |  | 2. In gores.                                 |
| E. Gable miters.                |  | I. Blanks for and miters of curved moldings. |
| F. Patterns for octagonal vase. |  |  |

## SHEET-METAL PATTERN DRAFTING—continued.

*Course A-2.—(b) Cornice work.*

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|---|--|
| <p>A. Pattern of junction between gable and pilaster.</p> <p>B. Pattern of gable mitering upon an inclined wash.</p> <p>C. An eyebrow window upon a dome.</p> <p>D. Development of an octagonal pinnacle.</p> <p>E. Pattern of rectangular molded base, not square in plan.</p> | <p>F. Pattern of molded base, square top, octagonal bottom.</p> <p>G. Pattern of raking bracket on a gable cornice.</p> <p>H. Pattern of raking bracket on a curved pediment.</p> <p>I. Pattern of broken pediment.</p> <p>J. Pattern of an elliptical splayed arch.</p> |
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*Course A-3.—Skylights.*

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|---|---|
| <p>A. Skylight construction, and proper combinations.</p> <p>B. Drawings to determine sizes and lengths of several parts.</p> <p>C. Patterns for curves, ridge, and common bars.</p> <p>D. Patterns for hip bars.</p> <p>E. Patterns for jack bars.</p> | <p>F. Patterns for circular skylights.</p> <p>G. Turret details and measurements.</p> <p>H. Patterns for turrets.</p> <p>I. Marquee, details and measurements.</p> <p>J. Taking measurements of rough work at buildings for purpose of making shop details.</p> |
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*Course A-4.—(a) Heating and ventilating.*

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|--|---|
| <p>A. Patterns of group flanges, three cases.</p> <p>B. Patterns of two-piece ell in round pipe.</p> <p>C. Patterns of two-piece ell in oval pipe.</p> <p>D. A round elbow in any number of pieces—Rule of miter line.</p> <p>E. A bevel elbow in any number of pieces with limited throw.</p> | <p>F. Pattern of a bifurcated pipe.</p> <p>G. Pattern of T joints, two cases.</p> <p>H. Pattern of tangent T joints, two cases.</p> <p>I. Pattern of pipe intersecting elbows.</p> <p>J. Principles of developing a section formed by the junction of any two shapes.</p> |
|--|---|

*Course A-5.—(b) Heating and ventilating.*

- |   |  |
|---|--|
| <p>A. Patterns for square to round transition, bottom and top parallel.</p> <p>B. Patterns for square to round transition, bottom and top not parallel.</p> <p>C. Patterns for oval to round transition, bottom and top parallel.</p> <p>D. Patterns for oval to round transition, bottom and top not parallel.</p> <p>E. Patterns for oval to round elbow:</p> <ol style="list-style-type: none"> <li>1. In the sharp.</li> <li>2. In the flat.</li> </ol> | <p>F. Patterns for three-pronged fork, all ends unequal sizes.</p> <p>G. Patterns for "breeches," two cases.</p> <p>H. Patterns for four-piece square to round elbow.</p> <p>I. Patterns for square pipe, describing a compound curve.</p> <p>J. Patterns for diagonal offset in rectangular pipe.</p> |
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## SHEET-METAL PATTERN DRAFTING—concluded.

*Course A-6.—(c) Heating and ventilating.*

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|--|---|
| <ul style="list-style-type: none"> <li>A. Patterns of flaring pipe flange, inclined roof.</li> <li>B. Patterns of ship's ventilator.</li> <li>C. Patterns for joining two small pipes of unequal diameter to one large pipe by means of two tapering elbows.</li> <li>D. Temperature and velocity:             <ul style="list-style-type: none"> <li>1. Gravity systems.</li> <li>2. Plenum systems.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>E. Location of inlets and outlets and sizes of ducts.</li> <li>F. Efficiency, piping, and cold-air supply of hot-air furnace.</li> <li>G. To design a plenum system of heating and ventilating from data.</li> <li>H. To design a gravity system of heating and ventilating from data.</li> <li>I. To design a hot-air furnace system of heating from data.</li> </ul> |
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*Course A-7.—Automobile parts.*

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|---|---|
| <ul style="list-style-type: none"> <li>A. Designs and patterns for hoods.</li> <li>B. Designs and patterns for dash.</li> <li>C. Designs and patterns for doors.</li> <li>D. Designs and patterns for seats.</li> <li>E. Designs and patterns for sides.</li> </ul> | <ul style="list-style-type: none"> <li>F. Designs and patterns for mudguards and shields.</li> <li>G. Designs and patterns for pan under engine.</li> </ul> |
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## WOOD MILLWORK.

*Course 1.—Window-frame making.*

- A. Laying out, listing, and making shop details for window frame, brick or stone construction, to include—
  - 1. Box or casement frames.
  - 2. Single or mullion frames.
  - 3. Circular or square frames.

*Course 2.—Sash making.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—             <ul style="list-style-type: none"> <li>1. Sash with cheek rail.</li> <li>2. Casement sash.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—Concluded.</li> <li>3. Circular or square sash.</li> </ul> |
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*Course 3.—Doorframes.*

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—             <ul style="list-style-type: none"> <li>1. Plain frames.</li> <li>2. Rabbeted frames.</li> <li>3. Paneled frames.</li> <li>4. Sliding doors.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—Concluded.</li> <li>5. Double-acting doorframes.</li> <li>6. Single or mullion frames, with side lights and transoms.</li> </ul> |
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*Course 4.—Door making.*

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|---|--|
| <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—             <ul style="list-style-type: none"> <li>1. Solid doors.</li> <li>2. Veneered doors.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>A. Laying out, listing, and making shop details for—Concluded.</li> <li>3. Single or double sliding doors.</li> <li>4. Circular or square doors.</li> </ul> |
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## WOOD MILLWORK—concluded.

*Course 5.—Wainscot making.*

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|---|---|
| <p>A. Laying out, listing, and making shop details for—</p> <ol style="list-style-type: none"> <li>1. Bevel wainscot.</li> <li>2. Rake wainscot.</li> </ol> | <p>A. Laying out, listing, and making shop details for— Concluded.</p> <ol style="list-style-type: none"> <li>3. Jib wainscot.</li> </ol> |
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## PRINTING.

*Course 1.—Make-ready for pressmen.*

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|--|------------------------------|
| <p>A. Cutting overlays.</p> <p>B. Scraping overlays.</p> | <p>C. Painting overlays.</p> |
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*Course 2.—Register.*

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|-----------------------|-------------------------------|
| <p>A. Gauge pins.</p> | <p>B. Points for folding.</p> |
|-----------------------|-------------------------------|

*Course 3.—Ink.*

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|--|--|
| <p>A. Consistency.</p> <p>B. Colors and tints.</p> | <p>C. Doctoring.</p> <p>D. Adjusting for papers.</p> |
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*Course 4.—Papers.*

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|--|--|
| <p>A. For half-tone work.</p> <p>B. Proper sizes and groups.</p> <p>C. Treating for press.</p> | <p>D. Paper manufacture—As of interest to printer.</p> |
|--|--|

*Course 5.—Up-to-date styles.*

- |  |   |
|--|---|
| <p>A. Invitations.</p> <p>B. Cards.</p> <p>C. Forms.</p> | <p>D. Letterheads.</p> <p>E. Folders.</p> |
|--|---|

*Course 7.—Composition.*

- |   |   |
|---|---|
| <p>A. Stonework:</p> <ol style="list-style-type: none"> <li>1. Imposition.</li> <li>2. Locking up forms.</li> </ol> <p>B. Rule forms conforming to the point system.</p> <p>C. Job composition:</p> <ol style="list-style-type: none"> <li>1. Books.</li> <li>2. Advertisements.</li> </ol> | <p>C. Job composition—Concluded.</p> <ol style="list-style-type: none"> <li>3. Letterheads.</li> <li>4. Billheads.</li> <li>5. Social forms.</li> <li>6. Script.</li> <li>7. Spacing.</li> <li>8. Relative position of cuts.</li> </ol> |
|---|---|

*Course 8.—Cutting stock.*

- |                                 |   |
|---------------------------------|---|
| <p>A. Cutting to advantage.</p> | <p>B. Cutting for folding with the grain.</p> |
|---------------------------------|---|

## JANITOR WORK.

*Course 1.—Relationships.*

- |   |  |
|---|--|
| <p>A. Relation of janitor to owner, agents, and tenants.</p> <p>B. Sobriety, cleanliness, politeness.</p> | <p>C. Enforcing landlord's and city's rules.</p> |
|---|--|

## JANITOR WORK—continued.

*Course 2.—Cleaning.*

- |  |   |
|--|---|
| <p>A. Sidewalks, stoops, areas, janitor's apartment, cellars, dumb-waiters, and windows.</p> <p>B. Removal of snow.</p> <p>C. How to keep away vermin, rats, mice, stray cats.</p> <p>D. Storing of tenants' property.</p> | <p>E. How to clean ink stains from floors.</p> <p>F. Cleaning windows in winter.</p> <p>G. Care of vacant apartments.</p> <p>H. Care of brass work, tile floors, mirrors.</p> |
|--|---|

*Course 3.—Repairs.*

- |  |  |
|--|--|
| <p>A. Cement floors and sidewalks.</p> <p>B. Whitewashing.</p> <p>C. Removing paint—Potash, gasoline torch, patent compounds.</p> <p>D. Care of freshly planed surfaces.</p> <p>E. Patching plaster walls and wall paper.</p> <p>F. Painting floors.</p> | <p>G. Wood fillers.</p> <p>H. Thawing pipes.</p> <p>I. Putting in window cords.</p> <p>J. Hanging doors.</p> <p>K. Putting on weather strips.</p> <p>L. Patching woodwork and floors.</p> <p>M. Remedying splintering.</p> |
|--|--|

*Course 5.—Fire escapes.*

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|--|---|
| <p>A. Inspection.</p> <p>B. Keeping them free from encumbrances.</p> | <p>C. Locate fire alarms.</p> <p>D. Precautions against fire.</p> |
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*Course 6.—Heating systems.*

- |   |  |
|---|--|
| <p>A. Kinds: Hot air, hot water, steam.</p> <p>B. Boilers:</p> <ol style="list-style-type: none"> <li>1. High and low pressure.</li> <li>2. Care and management of boilers.</li> <li>3. Firing, ashes, clinkers.</li> <li>4. Economy in fuel.</li> </ol> <p>C. Radiator valves, air valves, of different makes; one and two pipe systems.</p> <p>D. Knocking in pipes and noisy radiators.</p> <p>E. Laying up boilers in summer.</p> | <p>F. Installation of pipes.</p> <p>G. Risers, returns, and drips.</p> <p>H. Bronzing.</p> <p>I. Stopping leaks.</p> <p>J. Chimneys:</p> <ol style="list-style-type: none"> <li>1. Fire dangers.</li> <li>2. Corrosion of pipes to be guarded against.</li> <li>3. Cutting in or out one or more boilers under steam.</li> <li>4. Temperature-regulating systems.</li> </ol> |
|---|--|

*Course 7.—Gas.*

- |   |   |
|---|---|
| <p>A. Economy.</p> <p>B. Drips.</p> <p>C. Flickering.</p> <p>D. Detecting and stopping leaks.</p> <p>E. Loose or tight spigots.</p> | <p>F. Burners, tips, mantles.</p> <p>G. Meters.</p> <p>H. Lighting of halls.</p> <p>I. Danger of fires.</p> |
|---|---|

*Course 8.—Electric bells and lights.*

- |  |   |
|--|---|
| <p>A. Care and management of batteries.</p> <p>B. Detection and location of faults.</p> <p>C. Electric lights and fuses.</p> | <p>D. Detecting and locating troubles.</p> <p>E. Electric meters.</p> |
|--|---|

## JANITOR WORK—continued.

*Course 9.—Elevators.*

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Kinds.</li> <li>B. How to care for electric lifts.</li> <li>C. Inspection and care of cables.</li> <li>D. Commutator brakes.</li> <li>E. Safety appliances.</li> </ul> | <ul style="list-style-type: none"> <li>F. Strange noises in machine.</li> <li>G. Guides, shoes, and sheaves.</li> <li>H. Undue heating of parts.</li> <li>I. How to run elevators.</li> </ul> |
|--|---|

*Course 10.—Telephone service.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. How to use the telephone.</li> <li>B. Switchboard operation.</li> </ul> | <ul style="list-style-type: none"> <li>C. How to send messages during a thunderstorm.</li> <li>D. Notification of telephone calls.</li> </ul> |
|---|---|

*Course 11.—Sanitary appliances.*

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>A. Vent pipes.</li> <li>B. Soil pipes.</li> <li>C. Care of traps.</li> <li>D. Stopping leaks.</li> <li>E. Clearing obstructions in bowls, sinks, traps, etc.</li> </ul> | <ul style="list-style-type: none"> <li>F. Hand-pump refrigerators and their drain pipes.</li> <li>G. Cesspools.</li> <li>H. Area ways.</li> <li>I. Strainers.</li> </ul> |
|--|--|

*Course 12.—Roofs.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. Different kinds of roofs.</li> <li>B. Painting and patching tin roofs and leaders.</li> <li>C. Strainers.</li> <li>D. Snow and ice.</li> <li>E. Exposed water pipes.</li> <li>F. Vent pipes.</li> </ul> | <ul style="list-style-type: none"> <li>G. Places leaks are most likely to occur.</li> <li>H. Walking on tin roofs.</li> <li>I. Protection.</li> <li>J. Clotheslines.</li> <li>K. Tank houses and tanks.</li> <li>L. Cleaning of tanks.</li> <li>M. Wooden tanks and hoops.</li> </ul> |
|---|---|

*Course 13.—Water supply.*

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>A. Electric, gas, and hot air—Care of same.</li> <li>B. House pumps.</li> <li>C. Hot water.</li> <li>D. Hot-water boiler.</li> <li>E. Different kinds of faucets.</li> <li>F. Leaky faucets.</li> <li>G. Stopcocks.</li> <li>H. Tank and croton pressures.</li> </ul> | <ul style="list-style-type: none"> <li>I. How to avoid having water from tank rush back into croton systems.</li> <li>J. Leaks in water-closet cisterns.</li> <li>K. Different kinds of cisterns.</li> <li>L. Rattling of faucets.</li> <li>M. Humming in cistern valve.</li> <li>N. Repairing on faucets, pipes, lead joints, putty joints.</li> <li>O. Guarding against corrosion of pipes.</li> </ul> |
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*Course 18.—Care of mail matter.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. Registered letters.</li> <li>B. Special delivery.</li> <li>C. When to return undelivered mail to office.</li> </ul> | <ul style="list-style-type: none"> <li>D. Forwarding mail.</li> <li>E. Mail rates.</li> </ul> |
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## JANITOR WORK—concluded.

*Course 19.—Telegrams and express delivery.*

- |   |  |
|---|--|
| A. Where telegrams can be sent.                 | D. Where express matter can be sent.                           |
| B. Rate.  | E. Receiving express and delivery parcels and paying for same. |
| C. Question of receiving telegrams for tenants. |  |

## LAUNDRY CHEMISTRY.

*Course 1.—Water.*

- |  |  |
|--|--|
| A. Different kinds.                            | E. Hardness, temporary and permanent.                          |
| B. Gases dissolved in water.                   | F. Soap-destroying power of water, before and after softening. |
| C. Salts.                                      |  |
| D. Action of salt solutions on soap solutions. |  |

*Course 4.—Detergents.*

- |                            |                             |
|----------------------------|-----------------------------|
| A. Soap.                   | C. Hard and soft soap.      |
| B. Methods of making soap. | D. Cleansing power of soap. |

## CONCRETE CONSTRUCTION.

*Course 1.—Materials of concrete construction.*

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|----------------------|----------|
| A. Concrete.         | C. Sand. |
| B. Aggregate gravel. |          |

*Course 2.—Principles of reinforced concrete.*

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|--|---------------------------------------|
| A. Formulas used for calculating strength. | B. Use of tables for strength values. |
|  | C. Examples in design.                |

*Course 4.—Practical features of reinforced concrete design and construction.*

- |  |   |
|--|---|
| A. Laying out of floors, spandrels, columns. | C. Construction of parapet walls.           |
| B. Special foundation construction.          | D. Finishing and waterproofing of concrete. |

*Course 7.—Superintendence.*

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|---|---------------------|
| A. Examination of drawings and form work. | B. Laying out work. |
|---|---------------------|

## ESTIMATING FOR GENERAL BUILDING CONSTRUCTION.

*Course 2.—Taking off quantities from plans in accordance with specifications and tabulating.*

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|---------------------------------|---|
| A. Excavation.                  | I. Fireproof floors and partitions.             |
| B. Concrete footings and walls. | J. Column and girder covering.                  |
| C. Stone-foundation masonry.    | K. Roofing and sheet-metal roof.                |
| D. Stone-face masonry.          | L. Plastering and lathing—Plain and ornamental. |
| E. Brickwork and cut stone.     | M. Lumber and millwork.                         |
| F. Ornamental terra cotta.      | N. Plumbing, painting, and glazing.             |
| G. Cement and asphalt floor.    |   |
| H. Structural ironwork.         |   |

## ESTIMATING FOR GENERAL BUILDING CONSTRUCTION—concluded.

*Course 3.—Compiling general contractor's estimate for complete structure.*

- A. Includes miscellaneous items, such as building permits, street and vault permits, guaranty and penal bonds, insurance, temporary office, street protection.

## BOOT AND SHOE MANUFACTURE.

*Course 1.—Pattern cutting and clicking.*

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|--|--|
| <p>A. Methods for producing patterns from lasts.</p> <p>B. Use of construction lines in pattern cutting.</p> <p>C. Distinct type of sole shapes.</p> <p>D. Different systems of construction lines.</p> <p>E. Systems used in arranging patterns to prevent waste.</p> | <p>F. Direction in which parts of upper should be tight.</p> <p>G. Class of materials required in different parts.</p> <p>H. Character and quality of various parts of skins and hides.</p> <p>I. Suitability of each part for various purposes.</p> <p>J. Lining cutting, linens, russet.</p> |
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*Course 2.—Fitting and machining.*

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|--|--|
| <p>A. Preparing parts of upper for various processes.</p> <p>B. Making and use of gums, cements, and pastes.</p> <p>C. Fitting on the round, on the flat, on the last.</p> <p>D. Needles, shuttles, and threads.</p> <p>E. Relation between needle and thread, points of excellence in each.</p> <p>F. Peculiarities required in needle threads and shuttle threads.</p> | <p>G. Method of setting needles in upper-stitching machinery, leather points, and linen points.</p> <p>H. Sewing seams and stitching seams, lap, welt, open stitch, and plain seams.</p> <p>I. Stitching fitted work, held on and lasted work.</p> |
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*Course 3.—Sole leather cutting and stock fitting.*

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|--|---|
| <p>A. Structure of leather for bottom stock.</p> <p>B. Relative weight, flexibility, and hardness.</p> <p>C. Suitability of sides, bends, butts, middles, shoulders, and bellies.</p> <p>D. Use of box, eccentric, and revolution presses.</p> <p>E. Methods of cutting bottom stock, through soles, straight and curved splice.</p> <p>F. Ranging and cutting direct.</p> | <p>G. Systems to avoid waste, to economize labor.</p> <p>H. Wetting, rolling, and hammering bottom stock.</p> <p>I. Blocking, cementing, and fitting.</p> <p>J. Skiving, molding, and blocking machine.</p> <p>K. Tackers.</p> <p>L. Heel building by machine, slugging, channeling for sewing and stitching.</p> |
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## BOOT AND SHOE MANUFACTURE—concluded.

*Analysis of processes in boot and shoe machine operating.*

- |   |   |
|---|---|
| <p>1. Cutting room :</p> <ul style="list-style-type: none"> <li>a. Cutting vamps.</li> <li>b. Cutting tops.</li> <li>c. Cutting quarters.</li> <li>d. Cutting fixings.</li> <li>e. Cutting linings.</li> <li>f. Dieing trimmings—<br/>Facings.<br/>Back stays.<br/>Side facings.<br/>Button fly linings.</li> </ul> <p>2. Stitching room :</p> <ul style="list-style-type: none"> <li>a. Seaming linings.</li> <li>b. Seaming tops.</li> <li>c. Stitching labels.</li> <li>d. Stitching top facings.</li> <li>e. Stitching eyelet facings.</li> <li>f. Stitching back stays.</li> <li>g. Stitching outside stays.</li> <li>h. Stitching eyelet rows.</li> <li>i. Forming lining to top.</li> <li>j. Undertrimming top.</li> <li>k. Eyeleting, hooking, and buttoning.</li> <li>l. Stitching tip.</li> <li>m. Seaming vamp.</li> <li>n. Stitching button fly to lining.</li> <li>o. Making buttonholes.</li> <li>p. Vamping.</li> <li>q. Lacing.</li> <li>r. Inspecting.</li> </ul> <p>3. Sole-leather room :</p> <ul style="list-style-type: none"> <li>a. Cutting soles.</li> <li>b. Cutting top lifts.</li> <li>c. Cutting inner soles.</li> <li>d. Taps and counters.</li> </ul> <p>4. Lasting room :</p> <ul style="list-style-type: none"> <li>a. Picking up lasts.</li> </ul> | <p>4. Lasting room—Concluded.</p> <ul style="list-style-type: none"> <li>b. Assembling.</li> <li>c. Toe lasting by machine.</li> <li>d. Side lasting by hand.</li> <li>e. Heel and toe wiping in by machine.</li> <li>f. Inspecting.</li> </ul> <p>5. Bottoming room :</p> <ul style="list-style-type: none"> <li>a. Welting.</li> <li>b. Trimming welts and vamps.</li> <li>c. Filling bottoms shanking.</li> <li>d. Laying soles.</li> <li>e. Nailing heel seats.</li> <li>f. Rough rounding.</li> <li>g. Trimming heel seats.</li> </ul> <p>6. Sole-fastening room :</p> <ul style="list-style-type: none"> <li>a. Goodyear stitching.</li> <li>b. Shaping-last trimming.</li> <li>c. Leveling.</li> <li>d. Heeling.</li> <li>e. Slugging.</li> <li>f. Trimming or shaving heels.</li> <li>g. Trimming edges.</li> <li>h. Setting edges.</li> </ul> <p>7. Finishing :</p> <ul style="list-style-type: none"> <li>a. Finishing heels and bottoms.</li> </ul> <p>8. Treeing or dressing rooms :</p> <ul style="list-style-type: none"> <li>a. Pulling lasts.</li> <li>b. Cleaning.</li> <li>c. Brushing edges and heels.</li> <li>d. Repairing shoes.</li> <li>e. Putting in heel pads, laces.</li> <li>f. Inspecting.</li> </ul> <p>9. Packing room :</p> <ul style="list-style-type: none"> <li>a. Packing shoes in carton.</li> <li>b. Putting cartons in cases.</li> <li>c. Shipping.</li> </ul> |
|---|---|

## WAITRESS WORK.

*Course 1.—Care of dining room.*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>A. Regulating lights, heat, and ventilation.</li> <li>B. Putting in order after each meal.</li> <li>C. Daily cleaning.</li> <li>D. Weekly cleaning.</li> <li>E. Cleaning glass in windows and cabinets.</li> </ul> | <ul style="list-style-type: none"> <li>F. Care of hardwood floors.</li> <li>G. Care of rugs and carpets.</li> <li>H. Care and polishing of furniture.</li> <li>I. Cleaning brass and copper.</li> </ul> |
|---|---|

## WAITRESS WORK—concluded.

*Course 3.—Setting of table and serving.*

- |   |                             |
|---|-----------------------------|
| A. Laying of table for all meals and occasions. | D. Afternoon tea.           |
| B. Serving for family meals.                    | E. Bridge teas, etc.        |
| C. Formal serving.                              | F. Buffet lunch and supper. |

*Course 4.—Care of pantry.*

- |   |   |
|---|---|
| A. Care of food left from meals.              | F. Care of teakettle, teapot, and coffee-pot. |
| B. Care of fruit, relishes, bread, cake, etc. | G. Care of dish pans, towels, etc.            |
| C. Care of refuse food.                       | H. Care of cupboards and drawers.             |
| D. Care of refrigerator.                      | I. Care of fine linen.                        |
| E. Care of china, glass, and silver.          | J. Care of gas stove.                         |

*Course 5.—Bread, butter, and sandwiches.*

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| A. Cutting of bread.            | D. Bread and butter rolls.        |
| B. Butter balls and curls.      | E. Sandwich fillings.             |
| C. Bread and butter sandwiches. | F. Open and decorated sandwiches. |

*Course 7.—Preparation and serving of beverages.*

- |                             |  |
|-----------------------------|--|
| A. Ice water.               | D. Table waters and alcoholic beverages. |
| B. Tea, coffee, cocoa—Hot.  | E. Fruit punches.                        |
| C. Tea, coffee, cocoa—Iced. |  |

*Course 9.—Personal appearance.*

- |  |                        |
|--|------------------------|
| A. Cleanliness, orderliness, and neatness. | C. Shoes and slippers. |
| B. Hair, hands, and nails.                 | D. Uniforms.           |

## APPLICATION OF SHORT-UNIT COURSE TO HOUSEHOLD ART SCHOOL.

### *The all-day school.*

What has been said with reference to the part-time school applies with equal force to the full-time day school. There is also a further application of the unit course, especially with reference to home making. To take cooking in the day household art school as an illustration: In teaching cooking for home-making purposes, it is desirable that as early as possible the girl assume responsibility for the entire meal. But before this can be done, she needs a certain basis of cooking experience. One way of giving this is in short-unit courses where the pupil, not having a specific need derived from trade experience, is put through a number of these courses to give her the necessary knowledge and skill.

The pupil may begin her experience in any unit group, the length of her stay in each group depending upon her ability and the amount of subject matter in the unit. In the training of home makers, in order to make the experience practical and complete, the units of special cooking should be followed by others in marketing, the preparation of meals, and invalid cooking.

The following schedule illustrates how instruction by this method may be worked out:

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
<b>A. M.</b> 8 to 10	a. Meat. b. Cookies a n d small cakes.	Frozen desserts.	Pastry.	Cold desserts.	Hot desserts.
10 to 12	Vegetables, quick bread.	a. Sandwiches. b. Chafing - dish cooking.	a. Salads. b. Meat substi- tutes.	Left overs.	a. Fish. b. Quick breads.
<b>P. M.</b> 1 to 3	Cake.	Stews and casse- role cooking.	a. Bread a n d rolls. b. Fireless cooker.	Soups.	Canning and pre- serving.

The above schedule shows only two units in cooking for housekeepers. These units have been arranged from the standpoint of the administration of a school which disposes of its produce in the lunch room. The product of afternoon classes is such as to be available the following morning. If instruction and equipment permit, more than one unit class can be run at the same period. These cooking units can be repeated, duplicated, and extended according to the demand for instruction.

*Cooking in the part-time school for home makers.*

There is a large area of unexplored territory in training the mature housekeeper through the day school, and for this work the unit course is especially adapted. This is partly because the housekeeping job can be left at odd intervals and these intervals can be arranged by the worker more or less at her own convenience to permit her attendance at the day school.

In many communities it has been found that there are women anxious to obtain instruction in the units of home making. They will enter unit courses in cooking and sewing because they are at once put in touch with the specific information which they want, whereas a general course in either of these subjects would attract only a small percentage of these same women.

## PART II—A FACTORY SCHOOL EXPERIMENT.

BY CHARLES H. WINSLOW.

### INTRODUCTION.

In October, 1913, the public-school system of New York City assumed a new function, namely, that of extending its educational service to the illiterate, immigrant, wage-earning population of the city, and on June 4, 1914, the first graduation exercises for immigrant women and girl wage earners were conducted by the city's department of education. These exercises were conducted not in a school building but in a factory. In a word, since the worker could not leave the shop to attend school, the school authorities in this instance sent the teacher into the shop, and it is worthy of special note that this enterprise of bringing the school to the worker in the shop was undertaken by the school authorities not on their own initiative but in compliance with an urgent request made by the employer operating the factory.

According to the census of 1910, the number of illiterates 10 years of age and over, living in New York City was in that year 254,208. During the decade 1900-1910 the number of illiterates had increased from 181,835, or by more than 70,000. The number in 1910 was more than double the number returned by the census in 1890. It should be borne in mind in considering these figures that many individuals returned as literate—that is to say, as able to write—are unable to write or to understand the English language. This will be apparent from the census figures relating to the number returned from New York City as being unable to speak English. The figures relating to inability to speak English refer to the foreign-born white population alone, and according to the census of 1910 the number of foreign-born whites 10 years of age and over who were returned from New York City as being unable to speak English was 421,951. The corresponding number for 1900 was 168,974, the increase for the decade being 252,977.

In the 10 years, 1900-1910, the number of foreign-born white women and girls unable to speak English increased in New York City from 97,845 to 224,982. Practically the total number of these foreign-born white women and girls unable to speak English were 15 years of age or older (221,514 out of 224,982) and were, therefore, too old to enter the primary grades of the public schools.

That 40 illiterate working girls employed in a factory in New York City were, during the school year 1913-14, given some elementary instruction in reading and writing English and in the simpler processes of arithmetic is in itself a matter of small social significance. Obviously the importance attached to the event did not arise from the fact that the number of illiterate girls in New York City had been reduced in the course of a year by 40. It is highly probable that during the year ended July 4, 1914, the number of young women and girls in the city who were unable either to write or to speak English increased by thousands. The factory school is important only when regarded as an institution capable of expansion in the factories of New York City and of other communities.

Regarded as an extension of the public-school system, the factory school of the type under consideration in New York City performs a social service which can not, any more than can the service of public schools in general, be precisely valued in dollars and cents. In so far as it deals with the illiterate immigrant worker, it is clearly more than a social agency of elementary schooling. Teaching illiterate foreign workers to speak, read, and write English is work not simply of elementary schooling, but is much more essentially a work of assimilation of the population of foreign origin. The community which receives and economically exploits these foreign workers assumes an obligation with reference to them which it can not avoid with impunity. The welfare of the community as well as of the worker is involved.

These principles formed the groundwork of the establishment of the first factory school, and they will certainly underlie the establishment of similar schools in other factories, but it is significant that they are not made the basis of an appeal for an extension of the work to other factories. The basis upon which the appeal for an extension of the work rests is increase in efficiency of the workers. It was felt by those active in establishing this first school to be essential that the factory school be proved to be a profitable investment for the employer, and his cooperation in extending the work is expected only to the extent that his interest is apparent in doing so.

While, so far as the community is concerned, the profitableness of an investment in education can not be measured in terms of economic efficiency of factory workers, and while schooling, which did not increase the workers' efficiency in the factory, might nevertheless be absolutely essential and profitable in a community, when other than economic social needs are taken into account, the employer, in his character as an employer, is under no obligation whatever to undertake the education of citizens. Those who have figured out the cost of this first factory school and have related that cost to the

increase in efficiency of the workers taught in the school have, therefore, acted upon the correct principle, since the extension of the factory school as an institution is conditioned on economic considerations alone. Whatever the benefits of such a school, if the employer is to provide for its maintenance, it must be proved to be profitable to him.

It is, therefore, of fundamental importance that this first experiment in the operation of a factory school has been subjected to the test of economic value to the employer, and that it has been proved to be a paying investment. Since this is so, employers are not only justified in establishing similar schools in their factories, but in view of the much more important social benefits conferred upon the workers, should feel under obligation to undertake this work.

On the termination of the first year of the factory school the firm of D. E. Sicher & Co. stated it to be their belief "that the workers who have been thus trained have gained from 20 to 70 per cent in efficiency," and they make this fact the basis of their appeal to employers for cooperation with the school authorities in extending "this work of reducing illiteracy among the half million adults, mostly immigrants, in the city of New York."

### **THE INITIAL EXPERIMENT IN INSTRUCTING FACTORY WORKERS.**

In 1913 four manufacturers in the white-goods industry of New York City, conceiving that illiteracy among the foreign workers in their factories was a cause of inefficiency and low wage-earning capacity and, in consequence, of economic loss not only to the workers themselves but to their employers as well, initiated in cooperation with the public-school authorities a scheme of elementary schooling for certain of their employees. In this initial experiment the plan provided that four illiterates from each factory should attend in alternate weeks the district public school—attendance at school to be at the time expense of the cooperating manufacturers. The board of education indorsed the plan and undertook to provide the necessary instruction. In accordance with this arrangement two classes were formed, each composed of eight illiterate factory girls who worked in the factory and attended Public School No. 4 in alternate weeks. On each school day, from 9 until 12 in the forenoon, the workers were instructed in English, and in the afternoon, from 2 until 5, they were instructed—by an expert whose services were volunteered without charge—in the use of special machines. After a brief trial of five weeks, however, this undertaking was abandoned, largely on account of difficulties experienced in adminis-

tering the alternate-week rule and in keeping accurate account of the time spent in school by the worker.

### THE FACTORY SCHOOL ESTABLISHED.

One of the four manufacturers who had been interested in the original plan, Mr. D. E. Sicher, of the firm of D. E. Sicher & Co., decided to continue the experiment further, and accordingly applied to the board of education for cooperation in organizing in his factory a class among his own employees. In October, 1913, such a class was formed. This class, also, was under the direction of the principal of Public School No. 4, the instruction being given by the same teacher who had been appointed to the work under the alternate-week plan.

Forty-two workers were designated by the foreman of the factory for enrollment in the class. The ages of these workers ranged from 16 to 35 years. All of them were of foreign birth, 23 being natives of Russia, 5 of Italy, 8 of Hungary, and 6 of Austria. Fifteen had never attended any school whatever, 23 had attended school in the country of their birth, and 4 had attended school for a few months only—in each case far less than one year—in the United States. All of them had been employed for a considerable period in the factory. The class held sessions five days a week from 9 until 12 in the forenoon, the time being divided into four periods of three-quarters of an hour each. Workers were instructed in groups of 4, 4 groups, or 16 workers, being instructed each morning. The school year extended over about 42 weeks, or 2 terms of 20 weeks each, and 2 weeks vacation. The course of study prescribed by the board of education was completed by one-half the number of students enrolled in each 20 weeks of the school year.

### CHARACTER OF THE INSTRUCTION.

The character of the instruction was determined by the primal needs of the workers, and was, therefore, simple and elementary, the subjects taught being equivalent to the course in English provided for foreigners in the evening schools of New York City. Using as a basis for her work such themes as came within the daily experience of the workers, and were of personal interest and benefit to them, the instructor devoted her efforts principally to teaching her pupils to understand, speak, read, and write the English language, including spelling, the simple principles of sentence building and of elementary grammar, and letter writing.

The instruction embraced also the simpler operations of arithmetic, including tables of weights and measures and simple fractions. Talks were given on early history, on the lives of Washington, Lincoln, and other statesmen, and on legal holidays and their origin.

The school program included further some account of geography, especially that relating to New York City, to routes of travel, and to places of interest. Some instruction was given in civics, including some account of the merits of different systems of government, the essentials of good citizenship, and of patriotism. Finally, instruction in hygiene constituted an important educational factor in the course, embracing physical culture, personal cleanliness, and first aid to the injured.

Under each of these headings, the instruction offered was of the simplest and most elementary sort, and it may be freely admitted that even so the workers enrolled in the class were not prepared to absorb all of the instruction offered by the course of study prescribed by the board of education. The course served, nevertheless, the very important purpose of opening up avenues of further interest and study along profitable lines, and even if no other tangible result had been achieved than that of enabling these foreign-born workers to read and to understand the English language, the incidental benefits to them of this acquirement were of incalculable value, this elementary knowledge of the language of the community in which they live and work being an essential basis of any material improvement in their condition—either as wage earners or as citizens.

#### **COST OF THE SCHOOL.**

The total cost of this experiment to the firm of D. E. Sicher & Co., inclusive of space, light, heat, janitor's service, and loss of workers' time, amounted to \$672 for the entire school year; the cost to the board of education for instruction and materials used amounted to \$560, making a total cost of \$1,232 for the instruction of 42 employees during a period of 40 weeks.

#### **EARNINGS OF GIRLS AS AFFECTED BY SCHOOL INSTRUCTION.**

The earning capacity of the girls attending the school increased steadily throughout the school year, and since wages were paid by the piece this increase in earnings is a fair measure of increase in efficiency as workers. It is significant that any immediate economic benefit should result, even from such general elementary schooling as that which has been described, since this schooling was not specifically industrial or vocational in character. The explanation is, however, simple. Such elementary schooling as that given in the factory school is a condition of economic efficiency in any line of work.

With a view to determining as accurately as possible the immediate economic benefit derived from the simple instruction given in the school—instruction largely devoted to teaching the workers to understand, read, and write the English language—the following

table of earnings has been prepared, in which the average earnings per hour of 10 girls enrolled in the class (illiterate at the beginning of the school) are compared with the average earnings per hour of 10 literate girls not enrolled, during a period covering 32 weeks preceding and 16 weeks subsequent to the opening of the school. The girls composing the two groups were of exactly corresponding ages and experience in their work of machine operation.

AVERAGE EARNINGS OF 10 MACHINE OPERATORS ATTENDING FACTORY SCHOOL (ILLITERATE AT THE BEGINNING OF THE SCHOOL), COMPARED WITH AVERAGE EARNINGS OF 10 LITERATE MACHINE OPERATORS NOT ENROLLED IN THE SCHOOL.

Periods.	Average earnings per hour of—		Per cent of increase in earnings of illiterate girls attending factory school.
	Literate girls not attending factory school.	Illiterate girls attending factory school.	
	<i>Cents.</i>	<i>Cents.</i>	
32 weeks preceding opening of school.....	23.2	19.5	
First 4 weeks of school.....	23.4	20.9	7.2
Second 4 weeks of school.....	22.8	21.1	8.2
Third 4 weeks of school.....	23.1	21.2	8.7
Fourth 4 weeks of school.....	23.1	22.2	13.8

As may be seen from the above table, the average earnings per hour of 10 literate girls, operators, during 32 weeks preceding the opening of school exceeded the average earnings per hour of the 10 illiterate workers by 3.7 cents, or by approximately 16 per cent, the excess of earnings of the literate workers over those of the illiterate amounting in a full working week of 50 hours to \$1.85. Each 4-week period of school showed an increase in the earnings of the girls attending school, while the earnings of the other group remained practically stationary. During the last 4-week period of the 16 weeks of school the earnings of the literate girls exceeded the earnings of the girls attending school by only 0.9 cent per hour, or slightly more than 4 per cent, the excess amounting to 45 cents in a full-time working week.

Among the causes of this increase in earning capacity may be noted two practical benefits derived through even an imperfect knowledge of English, namely, the ability to understand the spoken orders of the foreman or forelady and the ability to read and understand rules relating to the prevention of accidents in the operation of machines.

If the average earnings during the 32 weeks preceding the opening of the school be compared with the average earnings during the last 4-week period shown in the table, the increase in earnings for those attending school averages 2.7 cents per hour (13.8 per cent), or \$1.35

per week. Assuming that no further advance in earnings results from the instruction given, this average increase amounts to approximately \$70 in a year, if employed for a full year. The average cost per pupil per week of maintaining the school was 73.3 cents. The cost assignable to the 10 girls whose average wages are shown in the table for the period of 16 weeks was, therefore, \$117.28; while the aggregate increase in wages for these girls was equivalent to approximately \$700 a year. If the total cost of the school had been assessed upon the earnings of the girls, their increase in earnings in one year due to the schooling would thus have exceeded the cost of the schooling by nearly \$600, the excess of the wage increase over the cost of the 16 weeks' schooling per girl amounting to approximately \$58.

#### ADVANTAGE TO EMPLOYER.

The profit to the employer is equally obvious. If it be assumed that these girls remain in the industry an average period of 8 years, the aggregate increase in earnings for the 10 girls amounts to \$5,600. It is fair to assume that the employer's profit on the work represented by this increase in earnings is not less than 10 per cent, or \$560, which is over four-fifths of the total cost to the employer of providing schooling for 42 girls during a period of 40 weeks. The cost to the employer for 16 weeks' schooling for 10 girls on this basis amounts to approximately \$64, or less than one-eighth of the profit which he may reasonably expect to derive from the increase in efficiency of the workers.

It will be understood that these figures are not offered as indicating precisely either the increase in wage or the profit to the employer to be expected from 16 weeks of elementary schooling, but the wage increase and the profit, as figured, are indicated by the actual experience shown in the records of 10 girls. If the data had embraced a larger number of girls, a somewhat greater or less immediate economic benefit might have been shown; but the margin of profit, both to the worker and to the employer, is certainly sufficiently great to warrant the conclusion that the factory school is a paying investment. Even if a much smaller increase in efficiency on the part of the workers be assumed, the factory school would still yield a high rate of profit. As a matter purely of shop economy it pays the employer to cooperate with the school authorities in providing instruction for illiterate workers. It is hardly necessary to add that other benefits, such as the reduction of the liability to accident and the appeal to the workers' loyalty and good will, although they can not be exactly measured in dollars, are, nevertheless, of even greater economic value to the employer.

## PROBABLE VALUE OF SIMILAR SCHOOLS IN OTHER INDUSTRIES.

While it may be laid down with a fair degree of certainty as a general economic principle of factory operation in a wide range of industries and occupations that illiteracy, wherever it obtains, is an immediate and direct cause of inefficiency among the workers and of consequent loss to the employer and to the worker, the data presented in the foregoing pages relates specifically to the white-goods industry. The conditions under which this first factory school operated successfully, achieving the economic benefits to worker and to employer which have been specified, were, therefore, determined by the requirements of the manufacturing processes and employments in this industry. Although there is no reason to believe that benefits less considerable than those which have been noted would result from a similar scheme of cooperation with the public-school authorities in providing elementary schooling for illiterate workers in other industries, it may be felt that the data which have been presented have special significance with reference to the white-goods industry alone, or with reference to other industries where similar factory conditions prevail. The following brief account of the processes and employments in the white-goods industry will suffice to show that the conditions of employment in the industry are not essentially different from the conditions necessarily prevailing in a wide range of allied industries in New York City, and that the processes of the industry do not in any peculiar or exceptional degree require school training as a condition of efficiency.

In comparison with such other clothing industries as the dress and waist industry and the cloak, suit, and skirt industry, the requirements of skill on the part of the worker are somewhat less in the white-goods industry. The materials used in the white-goods industry are less varied in texture, weight, and color, and are less expensive; changes in style less frequently necessitate material changes in the processes of manufacture, and the requirements of fit in white garments are less exacting. Generally, it is true also, that the risks of loss which the manufacturer must assume are less in the white-goods industry than they are in other clothing industries. This results, in part, from the fact that the demand for the white-goods garments is less seasonal than is the demand for other garments; in part, from the fact that the danger of overstocking is less in the white-goods industry, since this industry encounters less radical changes in style; and, in part, from the fact that in the white-goods industry less labor is expended upon the materials used, which are, in themselves, of less value per garment. The industry is, nevertheless, an important factor in the economic world, and an account of its

processes and employments is, therefore, of significance, since these processes and employments affect the welfare of many thousands of workers. The following account is based upon data obtained by personal visits to large plants, by contact with workers in the various occupations, and by conference with heads of departments and with manufacturers.

## DESCRIPTIVE ANALYSIS OF PROCESSES AND OCCUPATIONS.

The principal materials used by the industry are cotton cloth, cambric, nainsook, silk, chiffon, crêpe de chine and crêpe cloth, and vegetable silk.

The occupations in the industry may be grouped under the following headings:

1. Designing.
2. Grading patterns and cutting materials.
3. Fancywork.
4. Construction of garment.
5. Finishing.

### 1. DESIGNING.

The first process in manufacturing a garment, such as a gown, princess slip, corset cover, combination chemise, skirt, or drawers, is that of planning and designing. This work is done by women designers.

The designer is constantly on the lookout for new ideas, which she may derive from various sources. She studies the models put out by high-class houses, and when employed by manufacturers of the highest-grade garments, may be sent to Paris and to other European cities in search of ideas.

In all cases the designer must be a skilled artisan, possessing a thorough knowledge of all branches of the work in order to assure success in planning garments, and that such plans may be economically, practically, and tastefully carried out. Generally designers are workers of experience who have risen from minor positions, and where such is the case they are said to be more efficient in fulfilling the practical requirements of the trade.

The competency of a designer is largely determined by her ability to gauge the needs of the trade catered to by the house employing her. Upon her to a very great extent rests the responsibility for bringing the line produced by the house within the limits set by the trade as regards grade and price. The exercise of practical judgment in this respect is of prime importance, since any disregard of these limits necessarily results in loss to her employer.

Economy of material is another important condition in practical designing. The skillful designer plans her models so that the material can be cut with the least possible waste of material and at the same time without sacrifice of style.

The actual work of designing consists first in planning a model by drafting a pattern on paper, which indicates the lines or contours of the garment, the kinds of trimmings, and their proportions. In cases where the design is elaborate the designer, in addition to the drafting, will make cut-outs and will lay out and pin the trimmings on the drafted sheet, roughly completing the proposed model. She then cuts one garment from the materials selected for that style and gives it to the sample maker, together with the original paper pattern to be used as a guide.

The earnings of designers vary in proportion to their ability.

**Sample maker.**—The sample maker completes the garment forwarded by the designer in accordance with the details of the pattern. Sample makers are chosen from among the more skillful operators, and they work under the immediate direction of the designer.

Their wages range from \$10 to \$12 a week.

Special orders also are carried out and imported models copied by the designer and her staff of sample makers.

The garment completed by the sample maker is pressed and made ready for adoption as a line to be carried by the house. It is measured to determine the quantity of various materials and trimmings used, the cost of these materials and of the labor expended upon them is computed, the value of the garment is compared with previous running numbers, and, when proved satisfactory as regards style, selling price, and margin of manufacturers' profit, the new line is adopted.

## 2. GRADING PATTERNS AND CUTTING MATERIALS.

**Cutters.**—The head cutter receives the original paper pattern made by the designer, dissects it into its different operations, such as tucking, fancy yoke making, lace running, machine embroidery, and scalloping.

He then makes a permanent and complete pattern for each of the different operations and proceeds to grade these patterns into sizes for cutting in quantities. To grade for size he must make a set of paper patterns in reduced and increased sizes in proportion to the dimensions of the original pattern, which is drafted to the standard size 36. A great deal depends upon the correctness with which patterns are graded, and therefore the cutter must possess a knowledge of drafting as well as cutting.

The head cutter makes out a card, on which he enumerates all of the component parts of the garment, specific dimensions, quantities of materials, and perforations for guiding fancy operations. On this card he writes also notes of caution, a description of the garment and of the materials to be used, and any other necessary data. The card so filled out serves as a record and is kept in view by the cutters when operating.

The head cutter also makes out a card giving directions for trimming and sloping the garment. On this card he specifies length of neck, length of sleeve, length of ruffles, length of belts to be cut by the trimmers, and also the amount of trimmings called for by each design.

**Layers-up.**—The goods received from the cotton converter (selling agency) are stretched on cutting tables by the helpers in the cutting department, and laid up to as many thicknesses as the instrument for cutting will allow or the order may require. This is the work of the layer-up, whose wage ranges from \$5 to \$8 a week.

The pattern to be cut is marked out with pencil on the top layer of the goods by the skilled cutters, and cut with scissors, short knife, or electric machine, the instrument used depending upon the number of thicknesses to be cut.

The work of laying out the pattern necessitates skill, as misjudgment may result in losses.

The wages paid for this work range from \$12 for assistants to \$23 for experienced cutters.

The material cut is assorted by the assistants in the cutting department, bundled, and sent to the various departments of the factory.

**Trimmers.**—The trimmers measure trimmings, such as lace, cut the material with scissors according to directions on the cutter's card, and send the cut

trimmings to the operating room to be given out with the rest of the garment for different operations.

Trimmers are paid from \$5 to \$14 a week.

**Slopers.**—The slopers, following the directions on the description card prepared for use of trimmers and slopers, lay up trimmings, mark them into shape, and cut with scissors, except where large quantities are required, when the work of sloping is done by the sloping cutter with regular cutting instruments.

As in the case of that of trimmers, the work of the slopers is sent to the operating room, to be given out by the forelady for different operations with the rest of the garment.

Wages of slopers, as of trimmers, range from \$5 to \$14 a week.

### 3. FANCYWORK.

**Stampers.**—Where the pattern calls for embroidering, the pieces to be embroidered are sent to the stamping department. Here a stamper transfers the design to the material from a perforated paper pattern by rubbing a mixture of crayon and benzine with a pounce over the pattern. The stamped pieces are then forwarded to the factory proper.

**Tucking.**—The first occupation to receive attention in the factory proper is the tucking on the garment, which is done by machines for single and multiple tucking.

**Zigzagging, hemstitching, etc.**—Tucking is followed by the other branches of fancywork, such as zigzagging, lace running, hemstitching, machine embroidery, scalloping. Some of this work is done by special machines, a description of which is found further on in this report.

This fancy work is done by one set of operators for the various garments manufactured.

**Scallop cutters.**—The work of scallop making, done by a special machine, when finished is sent by the forelady to the scallop cutters, either before the hemming and felling or after, as she deems best. These scallop cutters trim the waste material from the scallops with scissors. (No machine has as yet been invented that can make the scallops and cut away the waste material at the same time.) When finished this is sent back to the operating room.

The scallop cutter receives from \$6 to \$9 a week.

In the meantime the other sections of the various garments are turned over to the foreladies of the different departments, to be distributed among the operators.

### 4. CONSTRUCTION OF GARMENT.

**Body makers.**—The work of making the body of the garment is done by machine operators called body makers. The body makers also make slits in skirt or drawers.

**Trimming operators.**—The work of trimming neck and sleeves or bottom of garments with laces or other trimmings, front making or shoulder joining, when required, is done by operators called trimming operators, who use plain sewing machines. These workers also make sleeves, if garment is constructed with set-in sleeves.

This accomplished, the garment is returned to the forelady, who gives it to other operators in the order in which their work is most advantageously done in completing the garment.

**Fellers, hemmers, and sleeve setters.**—These operators include the fellers, who join the seams of the garment; the hemmers, who hem the bottoms and do also gore seaming; and the sleeve setters, who set in the sleeves.

Garments that require ruffles, or fancy trimmings previously made by the fancy workers, are now ready for the joiners and operators on special machines.

**Joiners.**—The joiners join widths of ruffles made by fancy workers and are the beginners in the industry. They learn by using a gauge on the machine, and when proficient are taught other branches of the work by the special teacher employed in the shop for such purposes.

**Fancy machine operators.**—The fancy machine operators join the fancy trimmings, such as ruffles and lace yokes, to the garment, operating special machines constructed for this work. They also make and set dust ruffles. Their work completes the actual construction of the garment.

##### 5. FINISHING.

**Buttonhole maker; marker.**—A special machine is used in the making of buttonholes which is set by the operator for size of hole required. The buttonhole maker, instead of passing the work back to the forelady when finished, passes it on to the marker, who marks with a pencil the places for buttons and hands the work on to the button sewer.

The buttonhole maker is paid from \$6 to \$9 a week.

**Button sewer.**—The button sewer sews on buttons by machine, which machine can be adjusted to hold buttons of any size or kind. When she has finished her work she gives it to the girl in charge of the last three processes, i. e., buttonhole making, button marking, and button sewing, who returns it to the forelady.

**Ribboners.**—The garment is now ready for the ribboners, who pull ribbons through the lace insertions by use of a bodkin. This work is very simple and requires no skill or knowledge of garment making. Among these ribboners the more apt ones make bows and rosettes.

**Examiners.**—The garments are now forwarded to the examiner (whose wages range from \$5 to \$9 a week). It is the duty of these workers to measure the parts of the garment, to insure that the dimensions correspond to the given sizes, also to examine for slip stitches and rid the garment of threads.

**Presser.**—This done the garment is placed in the hands of the presser, who presses it thoroughly (using irons of 6½ pounds in weight), pleats and folds it into shape, and pins it into size, using tissue paper to keep from creasing when packed.

Pressers receive wages of from \$7 to \$14 a week.

**Final inspection and packing.**—The pressed garments are forwarded to a set of workers who inspect the ironing and pack the garments in boxes. Each box is properly marked (to designate lot, number, style, and size), tied, and made ready for shipping.

**Work ticket.**—The forelady of each department keeps a record of work done by her workers on a separate work ticket for each operator. This records the style, number, quantity delivered to worker, and the operation to be performed. When the work is finished and returned to the forelady, the amount returned by the worker is entered on the same ticket, the rate per dozen, and the full amount due to the worker for that quantity of work. At the end of the week these amounts are totaled and the ticket is sent to the office for making up the pay roll.

The rates of pay are determined with reference to the skill required for the work done, the degree of skill required depending largely upon the character of the garment. The gown requires the most skill; in the order mentioned the princess, the corset cover or brassiere, the combination, the chemise, the skirt, and the drawers require less skill.

By way of summing up briefly the manufacturing processes which have been described, the progress of two typical garments through the factory may be traced.

#### TRACING THE GOWN.

[Through the various processes of work in the order in which they follow.]

1. Designing (sample making).
2. Cutting (trimming and sloping.)
3. Stamping for embroidery, and embroidering when garment requires such.
4. Fancywork making, tucking, lace running, etc.
5. Trimming operations.
6. Hemming and felling.
7. Buttonhole making.
8. Button sewing.
9. Ribboning.
10. Examining.
11. Pressing.
12. Examining the pressing, and packing in boxes.
13. Shipping.

#### TRACING THE COMBINATION.

[Through the various processes of work in the order in which they follow.]

1. Designing.
2. Cutting (trimming and sloping.)
3. Stamping for embroidery and embroidering when garment requires such.
4. Fancywork making.
5. Trimming top (corset cover).
6. Felling (closing sides).
7. Trimming bottoms of drawers.
8. Facing drawers.
9. Gathering or pleating top of drawers.
10. Joining both legs of drawers.
11. Joining by belting.
12. Buttonhole making.
13. Button marking.
14. Button sewing.
15. Ribboning.
16. Examining.
17. Pressing.
18. Examining the pressing, and packing.
19. Shipping.

### DESCRIPTIONS OF SPECIAL MACHINES USED FOR FANCY-WORK, ETC.

1. **Overlock.**—Used for joining fancywork, embroidery, or laces to yokes of gowns, etc. This machine performs the operation in one stitch, giving a fancy finish to the seam. It is also used in combining waist and drawers of combination, accomplishing this in one operation.

2. **Lap seam.**—Two-needle machine is used for joining seams. It makes a flat fell stitch with one operation instead of four. The seams are called lap seams.

3. **Ruffle setter.**—This machine takes two pieces of material, gathers one, joining them together with a tuck-over seam in one operation. Used in setting ruffle to bottom of drawers, skirt, and chemise.

4. **Chain-stitch machine.**—Used for fancywork, joining laces and embroidery, tucking, etc., with single thread, making chain stitch (instead of overcasting by hand).

5. **Zigzag machine.**—Used for joining laces together for yokes. This works from side to side, making a fancy stitch (zigzag) in one operation, thus saving work of trimming seams and of overcasting for strength and finish of same.

6. **Embroidery machine.**—Works on stamped design inclosed in wooden embroidery frames. The operator directs the work of the machine by keeping the lines of design in proper position for machine, the width being controlled by a knee press.

7. **Embroidery machine scalloping.**—This is used for making scallops (no stamping necessary). Material to be scalloped is shaped for neck, or straight for ruffles, and the machine is guided from the edge of the material.