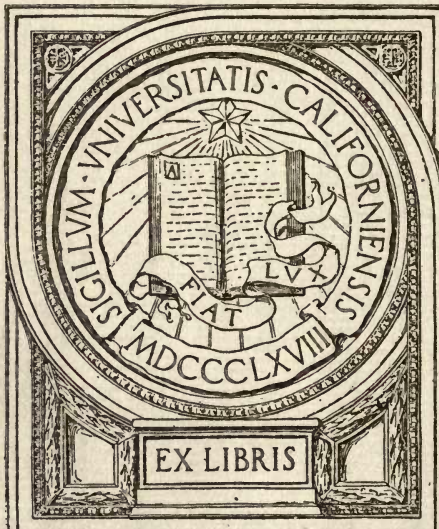
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# EMPLOYEE TRAINING

# TRAINING AND EDUCATION IN THE INDUSTRY

AS A MEANS OF

# VOCATIONAL EDUCATION

*Being a Study of the Training and Education Departments of Various Industrial Corporations*

BY

JOHN VAN LIEW MORRIS, A.B. (Harvard), A.M., PH.D. (Columbia)

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, in the Faculty of Education, Columbia University, September 1, 1920, New York City.

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JOHN VAN LIEW MORRIS, Ph.D.

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# PREFACE

THE author is glad of this opportunity to express his appreciation for the cooperation and courtesy of all connected with the training and education departments described in this book who have assisted him in any way in collecting the material. He feels himself under particular obligations to Mr. I. B. Shoup of the Westinghouse Electric & Manufacturing Co., Mr. Charles Trippe of the General Electric Co., Mr. J. W. Dietz of the Western Electric Co., Mr. A. C. Horrocks of the Goodyear Tire & Rubber Co., Mr. F. E. Searles of the Ford Motor Co., Mr. John McLeod of the Carnegie Steel Co., Mr. F. W. Pease of the Bethlehem Shipbuilding Corporation, Mr. F. W. Thomas of the Atchison, Topeka & Santa Fé Railroad, Mr. E. E. Sheldon of R. R. Donnelly & Sons Co., Mr. Harry Tukey of the Submarine Boat Corporation, Mr. L. L. Park of the American Locomotive Co., Mr. E. E. Fowler of the Pratt & Whitney Co., Mr. Franklin T. Jones of the Warner & Swasey Co., Mr. J. B. Chalmers of the Yale & Towne Mfg. Co., and Mr. Frank Lott of the Sperry Gyroscope Co. He also feels under very deep obligations to Mr. Charles R. Allen, formerly with the Emergency Fleet Corporation.

Finally no mere word here can pay the tribute which the author owes to Professors David Snedden and Arthur Dean, who have been his constant inspiration and counsellors throughout the shaping and growth of the book.

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# INTRODUCTION

## THE NATURE OF THE STUDY

THIS study has been undertaken in order to discover to what extent manufacturing industry can be relied upon to train its own workers. With the immense development of manufacture in America during recent years industrial executives have been more and more concerned over the fact that apprenticeship had pretty much broken down and the prevailing high specialization was producing a dearth of the old-time mechanics for maintenance work and as a reserve force from which foremen could be recruited. Two solutions of the problem were proposed—one, the revival of apprenticeship; the other, the establishment of vocational schools.

This investigation has been mainly an inquiry into the programs and organization machinery being utilized in carrying out the first solution, which has of late expanded into a much more comprehensive program than of apprenticeship alone. Intensive training for various productive activities, foremen training and for salesmen, and minor executives are designations of some of the newer types. In addition some corporations extend their opportunities for employee improvement from technical classes for members of

the engineering staff down to classes in English and citizenship for alien laborers.

It is evident that whatever contributions industry can and does make toward training its own workers lessens by that much the task imposed upon the public school system. It does not, however, preclude the possibility that public education can make extremely fruitful contributions to industrial education which raises problems as to efficient synthesization of trade and technical schools with the further training which may advantageously be provided after work has commenced.

This study should then be of interest to the educator as throwing some light on industry's own solution of its training problems and it is hoped equally interesting to manufacturers as suggesting programs of education and training recommended by the previous trial of others.

## DEFINITIONS

It has seemed desirable at the outset to draw up some definitions of terms current in this field and employed in this study as there seems a lack of uniform practice and occasionally a misunderstanding may arise from confusion of designation.

**Apprentice.**—The term "apprentice" shall mean any *minor*, sixteen years of age or over, who shall enter into any contract of service, express or implied, whereby he is to receive from or through his employer, in consideration for his services in whole or in part, *instruction in any trade, craft,* or *business.* (Section 2377, Statutes of 1917, Wisconsin.)

**Apprenticeship Training.**—As considered in this study apprenticeship training is based on the definition above of apprentice, in which the following two elements are held to be indispensable: (1) It will be applied only to the acquisition through observation and practice under skilled direction and productive conditions with related instruction of a recognized trade or craft. (2) The experience constituting the skill elements with the related technical knowledge must be sufficiently comprehensive to require for their acquisition practice by the apprentice during a period of several years (usually three or four) commenced *previous to his attaining his majority.*

This definition does not recognize as coming under its scope such relationships as of a fireman to a locomotive engineer where the former as an adult worker is supposed in course of time largely by observation to learn the duties of the latter. Neither does it include the endeavor to teach by close supervision during a period of several weeks or months only the same trades as taught commonly by apprenticeship. Such instruction should be recognized as intensive training which is defined later.

Apprenticeship will be considered as *formal* or *informal* according to presence or absence of a legally binding indenture or agreement stating years of work required for its completion, variety of experience offered, amount of supplementary instruction, basis of remuneration, etc., executed between the corporation's representative on the one hand and the minor and his parent on the other.

**Special Training.**—Definite instruction for a specific operation or specialized trade under an instructor

especially chosen and trained for that teaching will be designated as special training.

It is distinguished from apprenticeship in duration of instruction as special training ordinarily extends through a period of a few days to several months only. Also while apprenticeship training is rightly applicable to trade or craft teaching of minors only, special training is considered as alike applicable to the instruction of adults as well as minors. Elements in the instruction of apprentices may, however, be considered as special training, e.g., instruction in the operation of a lathe to a machinist apprentice.

**Intensive and Part-time Training.**—Special training is either *intensive* or *part-time* depending upon whether the learner spends his entire working time or a fixed part of it in acquiring the skills and knowledge embraced. It is *productive training* when the regular saleable products of the operations involved are produced. Otherwise it is *exercise* training.

**Initial Special Training.**—That given to a recruit inexperienced in the type of work involved will be called initial training. Ordinarily it is intensive training.

**Upgrading and Promotion Training.**—That given to an employee in order to render him capable of performing more difficult or more remunerative work will be called upgrading. When it leads to an occupation with a new designation it should be considered as *promotion training.* When upgrading training is given to one already employed at a trade it may be spoken of as *trade extension training.*

**Special Training Department.**—A department distinct from regular production but with similar equip-

ment, used in providing practice for apprentices or those in initial or upgrading training will be designated as a special training department. When used for initial training exclusively it is frequently called a *vestibule school.*

**Floor Training.**—When not in a separate department, training, either initial or upgrading, is called *floor training* or *training " on the job."*

**Trade Teaching Formula.**—*Trade teaching content* is considered as defined by the formula,*

$$E = M + (T + I), \text{ in which}$$

*E* represents the *equipment, skill,* and *knowledge* required for efficient service in the trade to be taught.

*M* represents the *manipulative skill* required either with tools or in the control of machines.

*T* represents knowledge of the *trade technical content* of the particular occupation in question.

*I* represents knowledge of the *general trade content* which can be shown to function directly in industrial efficiency.

*Supplementary* or *related subjects* instruction will include such portions of $(T+I)$ as can be more conveniently given in a classroom than in a training department or on the production floor. When given at the expense of and by the company involved, the school which provides such instruction will be called a *corporation school.* When such a school is for apprentices only, it will be designated as an *apprentice school.*

**Part-time Industrial School.**—When the school for such supplementary instruction is provided during

* Bulletin No. 52, Federal Board for Vocational Education, p. 7.

working hours and by the public school authorities, it is called a *part-time industrial school.* Especially when this school is conducted in the plant, there is in some places a tendency to call it a *co-operative part-time school,* but it is believed desirable to keep the term co-operative for the alternate-school-and-shop school defined later. If, however, the instruction is not supplementary, that is, if it bears no definite relation to the trade of the employees concerned, but is intended to add to their general education, the provision will be called a *continuation school.*

**Co-operative Instruction.**—That instruction provided where students alternate for equal periods between work in the industry and attendance at a separate school under public or semi-public auspices is considered as co-operative. It is commonly arranged by students being employed in pairs, one member of the pair working while his fellow member attends school. The following period the two exchange places, the one who has been working now going to school and the other going on with the interrupted work. The length of these alternating periods varies throughout the country from a half-day or a whole day in some places up to a week, a fortnight, or a term of twelve weeks in others. This type, it is believed, should be called a *co-operative full-time school,* if the *part-time industrial school* already defined is designated a co-operative part-time school.

### THE PORTION OF INDUSTRY INVESTIGATED

This study is in no sense a complete survey, being strictly confined to manufacture and the rather closely allied maintenance employments of the rail-

road shops and with rather more attention paid to that of the steel products as requiring all grades and types of employees; executives, engineers, mechanics, salesmen, clerks, semi-skilled operatives, and unskilled labor.

Furthermore, the study is, in the main, of the larger corporations. Plants were investigated with the number of employees varying from five hundred working people to fifty thousand. It is recognized that industries with less than this smaller number of employees may require wholly different solutions to their training problems, such as larger assistance from the public school system instead of the educational department inside the plant here advocated. It is believed that there is, however, one like element in preparation for employment, whether in a large or small plant, namely, that the specific training with the actual tools and surroundings for the duties and responsibilities of each job, trade, or office position as the final vocational training for such employment, in a very large number of cases can advantageously be given systematically.

This study also does not touch upon the building trades and the extremely varied occupations of our cities which may be grouped as independent service employments, such as that of automechanics. These, it should be recognized, employ a considerable number of skilled men. While the problems involved have not been studied exhaustively, it is believed that a much further development of the public vocational schools, trade preparatory (in some cases on a cooperative basis), part-time, and evening trade extension, are here the normal solutions.

The public service corporations; telephone, power, lighting, street railways, etc., and in some cities the municipal services, such as the police, fire protection, and street cleaning, it should be noted, have in increasing numbers their own highly developed training departments.

A similar situation holds as regards the larger commercial establishments, such as the great metropolitan banks and the department stores. Here, however, there seems a greater tendency to utilize public education facilities, such as continuation schools and university extension courses, as the commercial field seems to require a more extended general education than does manufacturing industry.

The generalization, then, from which this study proceeds is that the larger corporations differentiate from the smaller manufacturing units and the independent artisans in providing an economical unit for educational purposes. Certain plants devoted to manufacture have been studied as regards their training and educational facilities and the data obtained are the basis for arriving at some conclusions which form the final part of the study.

## METHOD OF STUDY

The method of the study has been to gain as much first hand information as possible. Altogether there are descriptions of the education and training departments of thirty-five different plants. In all except two instances the plants were personally visited by the author, some study was made of their products relative to the usefulness of training and apprentice-

ship, and where possible the educational work was seen in actual operation. The house organs descriptive of the training facilities were also consulted as well as the announcements of the apprenticeship department whenever such were published. In most instances the plant was revisited after a first draft had been made of the study and any misconceptions, as far as possible, eradicated. Also the description has been submitted to the training executive before final writing.

It is recognized that, depending so largely on the statements of those interested in making a good showing, some training departments may have been somewhat too favorably depicted. It is not believed, however, that this seriously detracts from the value of the study as determining the possible contributions of this type of educational activity to the whole problem of vocational education.

### THE GROUPING OF THE DESCRIPTIVE STUDIES

Forty plants were visited and their training and education departments were studied without any previously established routine of procedure. As has been stated no attempt has been made to make this study exhaustive. Wherever special training or apprenticeship has been found which seemed to merit study, as much has been learned as possible of its educational program and facilities. Each of these studies was then written up as a distinct unit as it appears in the first four sections.

In compilation the best classification seemed to be into these four sections, as follows:

I. Comprehensive Programs for Apprenticeship and Special Training.
II. Programs Emphasizing Apprenticeship.
III. Programs Emphasizing Special Training.
IV. Special Programs of Primarily Technical Instruction.

Under Comprehensive Programs are included those of such corporations as have both apprenticeship and special training. Among these were those of four plants engaged in the manufacture of electrical equipment, which seemed, on the whole, the most developed and standardized of all the plants visited and they are, accordingly grouped together to constitute the first chapter. The second chapter deals with three programs in the rubber and automobile industries. The six remaining comprehensive programs found in plants of extremely varied nature constitute the third chapter.

The second section of programs for apprenticeship is broken up into five chapters, each of which emphasizes distinct solutions of problems of apprenticeship training. In the first group in Chapter IV is described the apprenticeship which has become a tradition in five long-established manufacturing plants, but which has been modernized during recent years. The fourth chapter is devoted to four departments which seem to bring out the value and practicability of even small apprentice training departments. Their plans are recommended for study to those who, from size of plant, will find it impossible to train a large number of apprentices and yet wish to build their permanent personnel by this means.

The fifth chapter is of apprenticeship in the shipbuilding industry. Here are described two apprenticeship systems, one in a private plant with close

correlation between production training and apprentice school, the other in a navy yard with no attempt at thus relating the two parts of the instruction.

The next chapter is of the apprenticeship departments in locomotive and railroad shops which have points of similarity, even though in the locomotive works training for production is primarily the problem, while in the railroad shops it is that of maintenance.

The concluding chapter of this section is a study of apprenticeship in the printing industry, which is unique in its insistence on a seven-year program. It is, however, recommended to publishers as worthy of perusal, since in this industry apprenticeship, even though informal, still so generally persists.

The third section emphasizing special training has not been subdivided into chapters, as each study seemed unique.

The final section and chapter is of two brief programs of technical training, both planned with the avowed purpose of developing foremen and improved workmen under conditions that seemed to warrant emphasis on the technical phases of instruction.

In Section V an attempt at comparison and evaluation of the various programs is made under the general types of differentiation: Apprenticeship, Technical Training, Initial Training and Upgrading, Foreman Training, and General Employee Improvement. This is followed by a discussion of general problems of administration and, as a final chapter, the promotion and regulation of such educational facilities by the state.

# EMPLOYEE TRAINING

## *SECTION I*

## COMPREHENSIVE PROGRAMS FOR APPRENTICESHIP AND SPECIAL TRAINING

### CHAPTER I

### PROGRAMS IN THE ELECTRICAL MANUFACTURING INDUSTRY

THE reading of the four studies embraced in this chapter will convince one that this industry certainly as far as these companies are concerned is highly organized for training purposes. Just why it should thus be in the lead is a matter for interesting speculation. Perhaps it is due to the absorption into its executive personnel in each case for the invention and development of its products of a large number of engineers, some of whom have come to realize that the high development of the human element in production is as essential to efficiency as the perfection of the machinery involved.

A close study will show considerable difference of

procedure. The Western Electric Company, for example, has an educational director in the central executive offices of the company to co-ordinate education and training throughout its large and widely scattered organization. On the other hand the other companies seem to allow each plant to be a law unto itself, there being apparently only a friendly exchange of ideas between plants. All companies have developed apprenticeship to a high degree but adjusted to their local needs as of course it should be. There is thus considerable variation in method.

Special training as will be found throughout these studies is extremely varied. That for office workers, or technical positions, for foreman, in the vestibule school and to some extent for upgrading is to be found in the various systems. Evening trade extension along very different lines is also remarkably well developed by the Westinghouse and Western Electric Companies. Finally programs for teaching English and to encourage the securing of citizenship are being utilized by these companies.

## No. 1

### Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

The Westinghouse Company is one of the great manufacturing companies of the world. In the East Pittsburgh works alone eighteen to twenty thousand people are employed. Under the heading "Some Westinghouse Products" some thirty-four articles are mentioned including such products as Automobile Starting and Lighting Systems, Circuit Breakers,

Condensers, Fuses, Gas Engines, Generators, Heating Devices, Lightning Arresters, Electric Lamps, Locomotives, Meters, Ranges, Rectifiers, Rotary Converters, Transformers, and Turbines. While this is only a partial list, a glance will show that not alone skill but an immense amount of initiating intelligence must be constantly introduced in inventing and improving both the products and also their means of production. An organization consisting of designing and organizing engineers with a supply of labor of specialized efficiency is not alone sufficient. To these two important groups there needs to be added the third type of workman, not of the highly technical training requisite in the engineer, but with the practical all-around efficiency that can attack a problem of machine control with some expectancy of independent solution. This third type, the mechanic, is given recognition in this company's organization.

The Educational Department shows also that these three primary differentiations of productive skill and intelligence are considered by the management of this company. Special training and various devices of expert employment management are practiced to produce optimum efficiency among the partially skilled and specialist labor groups. Carefully supervised apprenticeship and a flourishing technical night school provide the training and industrial education for the skilled or mechanics group. Finally as one of the leaders in the practice of well-managed manufacturing concerns requiring a large technical staff, some three hundred or more graduates of the leading engineering schools are each year employed under conditions approximating apprenticeship to recruit

the engineering and administrative force of the company.

**Special Training.**—Considering these various programs more in detail we find that to efficiently handle the unskilled and partially skilled labor employed an elaborate system of employment is utilized. To facilitate this job analysis cards have been compiled enumerating the duties in detail of each separate occupation in the plant and a number affixed by which foremen can make requisitions on the employment department for additional workers. Standard methods are also carried out by this employment department to reduce labor turnover, such as transfer, when work slackens in one department and increases in another or where dissatisfaction develops between a foreman and one of his workmen. Before any employee is discharged or withdraws of his own accord the department endeavors to arrange an interview to discover the real reason and if possible amicably to adjust the matter.

At the present time an intensive training course is being conducted for stenographers. These are already either experienced stenographers or fresh from the commercial schools and are given this special training primarily to acquaint them with company forms and practices as well as to give them acquaintance with technical terms peculiar to this industry. This lasts from a period of a few days up to several weeks according to the ability of the pupils enrolled and the demands made for stenographic help in the various departments.

Similarly recruits to the clerical force are provided with special training by the educational department

upon requisition of the department by whom they are employed. This may take the form of four hours per week of instruction in matters directly related to their work, and is provided for both sexes.

Of greater interest from a mechanical standpoint is the special training department or "vestibule school" for operator-specialists on the various machines of construction. A boy or young man wholly inexperienced may thus in a few days to several weeks be taught to operate the boring mill, lathe, or miller and thus in a very short time reach standard production capacity when he is transferred to regular production. A small department segregated from the usual production floors with standard equipment is provided for this purpose. None of the work is, however, of an exercise sort but of a kind suited to beginners chosen from regular production. A similar training department is provided in winding and taping for female employees.

**Apprenticeship.**—Of the organized apprenticeship and evening instruction provided as previously stated for the mechanics or skilled craftsmen, we shall consider first apprenticeship which has not waned in popularity with the more capable boys or in favor with the plant's administration owing to the intensive machine training described above. This is due to the fact that with the broader training provided and steadier qualities of the individual concerned proved by the willingness to forego standard production wages by quick training, a group of superior workmen are selected who are assured of steady employment and, later, of preferment in the choice of foremen, superintendents, and ultimately even of execu-

tives. There is no absolute break in the ladder of advancement to those boys who will take the all-around training.

We find, at the present time, 198 four-year apprentices employed in the East Pittsburgh works. These are divided as follows: 142, or 72 per cent, are in the machinists' and toolmakers' trades, 17, or 9 per cent in the patternmakers', and 39, or 10 per cent, electricians. There is, in addition, an opportunity offered for apprenticeship in patternmaking and foundry work in the Cleveland works of the company where, at present, 10 apprentices in patternmaking are enrolled.

An effort was made to discover the ratio of apprentices to skilled men in the various trades, but without success, owing to the lack of definition as to what constitutes a skilled man. For instance, 39 electrical apprentices would, of course, be a very insignificant number compared with the very large number of people employed on electrical work in the plant; and the same applies, though perhaps in less degree, to the other trades. One must recognize that in this plant, as in most large manufacturing concerns, much of the training, if provided at all, is in limited special fields and does not conform to regular apprenticeship.

"The latter is designed to produce a man with far broader knowledge than is generally required on the majority of production jobs."

Approximately one-third of the four-year course is spent in a special training section by the machinists and toolmakers and the remaining two-thirds in various sections of the works which provide facilities for broad experience. There are, however, no special

training sections for patternmakers or electricians, as in those trades it is believed advisable for the apprentices to learn their trades by working with journeymen in the respective shops. Definite schedules for transferring apprentices from one kind of work to another are administered by the Educational Department, in order to insure that each apprentice receives an all-around and balanced training during his course.

For all apprentices four hours per week during the entire course are given up to classroom instruction. Classes meet from 7 to 9 A.M. in the educational department for the study of mechanical drawing and practical shop problems. The textbooks for these courses have been compiled by the instructing staff, all problems being drawn from the practice in the various shop sections.

The instruction in mechanical drawing includes blue-print reading, sketching, lay-out problems, developments and tool design. In " Shop Problems " the instruction is by problems in English, mechanics, shop system, costs, and the applications of the principles of arithmetic, algebra, geometry, and trigonometry to shop work. Two hours of home work are required each week in addition to class work. Instructors in the apprentice school are selected from the engineering, drafting, and shop departments of the company. Because of their close contact with the special shop conditions encountered in this particular industry, these men are obviously particularly well qualified to develop in each apprentice a correct understanding of the work involved and an appreciation of the relation between the various trades and this industry as a whole.

Apprentice pay, as in other progressive corporations, has shown considerable appreciation both during and since the conclusion of the late war. As of January 1, 1920, it stood as follows:

| | |
|---|---|
| 22¢ per hour for the first | 1218 hours |
| 24¢ per hour for the second | 1218 hours |
| 26¢ per hour for the third | 1218 hours |
| 31¢ per hour for the fourth | 1218 hours |
| 33¢ per hour for the fifth | 1218 hours |
| 35¢ per hour for the sixth | 1218 hours |
| 39¢ per hour for the seventh | 1218 hours |
| 44¢ per hour for the eighth | 1218 hours |

This pay is based on a forty-eight hour week or an average month of 203 hours.

As the method of training is similar, mention should here be made of the opportunities offered to those who wish to become draftsmen. They start as tracers in the drafting department and are given a two-year supplementary course for six hours each week by the Educational Department. This instruction covers design problems involving various applications of mathematics, physics, mechanics, materials, shop methods, estimating and cost calculating in tool design. It also includes such special subjects as lubrication and bearings, heat transfer and ventilation, electrical machinery, etc. The pay is somewhat better than for trade apprentices, and at present twenty are enrolled.

The company makes much of its care in the selection of apprentices. For admission to the trade courses the applicant is required to be of the standard age of sixteen to nineteen and to possess the knowledge of English and arithmetic to be expected of the grammar school graduate. For the electrician's

course, in addition, the applicant must have two years' high school training or its equivalent. Complete high school training is ordinarily required for entrance to the drafting course.

Every applicant is interviewed by two or more members of the company's Trades Apprentice Committee, usually the director of trades apprentice instruction and one of the foremen. In case of doubt or disagreement as to the suitability of a candidate, he is turned over to one or two additional interviewers whose judgment is final as to acceptance or rejection.

An interesting method has been developed for rewarding extra proficiency. Once a week the committee comes together and at each meeting the records of all apprentices who have finished eleven months of the apprentice year are brought to the attention of the members. The committee examines the records and grades the apprentices into four classes: A, B, C, and D. If an apprentice is placed in Class A, one month is taken from his apprentice course, or in other words, he is permitted to begin immediately on his next year. If an apprentice should be graded as a Class A man at the end of each eleven months during the four-year apprenticeship, he would save one month each year and would finish his apprenticeship course four months ahead of schedule. If he finishes his course as a Class A man, he will be also accorded a higher rate as journeyman than he would if he finishes as a Class B or Class C man. At the present time, the rate per hour for Class A men is 3 cents higher than the rate for Class B men, and the rate for Class C men, 3 cents lower than the rate for Class B men. If the apprentice is placed in Class B, he will be re-

quired to serve his normal time. This class includes the majority of the apprentices. If he is placed in Class C, he is notified that he must show an improvement, and if he should be so deficient that he is placed in Class D, he is either discharged or sent to the employment department for suitable work. During 1919 thirty-seven were given Grade A rating from the trades apprentices and student draftsmen.

**The Technical Night School.**—The night school, which has been previously mentioned, operates under the name of the "Casino Technical Night School." It is independent of the company in its corporate organization, though somewhat over one-third of its revenue is provided by the company. Nearly half of its income, however, comes from fees of the students, who in the course in Fundamental Engineering Principles pay $16.50 each of the two terms per year. The same fee is charged in the Preparatory Department, while in the Foreign Department the charge is $7.50 per term and in the Women's Department $12.50 is required per term. The imposition of so considerable a fee naturally limits attendance to the more serious students who show a much better record for sticking through the course than is the experience of most night schools.

The enrollment is ordinarily less during the second term than in the first, but on March 1, 1920, was as follows:

| | |
|---|---|
| Engineering Department | 372 |
| Women's Department | 169 |
| Preparatory Department | 61 |
| Foreign Department | 25 |
| Total | 627 |

The school, as its attractive announcement states, was founded in 1902. It is located in the several public schools maintained by the communities in the neighborhood of the Westinghouse industries where the population is, of course, largely employed. However, admission is extended to all, regardless of occupation, previous education, or present place of employment. Only those who have completed their elementary education are allowed to enter the Engineering course. All others must enter either the Preparatory or Foreign Departments. An interesting feature worth considering for our public schools is that, in addition to grading on regular courses, all students receive ratings on personal characteristics: Judgment, Thoroughness, Personality, Reliability, Initiative, and Health. These ratings are not shown on report cards which are sent to individual students, but are retained on the permanent record card in the school office and may be utilized in considering promotions. A faculty of approximately sixty-five, usually technical graduates drawn from the staffs of the company, with the able administration assures a high quality of instruction.

The standard weekly schedule of the engineering course, from which no variation is ordinarily permitted, is shown on page 12.

Inspection trips to a dozen nearby industrial plants form a useful supplement to the regular instruction and an hour assembly is held every other week. At these assemblies popular talks are given by members of the Board of Directors, some of the older engineers, or leading men throughout the country.

It may also be mentioned that graduates are per-

| Days per wk. | Monday | | | Wednesday | | | Friday | | |
|---|---|---|---|---|---|---|---|---|---|
| | 5.45 P.M. | 6.45 P.M. | 7.45 P.M. | 5.45 P.M. | 6.45 P.M. | 7.45 P.M. | 5.45 P.M. | 6.45 P.M. | 7.45 P.M. |
| **FRESHMAN YEAR** | | | | | | | | | |
| 1st Term | Shop Problems | Foundry | | Shop Problems | Pattern Shop | | Shop Problems | Mechanical Drawing | |
| 2d Term | Algebra | Mechanical Drawing | | Algebra | Mechanical Drawing | | Algebra | Mechanical Drawing | |
| **SOPHOMORE YEAR** | | | | | | | | | |
| 1st Term | Algebra | Machine Shop | | Algebra | Machine Shop | | Algebra | Machine Shop | |
| 2d Term | Physics | | Geom. & Trig. | Physics | | Geom. & Trig. | Physics | | Geom. & Trig. |
| **JUNIOR YEAR** | | | | | | | | | |
| 1st Term | Physics | | | Electricity | Mechanics | Business English | Electricity | Mechanics | Business English |
| 2d Term | Electrical Laboratory | | | Chemistry | Electricity | Mechanics | Chemistry | Electricity | Mechanics |
| **SENIOR YEAR** | | | | | | | | | |
| 1st Term | Steam | Engrng. Problems | Electricity | Electrical Laboratory | | | Engrng. Problems | Steam | Electricity |
| 2d Term | Engrng. Problems | Steam Laboratory | | Engrng. Problems | Metallurgy | | Electrical Laboratory | | |

mitted to make application for and to enter, if accepted, the one-year course for technical engineering graduates. Several are at the present time availing themselves of this privilege.

That the school has been successful is shown by the positions held at present by the 195 graduates of the course up to and including the class of 1919. Of the positions a summary follows:

| | | | |
|---|---|---|---|
| Administrative | 27 | Commercial | 38 |
| Managers | 8 | Business | 2 |
| Superintendents | 5 | Oil Field Development | 2 |
| General Foremen | 2 | Salesmen | 24 |
| Foremen | 12 | Clerks | 8 |
| | | Advertising Writer | 1 |
| Engineering | 72 | Buyer | 1 |
| Operating and Service Engineers | 24 | | |
| Design and Research Engineers | 18 | Manufacturing Trades | 16 |
| Consulting Engineers | 1 | Machinists | 7 |
| Supervisor | 1 | Skilled Workmen | 9 |
| Draftsmen | 10 | | |
| Tool Designers | 3 | Miscellaneous | 7 |
| Teachers | 2 | Farmers | 3 |
| Inspectors | 7 | Students | 3 |
| Testers | 6 | Lawyer | 1 |
| | | United States Army and Navy | 29 |
| | | Deceased | 6 |
| | | Unknown | 2 |
| | | Total | 197 |

This is a particularly satisfactory record when it is considered that the average period since graduation is only approximately six years. It should also be borne in mind that this has been a service of benefit

to industry in general, since one-half of these graduates are now in the employ of other companies than the Westinghouse Electric.

**Americanization.**—This company is one of the few among those investigated which had already awakened to the desirability of Americanizing its alien labor before the disaffection and unrest attendant upon the late war aroused the country to action. From the organization of the technical night school a course in English and civic education for the immigrant employees has been in operation. Many have been taught English and encouraged to become citizens. There are twenty-five enrolled in this course at present, receiving instruction for three hours per night three evenings per week. There are also provided free evening classes twice a week in sections of the plant employing a considerable number of foreign laborers. In these classes 110 are enrolled and 7 paid teachers are provided. While the more extensive course in the night school provides an opportunity for the ambitious young men, these latter classes appeal more particularly to the older men and, between the two methods, practically all non-English speaking employees are reached.

The aims of these classes might form a suitable program in any plant:

> "1. Learn to speak, read, and write English.
> "2. Learn about the United States Government and how to become a citizen.
> "3. Learn how to figure your pay by the different methods used in the Works.
> "4. Learn how a big Company like this is built up; where the money comes from to build it and pay wages.
> "5. Learn how to help yourself by being of service to other people and working well with them."

The success of the program may be gauged by the fact that during the past year 114 were assisted in obtaining first papers and 153 their second papers. In doing this the secretary of the Americanization Committee aids the men in getting them through and pays the time of the witnesses.

**Student Engineer Training.**—To recruit the engineering, administrative and sales staffs, as has been previously mentioned, graduates of the leading engineering schools are taken into the works for a year's training on a basis similar to that of the internship for medical students. The number varies somewhat with the needs of the plant from year to year, but 300 seems to be about the average number received. These students spend several months in the shop acquiring experience and information regarding the company's products, personnel, and policy; they are then segregated into the specific lines which they expect to follow as a regular vocation. There are three fundamental lines of employment open to them, namely, design engineering, works management, and sales. Approximately 40 per cent go into engineering, 40 per cent to sales, and 20 per cent to works management. Special schools are provided for the design engineers and sales students. These schools run for twelve weeks, usually, during which time the student receives his pay as usual but does no productive work. At the present time the pay is $90 per month for the first six months and $95 for the second six months.

**The Organization for Education.**—Everyone recognizes that the primary purpose of a manufacturing corporation is to get production. It is a newer con-

ception that there may be an important secondary purpose in education, which may minister profitably to the main object of producing goods. To effect this secondary aim of education, a large corporation needs to be as efficiently organized as for production. In the case of the company considered, the Educational Department has at its head a manager with a considerable staff. For the Graduate Students and for the Trades Apprentices there is, in each case, a Director and, for the two departments, a Foreman in Charge of Schedules. Competent individuals from each field are also detailed to handle Tracing and Drafting Instruction, Clerical Training, Stenographic Training; and the Director of Trades Apprentice Instruction supervises the English and Americanization work. The Technical Night School has as president the manager of the educational department and as manager a man devoting his whole attention to it and to the somewhat closely related welfare work of providing noon lectures and directing the Valley Garden Association, which provides an opportunity to employees who wish to raise their own vegetables.

To provide the necessary co-operation with the production and employment departments, suitable interdepartmental committees have been created and the interest and support of employees are fostered likewise by committees made up usually of those who have already benefited by the educational opportunities. Thus, there are enthusiastic committees of the alumni of the night school who solicit new students, and of naturalized immigrant employees who urge their countrymen to join the English and Americanization classes.

The whole program seems to be conceived not as philanthropy or charitable paternalism, but as essential functions of a well-organized productive corporation.

No. 2

GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

The Schenectady Works of the General Electric Company are the largest of this important electrical manufacturing company. Here are located its principal offices, research laboratories, and a plant, organized as distinct units for the design and manufacture of electrical machinery and apparatus of nearly every description; steam turbines of small, medium, and large capacity; and many other mechanical devices of intricate design, employing over 20,000 people.

The general management is committed to an established policy of apprenticeship and special training for all types of employment in the plant, which may be considered under six headings: (1) Apprenticeship; (2) Engineer Training; (3) Foreman Training; (4) Instructor Training; (5) Intensive Training; and (6) Americanization. There seems, however, to be considerable variation in the development of this policy in the various branches of the industry and, to some extent, between different departments.

(1) **Apprenticeship.**—Since 1901 a shop apprenticeship system has been in operation. To quote from the attractive announcement of the department: "It began with a systematized training in the various uses of machine tools. Later, night classroom work was added, which was subsequently changed to day

classes." By the records of those who have completed the courses to November 1, 1919, it will be noticed that the opportunity offered has been mainly confined to three trades:

| | No. Graduated | % of Total |
|---|---|---|
| Machinists | 626 | 61.5 |
| Draftsmen | 251 | 24.7 |
| Moulders and Coremakers | 129 | 12.7 |
| Blacksmiths | 9 | .9 |
| Tinsmiths | 2 | .2 |
| Total | 1,017 | 100.0 |

In connection with this table of graduates it should be noted that tinsmithing or sheetmetal working is no longer offered as a field for apprenticeship, and that, while blacksmithing is still offered, there are at present no apprentices. On the other hand, within the past three years patternmaking has been introduced, in which there is a growing number of apprentices.

Statistics are unavailable of the present positions held by the graduates, but the records of the company show that the most capable men are constantly being advanced to responsible positions. In the announcement of their apprentice system compiled in 1919, of the men still at the Schenectady Works from the Drafting Course, twenty had received promotions, as follows:

| | |
|---|---|
| Designing Engineer | 1 |
| Commercial Engineer | 1 |
| Assistant Engineer | 1 |
| Section Chief | 1 |
| Temporary Foreman | 1 |
| Assistant Foreman | 2 |
| Division Leaders | 12 |
| Assistant Division Leader | 1 |

Of those who had completed the courses for Machinists and Blacksmiths, fifty are enumerated as follows:

| | |
|---|---|
| Foremen | 8 |
| Assistant Foremen | 9 |
| Gang Foreman | 1 |
| Sub-foremen | 10 |
| Designing Draftsmen | 2 |
| Tool Designers | 13 |
| Tool Inspectors | 1 |
| Shop Instructors | 5 |
| Group Leaders | 1 |
| Following Special Turbine Work | 1 |

The present enrollment is as follows:

| | |
|---|---|
| Machinists and Toolmakers | 186 |
| Draftsmen (both three- and four-year courses) | 115 |
| Patternmakers | 15 |
| Moulders | 12 |
| Total | 328 |

The organization is typical of efficient apprenticeship training. In charge of the department is a superintendent who has himself been apprentice trained with a long practical experience coupled with a good general education and a strong human interest in the boys under his charge. He has direct control of the shop training department, which is elaborately equipped with all varieties of standard machines and provided with a staff of five machinists-instructors, all apprentice trained. Here, ordinarily, the apprentice machinists and draftsmen spend at least one year of their training, learning to operate all types of machine-shop equipment on actual products and in bench and

floor work, with such supervision of transfer from machine to machine that they have an opportunity to handle all the standard machine tools.

In conjunction with this is the apprentice school with four instructors which machinists, pattern-makers, and draftsmen are required to attend three sessions a week during working hours, the sessions being from an hour to an hour and a half in length.

Applicants for entrance as machinists and pattern-makers must be between sixteen and eighteen years of age. They must have good habits, be of respectable parents and able to speak, read, and write English. It is also considered desirable that apprentices come directly from school, as it is found, to quote the superintendent, " that such boys have not lost habits of discipline, obedience, and study." For the four-year drafting course the requirements are identical to those stated above, while to enter, the three years' course graduation from high school is invariably required; and satisfactory samples of their high school work in mechanical drawing must be submitted. Not much, however, in the way of academic education is apparently expected of moulders, although they are given an examination in common fractions and they report for class instruction only one session a week. Only young men eighteen to twenty-one years of age and strong physically are accepted for this trade.

The course of study for machinists and pattern-makers, as outlined in the announcement, seems to be a rather formal review of school arithmetic with some algebra and geometry and a course of mechanical drawing, one plate of which is to be completed each month at home. Two class sessions a week are de-

voted to mathematics and mechanics and one to drafting. For home preparation a schedule of problems and drawing are assigned, which are expected to require about four hours a week of study.

The four-year drafting apprentices spend their first year in the Blue Print Tracing Departments and their second year doing mechanical work in the machine shop training department, the foundry, and in the pattern shop. The three-year apprentices in this field enter upon this work their first year. The two final years in each case are spent in the drafting departments with two weeks in the physical testing laboratory during the last year. Their classroom work is a substitution of algebra, plane geometry, solid geometry, trigonometry, descriptive geometry, mechanics, and strength of materials with laboratory work for the more elementary mathematics of the machinists' course.

**Rates of Pay.**—During the past two years remuneration has more than doubled, but apprentice training is stated to be a profitable enterprise to the company, which is, of course, as it should be. In 1917 the rate of pay for machinists ranged from 11 cents an hour for the first year to 18 cents during the fourth year. It now ranges from 20 cents to 36 cents per hour. A premium of two cents an hour is also paid for good records in class and shop. Finally a bonus of $100 is paid at the conclusion of apprenticeship. For draftsmen the same improvement in pay is to be noted, the rate now ranging from 20 cents an hour for the first year to 40 cents for the fourth year and similar regulations hold as to premiums and the final $100-bonus. High school graduates start with the second

year rate of 26½ cents. For moulders the pay is 21 cents an hour the first year, 26½ cents the second year, 30 cents the third year with minimum journeyman's rate (now 90 cents an hour) for the fourth year and a bonus of $50 is paid when the certificate is conferred. It should be noted in connection with all the trades already referred to, that indentures are in each case entered into between the company and the young man with his parents. At the satisfactory completion of the term of apprenticeship a certificate is conferred.

(2) **Engineer Training in the Testing Department.**—There are two distinct groups being trained in the testing department while carrying through its work. The first group is made up of high school graduates, the second, in the main of electrical engineering graduates but also those from the first group who successfully complete the work laid out for them.

In the first group there are at present 75 enrolled in what is called a " preliminary course," which to some extent approximates apprenticeship as electricians. Their course is normally two years and one-half in length; though one may materially reduce the time required to cover it, if he displays unusual ability. The practical work is a routine course laid out of measuring work during the first year with work as assistants in testing during the remainder of the course. Instruction in which a standard electrical textbook is followed is given once a week with monthly quizzes. The management of the department emphasize the fact that each one being trained is considered individually upon his own merits. It is evident that young men undergoing this training have large opportuni-

ties to learn by observation as well as by the book instruction and the practical work performed. The pay starts at 30 cents an hour or $17.60 a week with normal increases of 4 cents an hour every six months. At the end of this informal apprenticeship the young men pursuing this course are given an examination and, if they pass successfully, are admitted to the regular test course for engineering graduates. In this way 9 have graduated during each of the past two years.

In this test course open to the second group there were 377 student engineers during 1919 coming from the leading technical schools both in this country and abroad. Ordinarily the student spends a year at this work, thus corresponding to the year's internship of the medical school graduate. The student acquires a training through observation and the practice in the work which they perform, but also by the technical lectures and discussions constantly available through the club to which they are admitted by pursuing this course. The pay of these student engineers is at the rate of 50 cents an hour for a forty-nine hour week for the first six months and 55 cents for the second six months, which figures out at $24.50 and $27.50 per week for the respective periods.

From the standpoint of the company it serves two purposes. It provides a large corps from which the other departmental heads may select recruits for their respective departments and it familiarizes these student engineers with the products of this company so that they will be in a position to utilize them even though they enter the employ of other companies at the end of their year's experience. To what extent

and in what field the company absorbed these men may be gauged from this summary of transfers in 1919.

| | |
|---|---|
| Total number of men engaged for the year 1919 | 304 |
| Total number of men leaving the Testing Depot | 209 |
| Of these there were transferred to Commercial Department | 44 |
| Engineering Department | 48 |
| Construction Department | 6 |
| Factory Department | 7 |
| District Offices | 8 |
| Total remaining with the Company | 113 |
| Leaving to accept position with other companies | 77 |
| Miscellaneous (dropped, discharged, leaving on account of health, resigned, etc.) | 23 |

This shows that about 55 per cent accepted permanent employment with the company, which conforms to the condition shown by their record of recent years. Mention should also be made of the 73 engineering students who in the summer of their college junior year were employed in this department and who, added to the number mentioned above, give the total of 377 mentioned earlier.

(3) **Foreman Training.**—As an initial step in the comprehensive scheme of systematic training for all employees entering the plant or of "upgrading" for those being advanced to improved positions, there have this year been organized classes for foremen, meeting once a week for one and one-half hours and extending through fifteen to twenty weeks. Since the completion of the first group the plan is now being tried of having them meet daily, so that the series concludes in about five weeks' time. This plan seems to be more favorably received than the more protracted course, as it permits closer connecting of the daily

units with the others of the series. Upon this basis, the director is handling three groups simultaneously.

These classes are composed of General Foremen, Foremen, Assistant Foremen, and Sub Foremen and are limited to 12 in each group, so as to provide for free discussion. An average of 85 per cent in attendance was maintained, which is satisfactory when the difficulties of assembling the administrative force of a large plant are considered. The practice is to limit the attendance in each section to not more than two men from any one department, so that the discussion will be general rather than of special departmental problems.

The course seems to be a combination of what might be called labor psychology with an analysis of the duties of foremanship. The following topics are typical: Handling men through leadership, interest, and job pride; Carelessness, temporary and persistent; Safety; Health and hygiene; Production and managerial phases; Machines; Records and reports; Job analysis; Man analysis; Tying up man and job.

(4) **Instructor Training.**—The next step planned is to organize training classes for instructors in special training for the important types of semi-skilled and specialist employment. For this, intensive full-time courses several weeks in length are planned. They will consist of a careful analysis of all the operations involved in the employment and of the difficulties to be overcome in teaching them to the learner to the end that his time of inefficient production may be shortened as much as possible.

(5) **Intensive Training.**—Intensive training is now provided in several departments. It is not at present

the policy to provide a " vestibule school," that is of a training department distinct from that for regular production. Instead training is provided on the regular production floor and at the regular machines, either the foreman or an experienced workman providing the instruction. Thus, for example, armature winders were being trained to the skillful manipulation of their machine until the quality of uniform winding and a reasonable speed is attained. It will be systematized in these departments and extended to others when the Instructor Training described above has been carried out.

(6) **Americanization.**—The sixth phase of training and education in the industry is found in the field of teaching English and of civic training to alien employees. A department was organized for this purpose which early in the winter completed a survey as the initial step. Of the total employees, 6,200 were found to be foreign born. Of these 2,000 were illiterate in English and 700 in both English and their native language. Forty volunteer teachers were enlisted and classes arranged to meet twice a week for one hour at 4.30 P.M., just after the day shift, or at 7.30 P.M., just before the night shift. The places of meeting were throughout all sections of the works. A partitioned-off recitation room is not considered essential, a blackboard and seating benches which will collapse against the wall being the only equipment installed. This saves loss of time in going to recitation rooms not readily accessible and reduces the inconvenience to both instructors and students to the minimum and promises attendance of the same regularity as daily employment.

As the conclusion of this series of classes about 800 each are now coming up for their first and second papers. The department is offering them all assistance possible, providing them conveyance in going to the court, in going through the formalities and by conferences explaining away the difficulties which naturally come up. This part of the program is being carried through at the rate of about 60 men a week.

## No. 3

### General Electric Co., West Lynn, Mass.

The West Lynn plant of the General Electric Company has some unique features in its educational and training programs which recommend it for special consideration. These are embraced in the following departments: (1) an apprentice system, inaugurated in 1902 and now a well established branch of its organization with supplementary instruction provided in an apprentice school and an engineering school; (2) a co-operative training course for engineers; (3) a special training department to provide instruction for foremen and intensive training for beginners at the various specialties; and finally (4) schools for teaching English to its immigrant employees and to prepare for their naturalization.

(1) **The Apprentice Department.**—The outstanding distinctive feature of apprenticeship in this plant is the organic independence of the training department for apprentices from the regular production departments. It is obvious that this offers the advantage of permitting the superintendent of apprenticeship

to see that all varieties of experience are provided without interfering with regular production.

At present training is being provided for 327 apprentices embraced under the following trades:

| | |
|---|---|
| Machine, Tool, and Die Making (four years' course) | 193 |
| (three years' course) | 50 |
| Special students (two and one-half years' course) | 6 |
| Pattern making (four years' course) | 21 |
| Draftsmen and Designers (three years' course) | 22 |
| Electrical Testing (three years' course) | 35 |
| Total | 327 |

There is also a four-year schedule laid out for Brass Moulders and a three-year program for Iron and Steel Moulders, but apparently those who wish to enter upon apprenticeship consider the other courses more to their taste. There is also scheduled a course for technical clerks, but this is likewise without any candidates.

Entrance to the four-year courses requires, as usual the attainment of at least the sixteenth birthday and the completion of grammar school. For the three-year courses the completion of high school is a prerequisite, and the satisfactory passing of an examination in algebra, plane geometry and elementary mechanics. The first two months are considered a trial period, after which satisfactory students are allowed to sign the standard apprentice agreement, which specifies the usual conditions of apprenticeship.

For practical experience the machinists spend their entire four years in the training department, which is amply equipped with all the usual machine tools, the work being selected from regular production jobs.

Here also the draftsmen spend approximately a year and a half of their apprenticeship on machine tool operations, tool making and repairing of machinery, followed by a similar period of time in the drawing offices. The Electrical Tester apprentices likewise spend a year in these shops. Of the remainder of their course three months are spent in the winding department and six months in the drawing office while the rest of their apprenticeship is spent in assembling and testing electrical machinery. The engineering students who are in the plant on a co-operative basis, whose training is described more fully later, also put in part of their time in this shop.

**Apprentice School.**—In this plant larger provision is made for supplementary instruction than is customary in most plants, daily one-and-one-half-hour recitations being required. For the machinists the complete course includes arithmetic, algebra, plane geometry, trigonometry, elements of mechanics, power transmission, strength of materials, elementary electricity, chemistry of common metals, free-hand and mechanical drawing, machine and tool design, business English, and industrial history. For the pattern-makers, electricity is omitted and an extended course in mechanical drawing with special reference to patternmaking is provided.

**Engineering School.**—For the draftsmen and electrical testers, the supplementary instruction is given in what is called the Engineering School and consists of advanced algebra, plane geometry, descriptive and analytical geometry, mechanics and mechanisms, mechanics of materials, magnetism and electricity, machine and dynamo design, heat and heat engines,

elementary chemistry and metallurgy, mechanical drawing, and business English. A somewhat similar schedule of instruction is laid out for technical clerks but, as previously stated, there are at present none pursuing the course.

Mention should be made of the prominence apparently given to social and recreational activities in the way of athletic teams, picnics in the summer and apprentice clubs during the evenings.

Also one may remark the interest that is taken in the apprentices after graduation. At the back of the attractive announcement of this apprentice system a register of graduates with their present positions when known has been inserted. From this list of 489 graduates enumerated, to which should be added those unrecorded, making a total of 587, one can by their present positions to some extent gauge the quality of the instruction, and while there has been no attempt to check the accuracy of the records, it is believed there is ample justification for the opinion that the record compares favorably with that of any institution, public or private, seeking to train for the same type of employments.

By an analysis of this data it is found that 116, or less than one-fourth of the graduates, are still in the employ of the General Electric Company. This may be interpreted either as proof that the company did not place sufficient value on the services of those whom it had trained to hold them or, in view of the responsible positions which they now hold, that a service in the way of free education had been performed for the benefit of industry in general throughout the country. The latter is the more reasonable

interpretation, as it is quite evidently in the interest of the individuals concerned and of the public to have as many skilled artisans as our industrial utilization will warrant. Again, it is an unfair criticism of the company to point out that this training has been given under conditions extremely profitable to the company. If apprentice training is a profitable enterprise for a corporation, it is quite evidently the privilege of competitors to embark in the same business and competition for candidates would quite evidently force up the wages paid to the limit where apprentice training is no more profitable than regular production.

Based on the incomplete data available, the analysis of graduate registry revealed that positions are now held as follows:

| | | |
|---|---|---|
| Administrative | | 73 |
| Managers | 5 | |
| Assistant Managers | 4 | |
| Superintendents | 7 | |
| Assistant Superintendent | 1 | |
| Foremen | 31 | |
| Assistant Foremen | 25 | |
| Professional (Engineering) | | 141 |
| Engineers | 4 | |
| Electrical Engineers | 2 | |
| Construction Engineers | 3 | |
| Assistant Engineers | 6 | |
| Inventors | 2 | |
| Experimental Work | 1 | |
| Designers | 20 | |
| Tool Designers | 41 | |
| Chief Draftsmen | 3 | |
| Draftsmen | 32 | |
| Inspectors | 4 | |
| Associate Editor *Machinery* | 1 | |
| Electrical Testers | 22 | |

| | | |
|---|---|---|
| Educational | | 30 |
| Superintendents of Apprentices | 3 | |
| Director Manual Training | 1 | |
| Supervisor Manual Training | 1 | |
| Instructors Trade and Apprentice Schools | 25 | |
| Commercial | | 25 |
| Proprietors (Garage, Machine Co., etc.) | 5 | |
| Salesmen | 16 | |
| Technical Clerks | 3 | |
| Purchasing Clerks | 1 | |
| Manufacturing Trade | | 194 |
| Tool Makers | 110 | |
| Moulders | 25 | |
| Patternmakers | 40 | |
| Machinists | 11 | |
| Die Makers | 5 | |
| Die Sinkers | 2 | |
| Steam Fitters | 1 | |
| Miscellaneous | | 6 |
| Patrolman | 1 | |
| Unclassified | 2 | |
| University student | 1 | |
| Unknown | 2 | |
| Deceased | | 20 |
| Not Listed | | 98 |
| Total | | 587 |

This record seems particularly creditable when one considers the fact that the average period since completion of apprenticeship for all graduates is only approximately seven years.

Compensation is at present at the following rates: Machinists, Patternmakers, and Brass Moulder Apprentices

18¢ per hour for the first half year
20¢ per hour for the second half year
22¢ per hour for the second whole year
26¢ per hour for the third whole year
31¢ per hour for the fourth whole year

$100 is the bonus paid to the apprentice when he satisfactorily completes one of these courses.

For the draftsmen, electrical testers, and technical clerks the rate is as follows:

21¢ per hour for the first half year
24¢ per hour for the second half year
27¢ per hour for the third half year
30¢ per hour for the fourth half year
33¢ per hour for the third whole year

In this case the bonus is $75.

**Co-operative Arrangement for Engineering Students.**—So far there has been outlined apprenticeship of the two usual grades, that for grammar school graduates with entrance preferably at the age of 16 and for high school graduates with entrance at around 18. The General Electric Company has, however, this year inaugurated in co-operation with the Massachusetts Institute of Technology apprenticeship upon a still higher plane. For this, about 40 students who have completed the first two years of the course in electrical engineering at the school of technology are annually selected and divided into two groups, one working at the electric plant and the other studying at the school. Thirteen weeks constitute the term in the plant with regular working hours of the forty-eight hour week when working in the shops and of forty-four hours when in the offices. At the school the term is eleven weeks in length, there being four terms a year in both cases. The period of apprentice-

ship under this plan is three years leading to the master's degree in science.

The following features seem to particularly recommend the plan in comparison with similar co-operative plans of other engineering colleges securing practical experience for their students in industrial plants. The Technology professor who is in general charge of the students as representative of the Institute is associated with the superintendent of apprenticeship for the company in arranging the progress of the student from one operation or department to another so as to secure as varied experience as possible. Secondly, three afternoon sessions of the students are held each week at the works in which one session has this novel feature as training in English. A selected number of the students organize into a board of directors before whom selected students appear to present an engineering project for approval. This is intended to eradicate the deficiency found in many engineers of the lack of capacity to convincingly market their ideas. The remaining sessions are devoted to the study of those scientific principles which are directly connected with the correlated work of the shops. During these assignments lectures on the different phases of manufacturing methods are given by departmental managers and superintendents of the company. On this basis 29 lectures have been arranged in each case by the works specialists in the field concerned.

In the final year it is planned to allow considerable latitude to the students in the selection of their line of work, being either shop management in the works' office or research in the company's laboratories. Also,

at the conclusion of the prescribed work an optional additional term of thirteen weeks at the works is offered and graduates are under no compulsion to permanently enter the employ of the company.

Compensation is paid by the company to students in this course at an hourly rate, amounting approximately to $15 a week for the first two terms at the works, $17.50 for the next two terms and $20 a week for the last two terms. This makes a total payment of over $1,300 during the co-operation period. Students also share the regular conditions of bonuses and in case of overtime are paid at the rate of time and a half.

**Special Training.**—A special training department is at present in the process of development. It is the plan of the director to build from the top down. With that in view, he started with conferences of the superintendents, in order to create a common point of view and a favorable impression of the program contemplated. Ultimately he plans it to reach through all grades requiring special skill. Having reached the departmental heads, the director's assistant is at present conducting foremen's classes which meet daily during a period of three weeks. Enrollment which is wholly voluntary is open to all foremen. Each group is made up of 10 men consisting in each case of a cost man, production man, inspector, and stock man, while the other six are floor foremen from various buildings and jobs but in all cases of the same rank. The reason for the makeup of sections on this basis is obviously to eradicate the misunderstandings frequently to be found in plants with a highly functionalized organization. The analysis prepared by the

Federal Board of Vocational Education for foreman training is being used as the basis for the course with such modifications as the special conditions of the plant seem to warrant. The next step in this training will probably be the assembling of these same men by departments, in order to attack the problems confronting each department as distinct from the general problems of foremanship.

The training of specialties instructors is also in progress. This contemplates careful job analysis with training in instruction methods. Where this has been tried it is said learning time for the recruit has already been reduced in one operation from two months to two weeks with a better learning of the process at the end of that time.

**English and Naturalization Classes.**—There is, in addition to the departments of education already mentioned, a department of Americanization under the charge of a director who is forming classes in English as frequently as required. Enrollment is continued in these until a satisfactory facility to speak and read has been acquired by the non-English speaking employees. During the past winter 107 have completed the course. Naturalization classes are then open to those desiring them, in which 200 are at present enrolled. The course in this field consists of 20 lessons, which are planned to provide as broad training as is possible in the limited time in the field of civic training and to lead to the securing of naturalization papers upon their completion.

## No. 4

### Western Electric Company, Inc.

The Western Electric Company, organized in 1869, is the oldest manufacturer in the United States engaged continuously and exclusively in producing electrical apparatus. The Company does a world-wide business in the manufacture and installation of telephone exchange equipment, aerial and underground lead covered cable, interphones and mine telephones, train dispatching outfits, military telephones, radio telephones, printing telegraphs, and a complete line of other apparatus to meet the needs of telephone and telegraph users. In addition to apparatus of its own manufacture, the Company distributes a complete line of electrical supplies. Among them are pole line hardware and poles, central station, electric light and power specialities, street railway specialties, electric wiring devices, household electrical goods and power apparatus.

The Company's activities are divided into three main divisions—Engineering, Manufacturing, and Commercial. The principal manufacturing plant is located at Chicago, Illinois (Hawthorne Station), the Engineering Department in New York City, and the Installation and Distributing houses in different parts of the country. In this immense organization there has been developed an elaborate system to provide apprenticeship and special training in the many different kinds of work required in the production and distribution of electrical apparatus. It has been the policy of the Company, or rather its responsibility,

" to assist in developing the employee to the full extent of that employee's capacity. It matters not where the employee had to turn off in his previous work or education."

**Training of Office Boys.**—In the Manufacturing Plant, where there are more than 100 office boys, there is an instructor assigned to see that these boys fresh from school are started right in the Company's employ. The office boy comes to them " not as a necessary evil but as a potential executive." During the first two weeks he is taught the geography of the Plant. The Plant occupies approximately 210 acres of land, while in the buildings themselves there are over 75 acres of floor space. The new boy is usually accompanied by one of the older boys, who takes him on his route around the Plant. After familiarizing themselves with the geography of the Plant, they are instructed in matters of courtesy and deportment. At certain times during the week they are assembled together, when their supervisor talks to them about their duties and responsibilities. If the boy is ambitious and has a desire to enter the Production or Operating Departments, he may qualify by attending certain classes and doing assigned reading, until he is of sufficient age and maturity to enter these departments. He is also, at the age of 16, eligible to enter the apprenticeship courses.

**Training of Apprentices.**—While entrance to the apprenticeship course is not confined to office boys, it is, however, limited to those between the ages of 16 and 20 who have a good grammar school education, inclusive of a working knowledge of elementary mathematics. Naturally, preference is given in the appren-

ticeship course to those who have had part or full high-school training. Before being allowed to take up this training, each applicant, in addition to a personal interview, has to pass an examination to determine his fitness for the work. They then serve a three-months' probationary period to determine their aptitude and fitness, final acceptance depending on evidence of intelligence, good spirit, punctuality, and mechanical aptitude. Observation of the apprentices leads one to believe that these considerations have been rigidly adhered to in the choice of the boys in the course.

In the Hawthorne Plant an opening is provided for boys of high school training to learn either the "tool" or "instrument-maker's" trades. The tool designing course, which is a thorough going apprenticeship, extends through a period of three years of 2,400 hours each. Six hours of each week are spent in classroom work, which includes training in mathematics, drafting room standards, and the principles of tool design. The rest of the time is spent on practical work in the operation of tool-making machinery of all kinds.

In the Engineering Department, located in New York City, an apprenticeship course is offered only for "instrument" makers. The work in this plant which was investigated, shows an endeavor to provide the best possible facilities for apprenticeship training. The work has only been initiated this year, so that there are at present but 20 boys in the first year of their apprenticeship. They are under the direct supervision of an engineering graduate, who has served a regular apprenticeship previous to

his university course, and who has for some years been employed in the production department of the Company.

All training work in the apprenticeship course is conducted in the Model Shop of the Engineering Department under the careful guidance of the Supervisor. In addition, classroom and laboratory instruction is provided for a total of six hours per week throughout the course. This includes elementary training in drawing, elementary mathematics, applied mathematics, the properties of engineering materials, etc. These classes are conducted within regular working hours during the morning when the boys will receive the greatest benefit from the instruction. Only a very limited amount of outside study is required. The course extends through three and a half years of 2496 working hours. The working week is forty-eight hours, the same as that of the regular Production Department.

Before entering upon his apprenticeship course, an "indenture," or agreement, is entered into with his parents or guardian, which binds him to observe certain rules and perform certain services during his apprenticeship. The Company binds itself to "carefully and skillfully teach every branch of the trade or art of instrument making." Upon the satisfactory completion of the three and a half year course, a certificate is given. A unique feature of the agreement is that, in addition to the $100 usually given as a bonus upon graduation, it is agreed that upon the completion of the first year of work as a journeyman, another $100 is to be paid. The wages during this first year as a journeyman shall not be less than 80

per cent of usual journeyman's wages. This is, presumably, planned to encourage the apprentices to remain in the Company's employ after they have completed their training. It has been the experience of the Company that only a few of the apprentices leave the Company after having completed their training. In this agreement are also stipulated the rates of pay for each period of the apprenticeship, and other matters relating to the apprentice's relations with the Company. There is one clause in the agreement regarding the rates of pay which is worth noting. "Should the rates of pay to apprentices employed by the Company be increased subsequent to entering upon the contract, the pay of the apprentice in any contract would automatically be increased."

**Special Training for High School Graduates.**—For graduates of technical or commercial high schools the following four courses have been arranged at the Hawthorne Works and the New York Engineering Department:

1. *The Production Course.*—This course extends through a period of one year and covers the work in fourteen separate departments. The training includes the study of the equipment and supplying of shops with materials for manufacturing, the specification of apparatus and parts to be made, and the following of the productive work through the shops. This training is given on the job, and is supplemented by classroom discussions and lectures.

2. *The Accounting Course.*—This course is also one year in length, and is planned primarily to give the student a general knowledge of the Company's system of accounting as a whole, before specializing

in the records and cost accounting systems of the various departments.

3. *The Manufacturing Course.* This course consists of a year's training in the operating departments, where the student works on the different machines. This training is supplemented by trips to the other departments of the plant, in order to give them a knowledge of the entire organization. At the completion of this course, they are assigned to some branch of the Operating Division.

4. *Laboratory Assistants.*—In the Engineering Department in New York City there are two courses open for technical high school graduates, or employees with equivalent preparation, as laboratory assistants. These courses are three years in length, and provide training in communication engineering, in either research development or design. At the present time, there are 170 enrolled in these courses. During their training period in the research laboratories and designing drafting rooms, their work is carefully supervised to insure the widest variety of experience possible. These boys, coming fresh from school without any experience, are started at $15 per week. Readjustments of wages thereafter are considered individually, based on the record and ability of the student concerned. While the practical work in the laboratories already mentioned is of the utmost importance, it alone would not make future engineers of the caliber which the course is designed to produce. A veritable junior engineering college has been established, with instruction extending through ten months of the year, beginning in October and divided into four periods. Standard engineering text books are

used, and judging by the application and evident enthusiasm of the students enrolled, coupled with the ability of the staff of six full-time specialists, it is not too much to say that the instruction is equal in quality to regular university engineering instruction, and perhaps superior to most in this specialized field.

A summary of the course of study follows:

*First Year.*—Mathematics, as "a method of expression and interpreting the laws of natural phenomena," in which "Algebra, Geometry, and Trigonometry are developed as one subject." Two hours per week throughout the year.

Physics.—Mechanics, Sound, Heat, and Light. Two hours per week throughout the year.

Correlation Problems, as far as possible based on the work in the Laboratories.

Physics Laboratory.—One two-hour period per week.

Drafting.—Individual instruction based on the ability of the student. Projection and dimensioning of machine parts, both with instruments and free hand, the emphasis being on the principal conventions in telephone practice. One two-hour period per week.

*Second Year.*—Calculus. Two hours per week during the first and second terms.

Physics.—Electricity and Magnetism. Two hours per week during the first three terms.

Correlation Problems, illustrating the application of Calculus to the theory of electricity and magnetism.

Laboratory.—One two-hour period per week during the first three terms.

Materials.—The physical, electrical, and magnetic properties of materials used in telephone and telegraph systems. Three hours per week during the fourth term.

Elements of Communication Engineering.—Three hours per week during the fourth term.

*Third Year.*—(Laboratory Course) Communication Engineering.—Three hours per week during the entire year.

Economics.—Two hours per week during the first term.

Use of Library Facilities. (Utilizing the excellent technical library provided in the plant).—One hour per week during the first term.

Engineering English.—Two hours per week during the second term.

Business Law.—One hour per week during the second term.

Business Organization and Accountancy.—Two hours per week during the third term.

Civics.—" Studied so that each student may realize that every engineer is a citizen and has his part to play in the municipal, state, and national governments." One hour per week during the third term.

*Third Year* (Drafting and Design Course) Design.—Present telephone and telegraph equipment and more thoroughly the properties of materials. Elements of Mechanism, supplemented with a historical treatment of the development of manufacturing processes and the influence of quantity production on physical design. This replaces Communication Engineering outlined above, but otherwise the courses are identical.

**Training Telephone Installers.**—Another interesting feature of the educational program of this Company is their excellent example of intensive training of recruits for the installation of telephone apparatus and equipment. As the Company is unable to secure competent men to install its equipment, it has been found necessary to plan an intensive training program to meet this need. As its service is nation-wide these training schools are located in the larger cities central to the districts served. There applicants are interviewed and physical examinations arranged for, and, if hired, a two-weeks' intensive training course is provided. The first training school of this kind was established in June, 1916, in New York City, and it proved so successful that similar schools were later established in Philadelphia, Pittsburgh, Cleveland, Chicago and St. Louis. The twelve days' training consists of the simplest and most common operations, such as sewing cables to cable racks, stripping, butting, waxing, forming cable ends and the connecting of cable ends to terminal blocks. At the end of the two weeks' training, the finished product of each student is required to pass inspection before the student is transferred to the field on a permanent job. They are paid while being trained. In the first fourteen months of its existence, the schools accepted for training 3,351 new men. Of this number 2,505, or 74 per cent, graduated and were distributed to the various points for employment. More recently, there has been established a supplementary course which offers an excellent example of upgrading of employees in specialized fields. It also is two weeks in length and provides elementary instruction in telephone

theory and circuit practice. This course is given to selected employees in the Installation Department who have been in the Company's employ one year or more. The idea is to broaden the installers' knowledge of the general action of electrical current as applied in modern telephone central offices, as well as to select supervisors and instructors for new employees.

**Training Machine Operators.**—There is also an intensive training course provided for machine operators in the Operating Branch of the Manufacturing Department. Assisting each foreman, there is a skilled worker who is assigned as an instructor. He takes the new worker and trains him in the operation of his machine until he has become capable of earning a minimum piece-rate wage. The instructor is personally responsible that the operator secures this wage within a certain specified time. Supplementing this training " on the job," there are lectures and demonstrations provided, where the worker is given a broader knowledge of the Company's business and its products. This training enables the worker to become a piece-rate worker much quicker than he could under the old system.

**Training of College Men.**—It has been the Company's policy, ever since it started, to take into its organization each year a number of graduates from representative universities. A large per cent of the present-day executives came into the organization fresh from college. The course of instruction usually covers about one year. During this period, the student follows a training schedule which has been laid out with considerable thought. It aims to give the

student a combination of experience in the different departments, so that when he completes his training it will be possible to assign him to some job in the organization. There are four courses open to college men, namely, the Manufacturing Course, the Engineering Course, the Commercial Course, and the International Western Electric Course. The amount of time that will be required for training depends largely upon the previous experience of the applicant and the type of work for which he is to be fitted. Before taking up the regular training schedule, the student is taken on inspection trips throughout the plant, followed later by assigned reading courses describing the activities of the Company. The Manufacturing schedule is primarily planned to provide technical men and supervisors for the different branches of that department. The Engineering schedule trains men as technical experts. The Commercial schedule is modified somewhat from the Engineering and Manufacturing in that the first six months the student works in some Distributing House, familiarizing himself with the Company's business. Later he is sent to the Manufacturing Plant and different suppliers for another three months. After he completes this training, he is then assigned to a definite job in the Distributing House from which he came. The International Western Electric Company provides a training schedule for men to qualify as representatives in foreign countries. This schedule calls for definite training in the Manufacturing, Distributing, and Commercial Departments. It also provides training for technical graduates from foreign countries who come here for special training. At the present time they

have students from China, Japan, San Salvador, Philippines, France, and England. These students return to their respective countries after completing their training.

**Voluntary Evening Classes.**—Extension evening instruction has been highly developed and encouraged by the Company in all of its departments. The Education Department states that it is not their intention to duplicate the evening class instruction given by the public school system or by philanthropic organizations. The policy of the Company is simply to bring to the assistance of ambitious employees the opportunity of educational guidance by the highly trained corps of engineers and other specialists employed in the fields that are covered only by this Company's activities. The Company's evening classes are usually held at a time directly after working hours most convenient to those concerned. In the Hawthorne Plant they have been conducting evening schools for a long time with considerable success. The classes are held under the auspices of the Hawthorne Club, an organization formed from the employees of the Company. The first classes were organized in 1913 and have increased both in attendance and popularity ever since. The instruction is given by employees selected from the different departments. Upon the satisfactory completion of given courses, certificates are issued. During the first five years, 1,060 certificates were issued for completed courses, of which 207 covered work in more than one course. The enrollment during the past year has been well over 1,000.

During 1918–1919 the following courses were provided:

I. Electricity and Magnetism, with the course divided into two grades of two terms each.
II. Telephone Practice, consisting of three grades of two terms each.
III. Practical Mathematics, with seven grades of instruction.
IV. Manufacturing Principles, with a one year's course of lectures illustrated by stereopticon slides.
V. Mechanical Drawing, with seven grades of instruction.
VI. English, with two regular grade courses and a special course designed especially for stenographers and typists in the typewriting course.
VII. Typewriting, with a year's course.
VIII. Sewing, also with a year's course.
IX. Production Principles, intended to present the commercial features of manufacturing similar to the technical features in Course IV. This is a one year's course.

A study of this program shows how closely the work in the evening school fits into the everyday job of the employee.

The Company has also closely co-operated with outside educational agencies, and encourages enrollment wherever the employee may find instruction best fitted to his needs. Records are kept of the progress that is made in the evening schools, and given consideration at the time of the employee's advancement.

In the Engineering Department in New York City, there have this year been provided twelve courses. These classes are held after business hours, between 5 and 8 P.M. There are two terms of twelve weeks each. The only cost to the student is that of the required text books and writing material. The instructors are largely selected from the staff of the Engineering Department and serve without extra compensation. The endeavor is said to be to make the quality of instruction in every respect equal to that of a university engineering faculty.

The following courses were scheduled:

I. Circuit Applications of Electricity and Magnetism.
II. Telephone Equipment and Systems.
III. Telephone Instruments.
IV. Telephone Transmission.
V. Elements of Alternating Current Theory.
VI. Theory of Electricity.
VII. Differential Equations.
VIII. Design.
IX. Shop Mathematics.
X. Mechanical Drawing.
XI. Engineering Accountancy Methods.
XII. Shop Reading Course.

It is believed that the mere statement of the title of the courses, as above, will show that opportunity is being offered for improvement to all classes of employees, from the university trained man down to the office boy. It is also apparent that such courses, conducted by engineers of the Company, can be more closely related to the daily activities of the students than similar courses conducted by outside institutions. That such was the case is to be inferred from the fact that there was a registration of 507 out of approximately 3,000 employees. The Company can also exert a reasonable restriction as to enrollment to those qualified and likely to benefit most, as compared to public evening schools, which ordinarily accept all applicants indiscriminately.

In the general or accounting departments in New York City, voluntary evening classes are also being conducted. The courses include:

*a*. Advanced Accounting Methods.
*b*. Elementary Accounting Practices.
*c*. Commercial Practices and Procedure.
*d*. Commercial English.
*e*. Electrical Supplies.
*f*. Spanish.

These courses are planned to supplement the work of the employees upon their everyday job, and to give them a broader knowledge of the Company's business as a whole. Likewise, similar classes and discussion groups are held in some of the Distributing Houses located in different sections of the country. These discussions are usually combined with some social function and have proven of considerable interest to employees. Many times they are supplemented by moving pictures describing the Manufacturing and Distributing organizations.

**The Administration of the Educational Activities.**—To adequately administer these varied educational activities requires a large staff. In each general department there are people definitely assigned for this particular work. In the Manufacturing Department, the Works Training Division has charge of the training of college graduates, apprentices, and high school graduates pursuing special training courses.

The Production, Operating, Technical, and Installation Branches each have specialists in training, who supervise the work in their respective departments. In the Engineering Department the training work is under the supervision of the Personnel Manager, who is responsible for both the recruiting and training of the technical workers in the Laboratories. In the Commercial organization and International Western Electric Company there is also a staff of specialists who look after the educational work in the Distributing Houses and General Departments.

To formulate the basic educational policy for the Company as a whole there is a central Committee composed of representatives from the different De-

partments. The membership of this Committee is appointed by the First Vice-President of the Company to whom the Committee chairman is directly responsible. This Committee also acts as a " clearing house " for newer ideas along training lines, and other questions affecting the personnel of the organization.

## CHAPTER II

## PROGRAMS IN THE RUBBER AND AUTOMOBILE INDUSTRIES

Both the rubber and automobile industries have, in general, adopted systems of standardized production. This system makes practicable the development of large plants and, if a popular product is produced, encourages a tremendous expansion of the manufacturing company. These phenomena have been particularly marked in the companies under consideration.

Training and education programs are most frequently found and most developed in rapidly growing companies. One reason is apparent. There is a constant demand for additions to the supervisory force, for more skilled workers, as well as for competent skill at the specialties found in the plants. All this urges various types of training.

It should also be remarked that the plants here considered have enjoyed unusual prosperity. It is doubtful if a company barely existing could be prevailed upon to introduce an expensive system of training. Educational work by a company is usually defended in directors' meetings, much as is turning profits back into the business. The practice is expected to show increased income during the following

and succeeding years by improved personnel and, certainly, the system can only be defended on that ground to the company's owners.

It is not believed that the programs here reproduced are altogether typical. It is probable that not even the most prosperous and most rapidly expanding corporations will in general feel warranted in establishing great educational institutions for their employees. It should, however, be noted that all instruction provided by these corporations, such as apprentice training and other educational provisions, are intended to have direct effect on the efficiency of the employees and in some measure the present prosperity of the respective companies is, no doubt, due to the good will existing between workmen and management which has to some extent been fostered by these educational provisions.

## No. 5

### Goodyear Tire and Rubber Company, Akron, Ohio

In an address before the foremen of the company on November 1, 1919, the Factory Manager made this statement:

"The big development of the last fifty years in industry has been the development of machines. Today, as a result, we think too much of machines and too little of men. The day has come when machinery is almost universal. Today it is not the industry which has the best machinery that wins. It is the industry which has the best men and trains its men best to run these machines efficiently, which wins. The keynote of success is men, not machines."

The whole policy of this company seems to be epitomized in that paragraph. To achieve the object of getting the *best men*, all the activities of the Labor Division should be considered: employment, recreation, service, safety and health, mutual relief and insurance, and industrial representation. We are here concerned, however, only with the Educational Work as the method of direct action toward obtaining the personnel desired.

How extensive is the educational work may be appreciated from the fact that, among a working force of 34,000, there are 6,100 taking some form of instruction, and that a staff of 112 full time instructors is required. From another angle the extent of the work may be gauged when it is stated that the annual budget for the coming year of the Educational Department, including physical education and recreation, is three quarters of a million dollars.

The management looks on the utilization in this manner of such a large sum as an investment fully justified if, after the training one-third of the graduates remain with the company. As a matter of fact their records show that two-thirds of those who have completed regular three-year courses continue in their employ and there are now nearly 2,000 graduates in the plant.

The Service Division is housed in the magnificent six-story building known as Goodyear Hall. Here three floors, each with an area of 170 feet by 400 feet are given over to the Industrial University, which is the designation given to all supplementary educational work in the plant. Altogether 45 large class rooms are provided. These include 3 well equipped

laboratories for physics, chemistry, and rubber products respectively.

Educational provisions may be conveniently considered under these five headings: (1) " The Flying Squadron "; (2) Apprenticeship; (3) Foreman Instruction; (4) Commercial School; and (5) Sales School. There is also, in various departments, a corps of labor training instructors with their own foremen, a system which is being extended throughout the plant.

**The Flying Squadron.**—In the company's house organ, " The Wingfoot Clan," on April 15, 1913, appeared the following editorial:

"It is the tendency of the times for most factories to develop among the workmen specialists who are skilled in a single operation. This sometimes throws the factory out of balance, because there are too few on another operation which is dependent on the first, with no skilled hands available to balance the production. With a view to overcoming this condition to some extent, we have instituted in The Goodyear Tire and Rubber Company, beginning April 15th, a body of fifty men which will be known as the 'Flying Squadron.' These men will be selected from among the best workmen now on the various operations in the factory and they will be trained not on one particular operation, but on all the principal operations in the factory, becoming general experienced rubber men. Whenever any one department is in need of men to balance up the production, as many of the Flying Squadron as are necessary will be put on the work needed, to keep the production uniform. At other times, these men will be changed from one operation to another, making piece-work prices on the operations on which they work, with a minimum guaranteed day work rate. These men will be trained to become proficient in all the different operations in the factory, and when they have accomplished this, will be given a certificate as "Master Rubber Worker." The Flying Squadron will have preference on steady work in the factory. This is an opportunity for a broad education in the different opera-

tions in a rubber factory, and those who demonstrate their ability will be in line for higher positions."

It is thus seen that this plan for all around training in rubber manufacture has been in operation more than seven years, giving abundant opportunity to test its value. That the number thus employed has increased from 50 to 1,200, suggests that the plan seems sound practice to the management.

The routine details of handling the scheme seem simple. For the first three to six months after a squadron is formed, the men are used exclusively for balancing production. In other words, they are put wherever they happen to be needed most, with the only care that they do not stay too long in any one department. For the rest of the year some attention is given to insuring that they complete the corcuit of all the important operations in the business, in order that full utilization may be made of their varied experience during the remaining two years of the course.

Throughout the three years' course class instruction is always provided for two hours a week. As some 10 per cent are college men and others never finished the grades, naturally, this has to be varied somewhat to correspond to the student's capacity.

It is, however, of the same general nature for all. During the first year the principal instruction is in letter and report writing and in public speaking under what is called personal salesmanship. For those who have not had enough of it, mathematics is also provided. The second year's class work is found mostly in the chemistry and economics of rubber and industrial management. For the third year the company's

organization and management, extending to general corporation administration, labor management, costs and statistics, with additional chemistry and public speaking, rounds out the course.

It is stated that 98 per cent of those who have completed the course have been promoted one way or another, frequently to executive positions. It is probable that this is the most useful function of the scheme and really justifies considering the plan as education rather than merely a clever scheme of managerial ingenuity for increasing production.

Other claims made for the plan by the factory manager are:

(1) " It has produced a group of workmen who, to an extraordinary degree, *work with a spirit and breadth of vision,* and their attitude of enthusiasm and co-operation has toned up the whole factory organization."

(2) *It fosters contentment* by stopping unfair agitation. A squadron man's word counts against the rumors that may circulate through the plant, since he has first hand information on the company's business and policy.

(3) *Examples are set the other men.*—The squadron men are picked for their industry as well as other good qualities, and working as they do at the same machines and at the same scale of wages as the ordinary operatives of the department, they are a very wholesome force in building up the organization morale.

(4) *It checks bad practices.*—At the weekly meeting of a squadron, members are encouraged to bring up whatever they have observed which can be improved.

As they actually perform the work rather than merely supervise, they frequently can report what inspectors and foremen often overlook. Also they have the advantage of being able to compare practice in every department, so that often by this means a clever innovation in one department is more quickly transferred to all departments.

(5) *They aid in handling new production problems.*—During the late war the squadron men, by their adaptability, were particularly useful in quickly adjusting from customary production to balloons, gas masks, and other war supplies. It is evident that in the same way they will be useful in adjusting to new peace time products or in furnishing the nuclei for a new factory to be installed in a foreign country or different city.

There are now around 1,200 men in about 50 squadrons showing that in size they average between 20 and 30 men to a squadron. This would be nearly 4 per cent of the working force of 34,000 employees. It is stated to be a company policy to increase their number until they form 10 per cent of the total employed.

Also there should be mentioned the 350 men in Engineering Squadrons which are made up of technical college graduates who are provided experience upon similar principles. Their period of training is also three years in length and when graduated they are expected to recruit the engineering staffs of the planning, production, and sales departments.

One interested in the revival of apprenticeship will probably be struck by the similarity of the flying squadron scheme to certain types of apprentice training, especially that for machinists being developed

for maintenance or production work. As a matter of fact, the outstanding difference seems to be that of age, for these candidates for the " degree " of Master Rubber Worker are invariably grown men although still young, while the almost universal practice is to require that apprentices should still be in their teens. The reason for this difference is, of course, that it is inadvisable to employ minors at many of the operations which squadron men are expected to perform in the manufacture of rubber products. This age distinction is recognized in the selection of apprentices for the mechanical department, which we shall now consider.

**Apprentice Training.**—The soundness of a policy of training minors through a definite period for certain types of skilled mechanical employment or, in other words, apprenticeship, has likewise been recognized by this company.

At present we find the following enrollment of apprentices in the plant:

| | | |
|---|---|---|
| Machinists | 54 | |
| Electricians | 14 | |
| Plumbers | 17 | |
| Carpenters | 9 | |
| Draftsmen | 11 | |
| Total | | 105 |

The ordinary period of apprenticeship, as arranged by this company, is three years and the usual requirements are made that the applicant shall have completed the eighth grade and be between 16 and 18 in age.

The excellent practice of apprentice shops separate from those for regular production is observed. Also, the recognition that thoroughgoing training for the

skilled trades requires strong technical and general educational preparation, is met by giving two hours to school from each eight-hour day, leaving six hours for productive work. There are also two hours a week provided for gymnasium recreation. Furthermore, the company has recognized that the selected individuals desirable in this field should be attracted by a superior wage, and $6 a day has been established as the uniform rate of pay during apprenticeship.

As it is recognized that there will be an outlet for many of their machinist apprentices in machine design, the instructor in mathematics does not stop with the limited arithmetic and trigonometry required in ordinary machine shop practice, but extends the instruction through the whole gamut of computation to calculus. The educational course in addition to this thorough mathematical course embraces mechanical drawing, machine design, and shop notes.

**The Industrial University.**—It is evident that a considerable teaching force is required for the two hours of weekly instruction for the 40 flying squadrons, the 350 technical men in the engineering squadrons, and the ten hours per week of instruction for the 105 apprentices. But aside from these over 4,400 others are receiving instruction of various kinds. This may be special classes in Factory Practice and Management or other educational work for foremen and inspectors. It may be one of the four months' office work training courses for recruits to the offices. It may be special provision of instruction by the screen for the 750 deaf mutes who are a distinguishing feature of the personnel of the plant and upon whom, of course, vocal instruction would be wasted.

Such subjects as Business Arithmetic, Business English, Organization and Management, Economics, Modern Business Methods, Business Law and Corporation Finance, Public Speaking, Mechanical Drawing, Mechanics, Shop Mathematics, Electricity, Rubber Manufacturing Practice, Spanish and Portuguese are taught.

It will be noted that each subject has a practical bearing on the work of the company and in every case it is so intended. There is a very decided effort to prevent multiplying courses merely to satisfy the whims of various applicants. On the other hand, it is expected that each course taken will ultimately, if not immediately, aid in the advancement of the one enrolling, although there is, of course, no guarantee of that result. Thus, French was not offered until it was foreseen that a subsidiary plant would in the near future be erected in France, and it was advisable for some employees to equip themselves for a promotion by transfer to the new enterprise.

Classes are so planned as to be most convenient in adjustment to the eight hour shifts in which the men work. Thus, whether a man works on the day, evening, or midnight to early morning tour, he can enter a class which does not interfere with his work.

Not the least important element of the work of the Industrial University is that among alien workers. Careful records are kept of the number in this category, and at present 96 per cent of all employees are American citizens. Out of the remaining 1,200 odd foreign employees of the company, 300 received instruction in English and assistance in naturalization. It will be seen that this is about one-fourth of the

number possible, which is a very creditable showing, since it should be recognized that only the younger men will greatly benefit. The effort is made to make the instruction thorough, including reading, writing, and speaking in order that they may come to think in our language.

No. 6

FORD MOTOR CO., DETROIT, MICH.

The Ford Motor Company has four well developed schools worthy of study by those who would introduce training into industry, and are this year inaugurating a fifth. They are: (1) an Apprentice School; (2) a Trade School for Boys; (3) a Technical Institute; (4) a Service School, and (5) the English School for Foreigners.

(1) **The Apprentice School.**—Among the 55,000 men employed in their Detroit plant the company is utilizing at present about 3,500 tool and diemakers and 1,200 machine repairmen. To recruit this force organized apprenticeship was instituted three years ago, and there are now 700 apprentices to the toolmakers' and diemakers' trades and 300 machinists' apprentices for the maintenance work. It is thus seen that a ratio of one apprentice to five journeymen is being maintained in the first group and one to four in the second group.

The wisdom of the differentiation between the training of toolmakers and maintenance machinists is apparent to those familiar with machine production. Certainly, a good toolmaker should do satisfactory repair work, but in his experience the highest refine-

ment of precision in measurement is constantly demanded, while the repairman needs an extremely varied experience in locating machine troubles and in quickly building duplicates for the broken parts. Both are, of course, all around machinists, but the toolmaker reduces the refinement in measurement to an art which is unnecessary in the repair department.

Apprenticeship is organized in each tool department under a general foreman for apprentices who oversees the placement of apprentices at all types of machines, so that an all around experience will be gained.

Entrance requirements are the completion of the eighth grade and the stipulation that the applicant must have been employed by the company at least six months, which offers an opportunity to observe the working qualities of the applicant. Of course, this is ordinarily at regular production on a single machine and many are weeded out as unsteady or otherwise lacking in the mental and moral traits desirable in what are to be considered as selected workmen. Also, some find in these easily learned machine operations work more to their liking than the skilled trades and are unwilling to leave it for the training course. However, there were said to be several hundred constantly on the waiting list.

To supplement the varied experience already mentioned, which is, of course, the main source of training, two class periods of one and one-half hours each per week are provided, one in drawing and sketching and the other in shop arithmetic and mechanics. These classes come directly after work, if the men are on the day shift; or directly before work, if they are employed at night.

For this instruction a unique series of lesson sheets have been developed in which the problems have invariably been drawn from actual machines. In each case a sketch is shown of the mechanism to be studied. The problem is thus associated with its application when a solution has been deduced. The course was first prepared on mimeographed sheets and after a practical try out, has been printed in a small book. Of course, there are now many excellent shop texts on the market. This course may or may not be superior for instructional purposes, but certainly should be considered for the variety of concrete problems provided.

The pay of these apprentices starts at $6 a day for the first year, and increases 40 cents a day each year until a final rate of $7.20 is reached for the fourth year. It should, however, be stated that while the course is laid out for four years, it may be completed by those with unusual capacity and application in three years, when regular journeymen's pay is granted.

(2) **The Trade School.**—The trade school provided by this company offers a highly interesting example of the possibilities of the vocational industrial school closely linked to an industry. The plan is briefly this: A large training shop has been fitted up with all the standard machine tools sufficient for 200 to be employed at the same time, and a schoolhouse contiguous to the plant, amply supplied with classrooms and now equipped with science laboratories, is utilized for school instruction on the basis of one week in school to two in the shop. Boys aged 12 to 18 are accepted on the basis of financial need rather than scholarly attainment. There are now 300 in attendance and

80 per cent were said to have come from homes where their earnings were necessary for the family's support, due to the death of either father or mother and in some cases of both. There is also a small number who have been turned over to the school by the local correctional officers as there receiving instruction and discipline more likely to encourage them to become good and useful citizens than in the regular public schools. And in most cases the plan seems to be successful.

Owing to the co-operation of the plant's management, an ample supply of standard production jobs is secured, so that the boys start at an hourly wage of 19 cents an hour for a forty-eight hour week with pay for the fourteen weeks in school, all holidays, and a three weeks' vacation during the summer.

Nineteen cents is, however, only the starting rate. Each month the boy is graded on his attitude toward his work,—his conduct, interest in his work, regularity, and quality of his school work; *not* upon the quantity of his production. A is *excellent*, B is *good*, C, *fair*, and D, *poor*. Each month a report is made on a boy's shop and school work, and if his rating is B or better, his pay is increased one cent per hour for the following month; if C, it remains unchanged; and if D, it is reduced one cent. On this basis a boy may in his last year be earning as much as 45 to 50 cents an hour.

In addition to encourage thrift each boy is paid $2 a month which he is expected personally to deposit in a savings account and allow to accumulate until he is 18 and graduates. The only control exercised is that if he fails to make these deposits without previous approval this special payment forthwith ceases.

The school is amply supplied with an instructing staff, having 12 shop instructors, 6 school instructors and 2 for personal supervision.

In spite of these generous provisions of pay to the boys and for their instruction, the school is a little more than self maintaining, as may be seen from the balance sheet, taking the month of May, 1920, as an example.

| | |
|---|---|
| Gross revenues | $22,659.25 |
| Less expenses | 14,363.17 |
| Balance | $8,296.08 |

When one considers the upkeep and depreciation of the half-million-dollar plant involved, this is, of course, but a reasonable balance. It should be compared with the maintenance cost of every other vocational school throughout the country, none of which pay their students one cent of wages.

Considering the school wholly from the standpoint of its educational possibilities for the boys concerned, we may agree that the students are getting a better opportunity than would otherwise be open to them. On the academic side their education is continued much as it would be in the public school until the eighth grade is completed. After that, the subject-matter is " drawing, mathematics, physics or mechanics, a little metallurgy and chemistry such as mechanics and good toolmakers should know." One should recognize that this education is continued up to the boy's eighteenth year, whereas, probably, without the school, it would be terminated just as soon as working papers could be secured.

It is also worth noting that this year the course is being extended by the introduction of what may be called the social-civic studies, i.e., economics and civics, and thus beyond the elementary school prepares for citizenship as well as for strictly vocational ends.

As far as the toolmaker's trade can be learned before the eighteenth birthday, an opportunity would here seem to be provided and the instruction may be completed by transferring to apprenticeship on reaching eighteen, when full credit will be given for so much as has been completed.

It is believed, however, that economic stress rather than educational considerations justifies the admission of boys under fourteen. There are no apparent disastrous effects on the boys' health. In fact, it is probable that, owing to the work provided, many of the boys are better nourished than they would otherwise be. Also, their physical well-being seems to be considered in instituting a free hot lunch each day and in the generous provision of a playground with ample opportunity for its use under instruction, as one hour a day is set aside for this purpose, leaving forty-two for instruction during the study week.

(3) **The Technical Institute.**—The Ford Company is also inaugurating a plan for training at least a part of their own engineers. This is to be through the opening this fall of the Ford Technical Institute, " an institution of university rank which will grant degrees in Mechanical, Electrical, and Chemical Engineering. Complete courses will be offered in the academic departments and the laboratories at the disposal of the students will include the Highland Park Plant, the Tractor Plant at Dearborn, the great Blast Furnace

at the River Rouge, a railroad, a mine, a lumber camp, and many subsidiary operations. These cover every phase of engineering, not by a meager equipment for demonstration and experimental purposes but by millions of dollars' worth of machinery and apparatus, all the last word in scientific development.

"The whole expense will be borne by the Ford Motor Company, no fees of any kind being charged students."

Comment must of course be reserved until the institution has proved its worth by actual operation, but the success of other companies in thus recruiting their junior technical force leads one to indorse the enterprise as worthy of hearty encouragement.

(4) **Service School.**—The third type of instruction is in the Service or Repair School, which auto mechanics from all parts of the country may enter. The course is five weeks in length and 120 men are constantly in attendance. This would thus provide instruction for 1,200 men during the year, if we assume that there are 10 separate terms during the year.

For this period $6 a day is paid the students by the Ford Company, but traveling and other expenses must be borne by the student, unless the student's employer sees fit to meet these expenses.

The instruction consists of a complete repair course on the Ford products; car, tractor, etc., and one lecture a day followed by thirty to forty-five minutes of discussion. These lectures seem to have been very carefully worked up to cover all parts of the mechanisms concerned and are, of course, primarily confined to the Ford machines. As mimeographed outlines

are furnished, they provide for further review when the student returns to the garage where he has been employed.

(5) **English Classes for Foreigners.**—The Ford Company have been pioneers in the teaching of English to their alien employees. Altogether, 16,000 were stated to have graduated from their classes in the six years in which instruction has been given. The enrollment is now about 700 a year. Also, there is a class called the American Club with about 100 enrollment in which the instruction is primarily directed toward preparing for citizenship and the promotion of American ideals.

## No. 7

### Packard Motor Car Co., Detroit, Mich.

The most significant educational work of the Packard Company is their apprentice training, in which 122 young men are enrolled. There are, however, in addition some excellent advanced training courses for technical graduates in which 21 men are enrolled, and in the Truck Department there is a three weeks' Salesman's School through which about 20 are continually passing.

**Apprentice Training.**—All of the 122 apprentices are in the machinists' trade except 7 patternmakers and 6 electricians. All, however, take the same supplementary course of about four and one-half hours per week of mathematics and mechanical drawing. All students are also required to attend the city night

school, when it is in session. The course is three years in length and during the third year the best students are selected for transfer to the toolmaker's shop and for tool designing. The number, of course, depends on the demands of those departments. The trial period is two weeks only in length.

The apprentices are in charge of a supervisor who is a technical graduate with extended shop experience. He has authority to arrange transfers of apprentices about the shops for variety of experience at all types of machines. He is assisted in the school instruction by a technical graduate for the drafting classes.

In the indenture which all apprentices must sign with their parents, the apprentices are required to deposit $25 as guarantee of good faith, to complete the apprentice course. This is returned at the expiration of the apprenticeship together with a $100 bonus. The rates of pay for the six six-months' periods are respectively: 30, 34, 38, 42, 46, and 50 cents per hour. "Graduates of the Detroit High Schools, well recommended by the Principal, may have their term of apprenticeship shortened at the discretion of the company."

**Technical Graduates' Courses.**—Some 21 technical college graduates are being transferred about the plant in a two-year course designed to give them the requisite experience for ultimate positions as executives or as engineers. Their pay starts at 40 cents an hour for the fifty-hour week which they work, the same as the regular production force.

The outline of their training programs follows. There are now 15 in the course for executives and 5 are in the mechanical engineer's course.

OUTLINE OF ADVANCED TRAINING COURSE FOR EXECUTIVES

| Weeks | | Class of Work |
|---|---|---|
| 21 | | Machine Shop Practice |
| | 4 | (*a*) Preliminary Instructions |
| | 3 | (*b*) Drill Press |
| | 4 | (*c*) Milling Machine |
| | 6 | (*d*) Lathe |
| | 4 | (*e*) Gear Cutting and Grinding |
| 4 | | Forge |
| | 1 | (*a*) Stamping |
| | 1 | (*b*) Drop Forge |
| | 2 | (*c*) Tools and Dies |
| 4 | | Foundry |
| | 1 | (*a*) Wood Pattern Making |
| | 1 | (*b*) Metal Pattern Making |
| | 2 | (*c*) Moulding |
| 4 | | Inspection |
| | 1 | (*a*) Rough and Finished |
| | 1 | (*b*) Gauges and Tools |
| | 2 | (*c*) Mat. Test and Chem. Lab. |
| 3 | | Hardening and Tempering |
| 6 | | Assembling |
| | 3 | (*a*) Rear Axle and Transmission |
| | 3 | (*b*) Clutch and Motor |
| 4 | | Testing Motor and Dynamometer |
| 4 | | Employment |
| 4 | | Factory Routine |
| 6 | | Purchasing |
| 8 | | Production |
| 6 | | Stock Methods |
| 8 | | Engineering |
| 8 | | Time Study |
| 4 | | Industrial Organization and Shop Management |
| 10 | | Electives |
| 104 | | |

NOTE.—Applicant must be a college graduate or equivalent.

OUTLINE OF ADVANCED TRAINING COURSE FOR MECHANICAL MEN

| Weeks | | Class of Work |
|---|---|---|
| 21 | | Machine Shop Practice |
| | 4 | (*a*) Preliminary Instructions |
| | 3 | (*b*) Drill Press |
| | 4 | (*c*) Milling Machine |
| | 6 | (*d*) Lathe |
| | 4 | (*e*) Gear Cutting and Grinding |
| 4 | | Forge |
| | 1 | (*a*) Stamping |
| | 1 | (*b*) Drop Forge |
| | 2 | (*c*) Tools and Dies |
| 4 | | Foundry |
| | 1 | (*a*) Wood and Metal Pattern |
| | 3 | (*b*) Moulding |
| 6 | | Inspection |
| | 3 | (*a*) Rough and Finished |
| | 3 | (*b*) Gauges and Tools |
| 3 | | Hardening and Tempering |
| 6 | | Assembling |
| | 3 | (*a*) Rear Axle and Transmission |
| | 3 | (*b*) Clutch and Motor |
| 10 | | Machine Repair |
| 24 | | General Tool Room |
| | 4 | (*a*) Tool Repair |
| | 6 | (*b*) Set-up Work |
| | 4 | (*c*) Tool Grinder |
| | 10 | (*d*) Jigs and Fixtures |
| 26 | | Engineering and Designing |
| | 8 | (*a*) Tool Design |
| | 8 | (*b*) Time Study and Routing |
| | 10 | (*c*) Mechanical Engineering |
| 104 | | |

NOTE.—Applicant must be a mechanical engineering graduate or equivalent.

**Truck Sales School.**—The Sales School is now only three weeks in length, but it offers the best instruction that the company can provide through the co-operation of engineers and department chiefs. It started as a five weeks, course, was later reduced to four weeks and they are now trying three weeks. Ordinarily, about 20 men are in attendance, sent in by the company's distributors and sales offices, who stand the student's expenses amounting to $250 to $500 per man.

The course has been carefully laid out as a study of the car's mechanism, of selling methods, and of the competitive points to be met in selling. It is, however, planned to be broader than a mere training course in the effective selling of the company's truck, as there are introduced some lectures which should go toward making of the students transportation engineers. We find for example such topics as:

Transportation's Influence upon Civilization and How it Has Made the World Smaller.

Importance of Correct Specifications.

The Coal Industry.

The Milk Industry.

Professional Haulage.

## CHAPTER III

## SOME VARIED COMPREHENSIVE PROGRAMS

THE following six programs have, in general, been developed in companies not as large as those considered in the first two chapters. All find a place for at least a limited utilization of apprenticeship in the skilled trades and of various types of special training which seem at this time best suited to their needs.

The wide variability in methods shows that a training or educational policy has not become crystallized; and it is, no doubt, fortunate that such is the case. It should be recognized as an expense to the company and, in most cases, entailing considerable effort on the part of the employee only to be justified if it brings increased effectiveness and a resulting improvement in salary. Of course, there is some instruction which can be justified as adding to the mental satisfaction of the learner, but, in general, corporation instruction will only incidentally provide this personal satisfaction.

### No. 8

### THE NORTON COMPANY, WORCESTER, MASS.

The Norton Company are the well-known manufacturers of abrasive materials and grinding machinery. They employ in their plant some 3,500

people, of whom not more than 250 are women. (1) Intensive training for machine operatives; (2) a Grinding Course for demonstrators, trouble men, etc.; and (3) a Half-time Mechanical Course are the present important educational developments. There are also projected a Foremen's Training Course and a plan of correspondence and resident instruction for agent's salesmen besides minor departments, such as office-work training and Americanization instruction.

(1) **Intensive Training for Machine Operatives.**—There are approximately 850 men employed in the machine division, of whom some 200 skilled machinists have come through the training department.

The present methods are as follows. The course as laid out for lathe and milling machine hands is six weeks in length. For the lathe worker a schedule of eight type jobs has been arranged in which Bulletin 52 of the U. S. Federal Board for Vocational Education is being followed. The work is in charge of a supervisor of training with long practical experience coupled with considerable practice at trade teaching in the local trade school. His methods are in part a reaction from what he conceives as unsatisfactory in public trade school teaching, but, in the main, an adaptation to the special needs of his company in attempting to strike an optimum balance between thorough teaching and minimum time in bringing the individual undergoing training to efficient production. For this reason he has selected his instructors upon what might be called a functionalized basis. Thus, while he has chosen for this purpose skilled mechanics who have proved themselves successful at

training, one is considered valuable for his painstaking thoroughness in teaching, the other for his success in bringing the individual being trained up to a high average speed of production.

There are some 35 or 40 being put through this training, of whom 7 are carefully selected apprentices following a two years' course for all around efficiency, while the remainder remain only for the intensive courses already described. In both cases, preliminary to entrance upon the course, an examination must be passed in the minimum essentials of arithmetic that are required by machinists.

Cost averages for training have been computed upon which it is estimated that about one-half the six weeks in training is a company expense not offset by production, and $70 has been thus computed as the approximate cost per man. Of course, every shop not having a training department will have this or an even greater cost with every untrained man taken on. The difference is that ordinarily it is absorbed in the regular production costs.

It is possible for an operative who wishes to become an all-around machinist to return after twelve weeks at regular production to the training department to learn another machine. Under those circumstances the rate fixed is 15 per cent below the standard day rate.

It is claimed for the training department that it has produced a greater *stability* in the company's labor supply, a *better type* of workman, has *reduced* the number of *accidents* and has provided a *reservoir* from which superior workmen could be chosen for foremen.

The average rate of graduation from this training course naturally fluctuates with demands for machine operatives, but at present is at the rate of four per week, which thus provides for about 200 recruits per year. If, however, a considerable number returned to the department for trade extension training in the way of learning another machine, this number would, of course, be proportionately lessened.

Apart from the training in this special department, mention should also be made of the rather informal type of floor training provided by rate setters. When a workman fails to attain the speed of production determined previously by the rate setter as possible, the latter is required to demonstrate to the workman concerned that such production is feasible by actual performance on the workman's machine, and to show him how to adjust and control his machine in order to attain the rated output.

(2) **The Grinding Course.**—About 20 are progressing through the Grinding Course, which is a training program for " demonstrators, service men, trouble men, etc." The purpose of the course is said to be " to provide for the sales department a supply of men who thoroughly understand both wheels and machines and who, above all, can actually promote future sales because of service rendered to customers. This means actual physical service and not pamphlet service—hand service and not lip service."

The desired qualifications are health and what is " vaguely called a good personality " and exceptional intelligence, " whether or not highly educated." It is also demanded that the candidate should, as a rule, have had sufficient machine shop training so that the

only manual training required in the course will be that involving grinding, the assembling of grinding machines, and a knowledge of wheels. It is obvious that this requirement places a premium on the man with several years of machine tool experience as compared to one with an extended technical education, even though the latter were trained in grinding. They also prefer men already in their employ, as offering a better opportunity to know the man and as providing the stimulus of hope of advancement to ambitious employees.

In the course scheduled, which is about one year in length, all the types of grinding are specified. The work is ordinarily on productive jobs and not in the form of exercises; though the student is required to perform a series of experiments in order to " discover the correct theory of grain depth cut, chatter causes and cures, speeds and feeds and dynamic balance."

Candidates are also sent out on local jobs under the care of experienced men during the course to see how " they react under strange conditions and adverse circumstances." Also, to quote further from a superintendent's letter outlining the course: " The educational director should keep these men busy on the mental side, in order to make them able to be of real value in the estimating of grinding production and expert in the mathematics and language of their particular product."

(3) **Special Half-time Mechanical Course.**—To commence this year the educational department has planned an interesting modification of the co-operative idea in education. Fifty of the company's employees are to have the privilege of resuming their

education on a half-time basis, and it is planned to offer the same provision each year hereafter to about 20 men. This privilege is open to selected employees who have finished at least two years' work in high school or its equivalent, are at least 20 years old preferably, and who have at least a year's shop experience.

For instruction they will be divided into two equal groups and each fortnight will alternate between their employment in the plant and the classes which are provided, one group being at work while the alternate group is under instruction. Only during the summer both groups are employed at work, which will enlarge their shop experience and no school instruction will be given. Wages will be commensurate with the work performed and arranged by individual agreement between each student and the company. Naturally, the students will be paid only for their time in actual production. The entire expense of the school is, however, to be borne by the company.

The summers, as now scheduled, are to be spent at work in the Norton patternshops and in a commercial foundry outside of the Norton Company. It is believed that this variety of experience is essential in providing the all-around training desired.

The course of instruction laid out for the ten fortnightly periods of each of the two years is divided into two terms. Each week is laid out on a forty-four hour basis.

Following this plan the mornings of the first term are devoted to an intensive study of mathematics and English, classes being scheduled not on the hour-a-day five-days-a-week principle usual in the ordinary

school, but instead are to be continuous from eight to twelve. Thus, all Saturday forenoon is devoted to English and the remaining forenoons similarly to Mathematics. All the five afternoons are in the same way given to free hand and mechanical drawing.

During the second term one forenoon is given to the chemical laboratory, another to the physics laboratory as alternates to the mathematics, which is continued. In the afternoon drawing is replaced by mechanism for two afternoons; science, one afternoon; and the other two afternoons by economics, government, and transportation.

The first term of the second year provides three forenoons for mechanics, with the three alternating forenoons for materials and metallurgy. Three afternoons are to be spent on machine parts and two in the mechanical testing laboratory.

In the second term, which concludes the course, for two forenoons and one afternoon *time study* is scheduled and a day given over to the work of the various departments of the company. Three forenoons are devoted to shop management, and of the remaining three afternoons two are given to shop visits and one to machine design.

The course may, of course, be considerably modified, as experience will probably justify stressing some of the courses at the expense of others, but it is thought worth while to reproduce the present plan to show its comprehensive scope.

The list of positions open to the graduates who prove their fitness is interesting, as showing the opportunities provided by employment in an expanding company awake to the desirability of recruiting its

skilled, technical, and supervisory force, as far as possible, through promotions inside the company. Thus, it is stated in the announcement of the course that graduates may hope to fill the following vocations in the company: Mechanics, Draughtsmen, Foremen, Inspectors, Production Engineers, Office Sales and Quotation Men, Credit Men, Order Editors, Demonstrators, Traveling Salesmen, Publicity Men, Superintendents, and Managers.

A further educational provision is the establishment of four scholarships in the Worcester Polytechnic Institute covering all tuition and laboratory fees for one year to employees whose educational equipment is ample. Ordinarily the holders of the scholarships will be employed by the company during the summer and it is to be expected that they will be re-employed after completing the course.

The possibility of synthesizing these educational provisions is worth considering. We shall assume that a boy of normal or superior ability finishes two years at the high school and then enters the apprentice course in the mechanical training department. He finishes this in two years and continues with the company until he is 20, when the half-time mechanical course is open to him. Upon completion of this, the grinding course or else the year's scholarship at the Polytechnic Institute should be possibilities. At twenty-three or four he should stand out as an industrial or production engineer with both the practical experience of an extended apprenticeship and, in addition, a broad technical training.

Altogether, the training and educational program of this company as outlined has interesting and novel

features which the management plan to extend and amplify as opportunity offers with the complete installation of the educational department now under way. We shall then expect a thorough program of foreman training, office work training, Americanization classes, and several unique features, such as " external " or correspondence instruction for agents' salesmen and for customers in their home works, a feature which is considered of particular importance.

## No. 9

### Watervliet Arsenal, Watervliet, N. Y.

The Watervliet Arsenal has long been maintained by the Ordnance Department of the United States Army. For ten or twelve years apprentices have been employed, but, owing to the relatively small number of employees previous to the late war, not more than 10 or 12 were taken on each year. As a result, however, of the increased production stimulated by the war and an awakened interest in apprenticeship, there are now 76 apprentices, all being at present in the machinist's trade. In this connection it should be noted that there are 475 all-around machinists and toolmakers employed in the arsenal and about the same number of operatives and skilled specialists.

The plan of organization for training is of interest. In general charge of all educational activities in the works is a Superintendent of Education. These activities embrace (1) Apprenticeship; (2) Intensive Study; (3) Visual Instruction; (4) Mass Edu-

cation; (5) a Vestibule School; and (6) Foreman Training.

(1) **Apprentice Training.**—In charge of Apprenticeship, under the direction of the superintendent already mentioned, is a supervisor, who is a machinist of long experience, apprentice trained, who previous to the expansion of the apprentice department gave all the supplementary instruction. He is now assisted by an instructor in Shop Mathematics and Applied Science, formerly an Assistant Professor in Rensselaer Polytechnic Institute, who is devoting all his time to this instruction, and for the work in drawing by a professor of design from the same institution who is employed on a part-time basis.

The first year of apprenticeship is spent in the training department, which is a section of the plant wholly distinct from the remainder of the plant with a generous equipment of all the standard types of machine tools with facilities for 25 boys. In charge of this is the supervisor, who is assisted by two experienced mechanics who act as sub-foremen in training at regular production jobs. For the remainder of the term of apprenticeship the boys are transferred for further experience about the plant, but always under the friendly direction of the supervisor.

Supplementary instruction is provided for six hours a week so arranged as to be about equally divided between the employer's and the apprentice's own time. This is accomplished by requiring them to work until six o'clock instead of five on the two days a week on which they receive their instruction. The adherence of the apprentices to this arrangement is secured by their signing a special agreement upon

indenture to put in one hour of study on mathematics and drawing for each hour of instruction given in place of work during regular employment hours.

The instruction is divided into six terms of twenty-one weeks each, as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Term 1. | Arithmetic | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Algebra | 2 | " | " | $\frac{3}{4}$ | " | " | " |
| | English | 2 | " | " | $\frac{1}{2}$ | " | " | " |
| | Practical Talks | 2 | " | " | $\frac{1}{2}$ | " | " | " |
| Term 2. | Arithmetic | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Algebra | 2 | " | " | $\frac{3}{4}$ | " | " | " |
| | English | 1 | period | " | $\frac{1}{2}$ | " | " | " |
| | Practical Talks | 1 | " | " | $\frac{1}{2}$ | " | " | " |
| | Mechanical Drawing | 1 | " | " | 1 | " | " | " |
| Term 3. | Mechanical Drawing | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Mensuration and Geometry | 2 | " | " | $1\frac{1}{4}$ | " | " | " |
| | Practical Talks | 1 | period | " | $\frac{1}{2}$ | " | " | " |
| | Industrial history | 1 | " | " | $\frac{1}{2}$ | " | " | " |
| Term 4. | Trigonometry | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Mechanism | 1 | period | " | 1 | " | " | " |
| | Mechanical Drawing | 2 | periods | " | $1\frac{1}{4}$ | " | " | " |
| Term 5. | Tool Design | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Strength of Materials | 2 | " | " | 1 | " | " | " |
| | Mechanics | 1 | period | " | 1 | " | " | " |
| | Practical Talks | 1 | " | " | $\frac{1}{2}$ | " | " | " |
| Term 6. | Tool Design | 2 | periods | of | $1\frac{1}{4}$ | hours | each | per week |
| | Practical Science | 2 | " | " | 1 | " | " | " |
| | Mechanics | 1 | " | " | 1 | " | " | " |
| | Shop Economics | 1 | " | " | $\frac{1}{2}$ | " | " | " |

Boys fifteen to eighteen years of age are eligible for apprenticeship, those with at least one year of high school being preferred, and candidates must pass a

civil service examination which is given twice a year, and from the eligible list thus established selections are made at such times as needed.

The remunerative returns for apprenticeship in this arsenal seem more generous than would be possible for a private concern to offer. The indenture calls for six whole terms of 1,250 hours each, which works out as about three and one-half years; since the boys are granted a thirty-day vacation each year and the working week is forty-four hours in length. Upon this basis the apprentice pay is as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1st | period | 25¢ | an | hour | or $11.00 | a week |
| 2d | " | 27¢ | " | " | $11.88 | " |
| 3d | " | 30¢ | " | " | $13.20 | " |
| 4th | " | 32¢ | " | " | $14.08 | " |
| 5th | " | 35¢ | " | " | $15.40 | " |
| 6th | " | 40¢ | " | " | $17.60 | " |

In addition to this, after the first six months, $20 per month bonus is paid by the government, which brings the apprentice's pay up to what seems generous proportions.

(2) **Evening Improvement and Trade Extension Classes.**—*Intensive Study* is the caption under which evening classes were, during the past winter, organized in the plant. Merely the fact that a night school is provided is, of course, of no great significance beyond the plant, but that they were planned and promoted by a committee of employees does seem of some importance as suggesting an essential form of procedure to insure their success. The year was divided into two terms of twenty weeks each with two lessons a week. The cost of registration was placed at $5 per term for adults and $2.50 for employees under twenty

years of age. There was said to be an average enrollment of 84 altogether in the following 8 courses:

English and Current Events
Elementary Mathematics
Advanced Mathematics
Strength of Materials
Drafting
Elementary Electricity
Commercial Arithmetic, Cost Keeping and Stock Keeping
Penmanship, Stenography, and Typewriting

Some of the classes were held from 5 to 6 P.M., while others were from 7.30 to 9 P.M. so as to be at times most convenient to the students.

(3) *Visual Instruction* seems to be merely a title under which "industrial and entertaining movies" are being provided. It is not believed that much was expected of them as an effective means of education in the industry, but rather that they were intended to provide innocent diversion which might not otherwise be available. Such a provision is, of course, to be recommended more especially in industries located at points not readily accessible and where the plant seems the natural center for such activities.

(4) The employee's committee on *Mass Education* has provided a series of noon hour lectures twice a week. The lecturers seem to be in the main nearby clergymen and educators. The idea actuating the movement is evidently inspirationally to enlist the best efforts of the working force toward co-operation in production and enlightened community activity. How effective this movement will be undoubtedly depends on its permanency and its effectiveness in reaching the bulk of the workers. If the lectures are

patronized only by those habituated to church, Young Men's Christian Association, and lecture forum, it is reasonable to assume that the movement will not function beyond the circles already reached by these community agencies.

(5) **Vestibule School.**—In the Vestibule School it was stated that there were now three ex-service soldiers being given training under rehabilitation. Their first period of training is for six months and, if they are not yet proficient at the end of that time, they are to be given one or even two more similar periods of training.

(6) **Foreman Training.**—A Foreman's School is also maintained, meeting fortnightly in lunch sessions in the plant's cafeteria. This effort toward improvement of the working force at a vital point seems to be favorably considered and to be developing toward more intensive utilization.

Apprenticeship, Intensive Study, i.e., night school trade extension as a co-operative movement of employees and management, and Foreman Training all seem measures favorably received and developing as useful expedients toward improving the plant's working force. Particularly to be commended seems the apprentice system where the equipment of the training department, the quality of the teaching staff and the plans for related work instruction with that for systematic training in practice all seem eminently satisfactory. This condition is reflected in the apparent high quality of the young men undergoing apprenticeship and their satisfaction expressed to the author as to the conditions.

No. 10

WINCHESTER REPEATING ARMS COMPANY,
NEW HAVEN, CONN.

The Winchester Repeating Arms Company at the conclusion of the late war found itself confronted with the problem either of greatly retrenching its production or of branching out into many new lines of manufacture. In order to utilize the greatly increased space, equipment, and working force which had been required for war production, it chose the latter course. This has meant the entrance into the manufacture of pocket knives, shears, and other forged and edged tools, skates, fishing tackle, batteries and flash-lights, and still other products yet to be developed. To market these new products it was considered necessary to acquire a chain of district warehouses and of retail stores and agencies extending throughout the country.

To reorganize the personnel for the changed production, more minor executives, foremen, and office workers were essential, which argued for the installation of an educational division. Equally the training of the workers in these new lines was believed to justify the development of a training department. It should be noted that in this corporation the two functions are considered distinct and co-ordinate. The educational work heads up to the personnel department, while training is subordinate to the manufacturing department. A third division of the field is found in apprentice training, which antedates the adjustment to war conditions and, of course, the other

instructional features. Over this the educational director exercises only supervisory control.

**Apprenticeship.**—To consider first the provision for apprentice training, only that for the machinists' and toolmakers' trade is at present offered. In this there is an enrollment at present of 116, for whom a three years' course is laid out. The usual provisions are found, such as limiting entrance to boys aged sixteen to twenty and requiring an apprentice agreement.

Apprentices are very carefully selected. In every case grammar school graduation is required and, to insure a satisfactory knowledge of arithmetic, a rather difficult examination in that subject is imposed, which must be passed with a high standing. Also the applicants are given a physical examination with the requirements, in addition to good health and physique, of a minimum height of 5 feet 3 inches, a weight of 105 pounds, good eyesight and hearing. Also, the character of the boy is investigated to insure the best and most satisfactory material. If accepted, they are placed on probation for two months' trial before indenture for the three years is signed. They are then required to purchase their own individual measuring tools and a machinists' handbook.

To insure ample instruction at all the standard machine tools, a separate training department is provided under a highly skilled mechanic as supervisor who takes a personal interest in the progress of each of the apprentices. He is also assisted by carefully chosen machinist instructors. This feature of a separate training department with high grade instruction coupled with the high quality of tool work required in the production of fire arms, it is believed

provides an exceptionally favorable opportunity to learn the toolmaker's trade.

Two hours per week of classroom instruction in mathematics and mechanics during working hours and an eight weeks' continuous period of intensive instruction in the drafting department provide the minimum requirements of supplementary instruction in drawing, mathematics, and science. This may, however, be supplemented by the more ambitious through evening instruction in English, mathematics, including trigonometry, and in drafting. These classes meet from October to July from 6.30 to 8 P.M. and are provided without cost to the student, though no additional compensation is given for taking them. A library of modern technical books and magazines is also at the disposal of those eager to learn.

Ordinary compensation at present starts at $12 a week and is increased by two cents an hour advances every six months until $18 a week is reached for the final term. A bonus of $100 is also paid, if the apprentice completes the course and remains in the company's employ one year after graduation. This, in a sense, establishes the apprentice period at four years, which conforms to the practice in most plants. To stimulate and reward extraordinary effort and capacity, prizes are also given to those receiving the highest rating in their studies.

Outside activities include athletics with skilled coaches in all the major sports, dramatics, and music, which are provided in an effort to keep work for the lively young fellows from becoming a dull grind.

**Special Training.**—Initial training has been organized throughout the plant under the director of

training. Intensive instruction in trades, semi-trades, and operations is organized in 40 separate sections. This includes definite instruction in such trades or specialties as that of sheet-metal workers, gun-mechanism adjusters, bamboo-rod winders, electrical wiremen, polishers, buffers, hafters, glazers, blade grinders, scissors and shear workers, fish-reel assemblers, bench filers, milling machine, drill press, and profile-machine operators, machine-tool specialists, die makers, die sinkers, drop forgers, shop and office clerks.

The number undergoing training, of course, varies with the demands of the plant, depending upon departmental expansion and turnover. At present 175 are receiving instruction, for whom a corps of 25 instructors are required. During the process of training, experience has shown that about 15 per cent are eliminated as unsuited to the particular work or else because they find it distasteful.

The director believes that much attention should be given to teaching the instructors efficient methods of instruction. For this reason he holds weekly conferences of his staff, when methods of teaching are discussed and solutions are suggested for problems arising in the work.

The length of training, of course, varies with the type of work concerned. Three days, for example, are considered sufficient in a punch press operation or in that of merely feeding a machine, while ten weeks are usually necessary for a machine tool specialty. In the latter case it may be of the nature of trade extension for a machinist inexperienced in the particular work required.

In general, it may be said that all work is of the

nature of floor training on machines segregated from regular production but installed in the department where the employee in training will ultimately be utilized.

As stated by the training director, the work of the department is to test, train, upgrade, and adjust all new or inefficient operators in the plant.

**Training for Minor Executives.**—There are ordinarily about 20 young men in the plant receiving a varied experience to fit them for administrative positions. The major portion are college graduates, though, on the average, about one-fifth are promoted from the ranks in the plant.

A definite route through the plant has been arranged as follows:

Three months apprentice training department.

Nine months in various departments of the factory.

Three months general administrative work.

Six months specialization along the line they wish to follow.

This provides a total of twenty-one months of training.

The educational department requires that they purchase and study the Alexander Hamilton Institute course, toward the cost of which the company pays one-half. Weekly conferences are held to discuss these lessons and during a similar period each week a talk is given by individuals from the executive staff of the plant.

**Foreman Training.**—One hundred fifty foremen have been selected for a training course which has been organized and is being developed by the educational director. These men are grouped into six sec-

tions of 25 to 30 each. In the weekly meetings about fifteen minutes is taken up by a brief pointed talk on the day's topic by the director. This is followed by an open discussion of the topic among the foremen in the group. Mimeographed outlines are provided of the subject in hand.

The first subject to which three to four months are being devoted is that of Management, on which the outlines of two conferences are here reproduced.

FOREMEN'S GROUP CONFERENCES I

SUBJECT: *Aims of Management*

I. Interpretation of Management
  A. Broad
    1. Gathering data relating in general to
      *a.* Conditions
      *b.* Methods
      *c.* Processes
      *d.* Results
    2. Applications
      *a.* Interpreting data
      *b.* Establishing of standards
      *c.* Means of utilizing data and standards
      *d.* Establishing means of further investigation
      *e.* Securing maximum prosperity for employer, employee, and consumer
  B. Narrow
    1. Collecting data relating to
      *a.* A particular or specific activity
II. The three components, broadly speaking, in management
  A. Organization
    1. Division of work, to be done, into defined tasks
    2. Assignment of these tasks to individuals
    3. Deals with qualifications and characteristics of human beings
      *a.* Engineers' type (Edison, the Wrights, Bell)
      *b.* Executive type
      *c.* Specialists
      *d.* Functionalists

B. System
   1. Method pursued by organization in carrying out tasks
C. Administration
   1. Work of organization in operating the management mechanism or system

Questions for Discussion:

In what way does management help the foreman?

The effect of management on the initiative and inventive spirit of the employee.

The relation of system to organization and administration.

Types of men needed for planning and execution.

### Foremen's Group Conferences II

Subject: *Types of Control*

I. Line Control (Chart)
   A. General Manager, responsible to Board of Directors
      1. Accounting (Comptroller)
      2. Producing (Works Manager)
         *a*. Superintendents of Foundry, Forge Shop, Machine Shop, etc.
            *a*–1. Foremen
      3. Selling (Sales Manager)

II. Line and Staff Control (Chart)
   A. General Manager
      1. Accounting (Comptroller)
      2. Producing (Works Manager)
         *a*. Superintendents, of Foundry Forge Shop, Machine Shop, etc.
            *a*–1. Foremen
         *b*. Chief Engineer
         *c*. Chief Chemist
      3. Selling (Sales Manager)

III. Winchester Functional Control (Chart)
   A. President or Vice-President
      1. Planning
         *a*. Superintendent Sales Production
         *b*. Export Head
         *c*. Credit Head
         *d*. Sales Engineer
         *e*. Advertising Engineer
         *f*. Warehouse Superintendent

2. Preparation
   - *a.* Manufacturing Engineer
   - *b.* Product Engineer
   - *c.* Industrial Engineer

3. Scheduling and Production
   - *a.* Manufacturing Superintendent
   - *b.* Personnel Superintendent
   - *c.* Purchasing Agent

4. Inspection
   - *a.* Comptroller
     - *a*–1. Statistician
     - *a*–2. Accountant
     - *a*–3. Auditor

5. Office Superintendent

IV. Committee Control (Chart)

A. Works Manager

1. Committee
   - *a.* Manufacturing
   - *b.* Tool
   - *c.* Suggestion
   - *d.* Safety
   - *e.* Welfare
   - *f.* Educational
   - *g.* Etc.

Questions for discussion—

Of what use are organization charts?

Discuss the merits of the W. R. A. type of organization.

This will be followed by a similar treatment of such comprehensive topics as Economics, Finance, Personnel Problems, Accidents and Safety Work. The director has in mind the development of a course which will extend indefinitely, perhaps as long as five years.

It will be seen that this program has as its basis the assumption that the foreman will gradually acquire the fundamental philosophy and method of his administrative functions, in other words, that his efficiency is dependent upon a gradual growth in per-

spective and comprehension of his duties and opportunities. The brief intensive method of four or five months of instruction found in other plants is quite evidently of more limited scope, that of providing of the initial attitude desired with a changing conception of the functions of the foreman as that of the leader rather than the driver, or else to provide the technical knowledge of the product deemed essential for its efficient production. Of course, these newer conceptions are embraced in the program here provided, but the plan evidently does not stop there, as it proceeds with the idea of the continued development of these lieutenants upon whose efficiency so much depends for success in production.

**Noon Hour and After-work Classes.**—The company has a program of Americanization, chiefly of teaching English to its foreign laborers. For this, noon hour classes are provided three days a week and a total of about 200 alien workers are enrolled.

Classes in Stenography and Typewriting are provided, two hours a week in each, either during the noon hour or seven to nine in the evening. In stenography 50 are enrolled and in typewriting, 30. Of more interest from the standpoint of manufacture are classes in mechanical drawing arranged for four hours a week from 5.35 to 7.35 P.M., arithmetic and shop mathematics two hours per week, 5.35 to 6.35 P.M., the slide rule, two hours per week, 5.35 to 6.35 P.M. Altogether, some 25 part-time paid teachers assist in this work in English for foreigners and the part-time educational classes.

**The Educational Organization Plan.**—As has been previously stated, training and education are con-

sidered two distinct functions for which in each case a director is provided. It is argued that training is properly a function of the manufacturing department, as only in that way can it be introduced without arousing the hostility of those responsible for production, who are the ones primarily interested in its provision. Similarly, the educational work heads up to the personnel department as being in certain particulars closely allied to employment work and in other activities, notably the noon hour and evening extension classes, to other forms of employee service.

A considerable staff is naturally required to provide these various programs of training and supplementary education. Under the training director, as has been mentioned, is a staff of 25 specialty instructors. The apprentice department has a staff of 5 instructor mechanics and the educational director has 8 full time assistants and, in addition, the staff of part-time extension instructors already mentioned.

## No. 11

### Mergenthaler Linotype Co., Brooklyn, N. Y.

The Mergenthaler Linotype Company offers an interesting example of a variety of training facilities in a moderate sized plant. The product is the very intricate linotype machine requiring for its production and constant improvement an engineering staff, a corps of machinists and, chiefly, a large number of specialists. Altogether some 3,000 are now employed, including 500 females. The plant is, however, expanding, which is a condition even more urgently suggesting the desirability of special training facilities.

**Apprenticeship.**—To consider first the provision for apprenticeship, there are in the plant at present 55 apprentices in the Machinists' and Toolmakers' trade. This corresponds to the reasonable ratio of one in five to the total of 269 employed in the tool room. Boys aged sixteen to twenty are admitted to the four-year course provided and it is preferred that they come directly from school. The usual requirements are insisted upon of sound health, good morals, and the completion of a grammar school education. Selections are made from the waiting list, on which there are at present 22 enrolled.

There is no part-time supplementary school provided, though there is a limited opportunity for after-work instruction in blue print reading, shop arithmetic, and gauge reading; and in the public night schools there is plenty of opportunity for further study, if required. Careful instruction is, however, given on maintenance work, which offers the basis for experience.

After the trial period of the first six months of employment, if the boy is judged satisfactory, an agreement is signed between the company and both his parents, if living, or his guardian to complete the period of apprenticeship, the company binding itself to " carefully and skillfully teach every branch of the business of machinist and toolmaker " with the reasonable conditions stipulated.

These conditions, except for the limited amount of supplementary instruction, seem particularly satisfactory. Thus, based on a percentage of the prevailing hourly rate, the rate of wages are for the respective six months' periods as follows: 25 per cent for

the first; 31 per cent for the second; 37 per cent for the third; 50 per cent for the fourth; 55 per cent for the fifth; 60 per cent for the sixth; 75 per

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**Mergenthaler Linotype Company**
**Brooklyn, New York**

## Conditions of Apprenticeship

1. **Requirements** The applicant for admission to Apprenticeship must not be less than sixteen years of age, nor over twenty years of age. He must be physically sound, of good moral habits, and must have received a good grammar-school education.

2. **Application and Agreement** The applicant must apply in person, and, if this application is considered favorably, he will later be notified when to begin work, subject to the rules and regulations governing employees of this factory. In order that his special fitness for the Machinist's and Toolmaker's trade may be judged correctly, the first 1160 hours (about six months) will be considered a trial period. During this trial period he shall be paid at the same rate of wages allowed for the first period of apprenticeship. If, at the expiration of the trial period, his conduct and workmanship shall have been found satisfactory, he shall be engaged as a regular apprentice, and he shall be requested, together with his guardian, to sign in duplicate the within form of agreement, which shall be dated from the beginning of the trial period.

3. The time of apprenticeship shall cover eight terms or periods of 1160 hours, making in all about four years' time. The rate of wages per hour for the respective periods shall be based on a percentage of the prevailing hourly rate paid Toolmakers by the Company, and shall be as follows: 25 per cent. for the first; 31 per cent. for the second; 37 per cent. for the third; 50 per cent. for the fourth; 55 per cent for the fifth; 60 per cent. for the sixth; 75 per cent. for the seventh; 85 per cent. for the eighth. The Company will further pay a bonus of a sum equal to ten per cent. (10%) of all wages paid to said apprentice during said period of apprenticeship, and confer a diploma signed by the Company if he satisfactorily completes the full term of his apprenticeship, as provided elsewhere in these Conditions and Agreement.

4. Careful records shall be kept of each apprentice, including his efficiency, initiative, progress, obedience, attendance, etc.; and, at the expiration of the third year, if in the opinion of the Company the record of the apprentice warrants it, this Company will permit said apprentice to graduate three months from that date, and present him with his diploma; that is, the Company will deduct nine months from his term of service because of his good record, making his full term three years and three months.

5. During the term of his apprenticeship, the Company shall furnish the apprentice with certain tools needed in his trade. These tools will be as follows: One 1" Micrometer, one 12" Combination Square Set, one one-pound Hammer, one 6" Scale, one 4" Scale, one 8" Monkey Wrench, one 8" outside and one 6" inside Calipers, one 6" Divider, one 6" Hermaphrodite, two Center Punches, and one copy of American Machinists' Handbook, the value of which amounts to about $20.00. These tools will be loaned only to the apprentice during his apprenticeship, and he will be responsible for their good condition. They will be the property of the Company during this time, but on the satisfactory completion of his full term, they will be voluntarily given to him, in addition to his bonus.

6. **General Conditions** It will be the endeavor of the **Mergenthaler Linotype Company** to give to the apprentice, as far as possible, an opportunity to acquire a practical knowledge of the Machinist's and Toolmaker's trade, and it is expected the apprentice will manifest an interest in this by being punctual in attendance, by good conduct and faithful work in the shop, and by improving himself in his leisure time by reading and studying literature relative to his work. As far as is practicable, the Company will give to the apprentice his shop-training on the following machines during his apprenticeship: One month, Tool Crib; eight months, Lathes; eight months, Plain and Universal Milling Machines; five months, Grinders; three months, Planers and Shapers; six months, Bench Work and Assembling; one month, Radial Drills and Boring Mills; twelve months, Tool Work; making a total of forty-eight months. The time to be spent on the various machines above enumerated may be varied, however, in the discretion of the management, according to the record of the apprentice. This Company will also help the apprentice by educating him in the theoretical problems of mechanics and mechanical draughting, by such methods as it might establish for the benefit of its apprentices. Graduates of the State Trade Education Shop of New York, or any other equally good training-school, shall be allowed the same number of satisfactory hours which they spent in that school to be applied on this apprenticeship. They will also receive the regular bonus given on the satisfactory completion of this apprenticeship.

7. Finally, the Mergenthaler Linotype Company reserves the right in its sole discretion to terminate this agreement and discharge the apprentice for any of the following reasons: Nonconformity to the shop rules and regulations, want of industry or capacity, indifference to duties, the practice of vicious and licentious habits, the continuance, after notice of their impropriety, of association with individuals deemed by the Company dangerous to the welfare of the apprentice, or other conduct deemed improper by the Company, within or without the shop. However, no apprentice will be discharged until after investigation and approval by the general foreman and superintendent of his department; and after notice of such discharge, said apprentice shall be entitled to a full hearing before the Works Management of this Company. Said management may, if warranted by the facts, reverse the decision appealed from.

MERGENTHALER LINOTYPE COMPANY

cent for the seventh; and 85 per cent for the eighth. The company provides a novel basis for the bonus paid at satisfactory completion in that it is not a fixed amount, but is at the rate of 10 per cent of all wages

paid during the period of apprenticeship. This would amount to $4,361.60 as wages at the rates now (1920) prevailing, and to a bonus, hence, of $436.16 at com-

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**Agreement**

**This Agreement,** made this _____ day of _____ 19____, by and between _____ (Apprentice) of _____, hereinafter called the "Apprentice," _____ (Father or Guardian) of _____ and _____, his wife, the parents (or guardians) of the Apprentice, hereinafter called the "Parents," and Mergenthaler Linotype Company, a New York Corporation, of Brooklyn, New York, hereinafter called the "Company."

**Whereas,** the Apprentice, who is of the age of _____ years and _____ months, wishes to become an apprentice of the Company for the purpose of acquiring the art or trade of a machinist and toolmaker;

**Therefore,** the Parents hereby apprentice the Apprentice to the Company for a term or period of 9280 hours, amounting to about four years' time, unless varied under Paragraph 4 of the "Conditions of Apprenticeship," which are hereto attached and made a part hereof, such period commencing _____ 19____, and terminating _____ 19____, subject to the variation above provided for, and agree that the Apprentice shall become an apprentice in the art or trade of a machinist and toolmaker, subject to and in accordance with the conditions of the apprenticeship which are given on the reverse of this agreement and made a part hereof, and that during such period the Apprentice will abide by the rules and regulations of the Company, and not leave the Company prior to the expiration of such term; in all of which agreements the Apprentice joins. The Parents further agree to furnish suitable and proper board, lodging, and medical attendance to the Apprentice during the continuance of the above-named term.

The Company agrees that, during the said period, it will pay to said Apprentice wages in accordance with the "Conditions of Apprenticeship" given on the reverse side of this agreement; and that if the Apprentice shall complete the full term of his apprenticeship, and if this agreement shall not be terminated, and the Apprentice discharged by the Company as provided in Paragraph 7 of the "Conditions," the Company will cause to be carefully and skilfully taught to the Apprentice every branch of the business of machinist and toolmaker set forth in said "Conditions," and, upon the expiration of the aforesaid term of apprenticeship, will pay to the Apprentice, as bonus, a sum equal to ten per cent. (10%) of all wages paid him during the period of such apprenticeship, and will further give to the Apprentice a certificate in writing that the Apprentice has served at such art or trade a full term of apprenticeship as above specified.

The parents or guardians agree that any sums due or payable hereunder may be paid to and received by the said Apprentice.

**In witness whereof,** duplicate copies of this agreement have been signed by the parties on the date above mentioned.

_____ (Apprentice)

_____ (Father or Guardian)

_____ (Mother)

MERGENTHALER LINOTYPE COMPANY,

By _____

pletion. Also, the individual set of toolmaker's tools valued at $20, which are loaned during the period of apprenticeship, are presented to him with the diploma when he graduates.

Careful records are kept of each apprentice "including his efficiency, initiative, progress, obedience, attendence, etc., and at the expiration of the third year, if in the opinion of the Company the record of the apprentice warrants it, this Company will permit said apprentice to graduate three months from that date and present him with his diploma"; that is, the company deducts nine months from the term of service because of good record, making the full term three years and three months.

The schedule of training, modifiable at the discretion of the management according to the record of the apprentice, is as follows: One month, Tool crib; eight months, Lathes; eight months, Plain and Universal Milling Machines; five months, Grinders; three months, Planers and Shapers; six months, Bench Work and Assembling; one month, Radial Drills and Boring Mills; twelve months, Tool Work.

A very desirable feature is that "Graduates of the State Education Shop of New York, or any other equally good training school, shall be allowed the same number of satisfactory hours which they spent in that school to be applied on this apprenticeship. They will also receive the regular bonus given on the satisfactory completion of this apprenticeship."

The conditions of apprenticeship are here incorporated into this study, as being a model of the best practice.

**The Linotype School for Operators.**—Another of the company's interesting schools is that maintained to train its customers' operators. A six weeks' course is provided during which the student has instruction in operating and repairing the press, including its assembling and disassembling. The

equipment of the department used for this purpose consists of twelve machines, which fixes the limit to attendance. There are also provided a variety of teaching models for amplifying and illustrating the instruction. Two experienced operator mechanics provide the instruction.

**School for Engineers and Department Heads.**—The equipment of the School for Operators just described has been used during the past winter to provide a type of technical extension course. Fifteen of the engineers and departmental heads would assemble after office hours two nights a week for an hour to get direct first-hand instruction on the operation and construction of the press.

**Trade Extension Night Classes.**—Special night classes for general machinists were also provided two nights per week with units in blue print reading, shop arithmetic, and gauge reading. Thus, there was a class of 70 for six one-hour periods in the blue print reading and 25 for similar courses in Shop Arithmetic and Gauge Reading.

**Intensive Training School.**—The Engineering Department is conducting a school for breaking in novices as specialists on one type of machine. Those in training are usually "floaters" but selected as young ambitious fellows with ages running from twenty-two to thirty. The course lasts five to six weeks and 15 are now constantly going through this course.

**Foreman Training.**—A rather informal system of foreman training is provided, the foremen meeting with company officials once a week, when the various problems of production and employee control are discussed and suggestions for solution formulated.

## No. 12

### The Carnegie Steel Co., Pittsburgh, Pa.

The Carnegie Steel Company, in its three principal plants and central office in Pittsburgh, offers some

Page 3

**Application for Apprenticeship**

On this _____ day of _____, 19__, I hereby make application for admission to apprenticeship of the Machinist's and Toolmaker's Trade in the factory of the Mergenthaler Linotype Company, and I agree to conform to the "Conditions of Apprenticeship" and "Agreement" mentioned in these Apprentice Papers, and to the rules governing workmen in the employ of their factory.

Name in full_____

Residence and address_____

Place and date of birth_____

Father's or Guardian's name_____

Father's birthplace_____

Father's occupation or profession_____

From what physical ailments, if any, are you suffering?_____

Do you use tobacco in any form?_____

Do you use intoxicating drinks?_____

Do you use profane language?_____

Is it your custom to attend church services?_____

In what city were you educated?_____

Did you graduate from a Grammar School?_____

Name of Grammar School; age when graduated_____

Did you graduate from a High School?_____

Name of High School; age when graduated_____

Technical education, if any_____

Give name of any employee of this factory whom you know_____

How have you been employed since leaving school?_____

Why do you wish to learn the Machinist's and Toolmaker's trade?_____

_____

_____

_____

interesting developments of the training idea in industry. An apprentice school has been in operation for seven years and a salesmen's school is also well established. Out of the technical training for the

latter has grown the idea of the third and, perhaps, most interesting type, the works school.

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**Certificate of Apprenticeship**

This is to Certify that _____ has fully and satisfactorily completed his term of apprenticeship in the Machinist's and Toolmaker's trade, and has fully complied with all the conditions in the Apprenticeship Agreement.

Dated at _____, this _____ day of _____ _____ A. D. 19____

MERGENTHALER LINOTYPE COMPANY

_____
(Works Manager)

Witnesses:

_____

_____

**Apprentice Papers**

OF

**Mergenthaler Linotype Company**

WITH

_____

Commencing _____

Ending _____

Special Apprenticeship Committee { E. A. Sytz, J. Bradley, H. Kiever, S. Neilson

**The Salesmen's School.**—As regards the salesmen's school it should be remarked at the outset that it is not the policy of the company to take on inexperi-

enced young men who think they want to become salesmen, give them a course of training and send them into the field as their sales representatives. Those accepted for the training course are already successful salesmen. The plan of the course is to give two months to the concentrated study of the technical elements of steel, coupled with inspections and observation throughout the mills. It is thus expected that the salesman under training will arrive at a point where he may be said to know steel sufficiently well to be of service to the company's customers and, through understanding their needs, to present the merits of his product.

For this purpose classes of approximately eight salesmen are formed four times a year, thus providing for training 30 to 35 men each year. Three men, the director of this work and two assistants, all first class salesmen as well as technical experts in regard to the product sold, constitute the faculty, which by lectures and plant inspections provides the instruction.

**The Works School.**—The fact that the material developed for the lectures in the salesmen's school would be equally valuable in training all the personnel of the company whose intelligence is in any way enlisted in maintaining or improving the quality of the product has gradually grown in the minds of the management. Consequently, this material has been compiled as a 600-page book written in layman's rather than in technical phrasing. It has been put into an attractive and durable format, and is to be sold to all employees who desire it at a nominal sum—less than half that which the management finds it necessary to charge the general public.

An able educator has been engaged to open classes in each of the major plants of the company, in which this book will be used as the text. Attendance at these classes will be voluntary, although they will be held on the company's time and composed usually of men selected by the foremen as of a superior sort in intelligence. It is possible that ultimately the classes will include all from superintendents down to the brighter apprentices who are ambitious and capable of advancement.

To start the experiment, these classes will meet but one hour a week during a period of twenty-four months, which is expected to be the time required to cover the course as now projected. A considerable amount of outside reading will be expected, for which ample facilities are available, as might be expected in Carnegie plants in the generously provisioned metallurgical libraries provided for each of the plants.

The course as projected follows:

FIRST PERIOD—STUDY OF RAW MATERIALS—4 MONTHS

| | | |
|---|---|---|
| 1. | Preparatory study—physics and chemistry | 1 month |
| 2. | Refractories | 1 week |
| 3. | Ores of iron | 1 week |
| 4. | Fuels and the manufacture of coke | 2 months |
| 5. | Fluxes and slags | 2 weeks |

SECOND PERIOD—STUDY OF THE BLAST-FURNACE—5 MONTHS

1. Composition and constitution of pig iron
2. Principles of the process and equipment for the manufacture of pig iron
3. Construction of the blast furnace
4. Blast-furnace accessories
5. Equipment for handling raw materials
6. Operating the furnace
7. Chemical reactions

THIRD PERIOD—THE MAKING OF STEEL—7 MONTHS

1. Consideration of the ferrous products
2. The Bessemer process..... 6 weeks
3. The basic open-hearth process..... 3 months
4. The electric process..... 1 month
5. The duplex and triplex processes..... 1 week
6. The chemical testing of steel..... 3 weeks
7. The physical testing of steel..... 2 weeks

FOURTH PERIOD—THE SHAPING OF STEEL—6 MONTHS

1. Methods of shaping steel
2. Essentials of rolling mill construction and operation
3. Ingots and their defects
4. The soaking pit
5. The rolling of blooms and slabs
6. The rolling of billets
7. Rolling sheet bars and skelp
8. Defects in the semi-finished product
9. Rolling of sheared plates
10. Rolling of universal mill plates
11. Rolling of large sections
12. The hot rolling of strip
13. Merchant mills
14. The rolling of circular shapes
15. Forging of circular shapes
16. Forging of axles, shafts and similar shapes

FIFTH PERIOD—THE CONSTITUTION, HEAT TREATMENT AND COMPOSITION OF STEEL—2 MONTHS

1. The structure of plain steel
2. Thermal critical points for plain steel
3. The crystalline structure of steel
4. Heat treatment of plain steel
5. The composition of steel

Total, 24 months

**Apprentice School.**—To study the apprenticeship provided by this company the Duquesne Works were visited. Here apprenticeship has been in operation since the establishment of the works, although sup-

plementary instruction in a corporation school has only been provided during the past seven years. There are now 70 apprentices, to whose instruction a supervisor gives his whole attention with the aid of six part-time assistants from the technical staff.

A larger variety of trades are recruited in this plant by apprenticeship than is the custom in many plants, as will be seen by the following summary of enrollment:

| | | | |
|---|---|---|---|
| Armature winders | 4 | Masons | 12 |
| Blacksmiths | 1 | Painters | 1 |
| Machinists | 38 | Patternmakers (at present) | 0 |
| Boilermakers | 7 | Pipefitters | 5 |
| Carpenters | 1 | Roll turners | 1 |
| | | Total | 70 |

Twenty-two have been graduated during the past three years, thus at an average of a little over seven per year, while 51 have resigned, a mortality which may be accounted for to a considerable degree by the unsettlement of employment conditions attendant upon the late war.

The work which provides the experience for the apprentices, particularly for the machinists, but in general for all trades except those in the nature of a specialty, is largely provided through the repair and maintenance jobs always to be found in a large plant, these being of a varied nature but fruitful in providing a broad general experience for the all-round mechanic. To insure that these will embrace all the operations to be expected of a trained worker in the trade being pursued, and to rate the quality of workmanship, intelligence, and general attitude displayed in per-

formance, the supervisor keeps on file a record for each six months of each boy's apprenticeship. This provides for a job number for the jobs or operations which have been performed, with the problems which have been selected as suitable to accompany the same. This form is mimeographed on letter-size paper and provides for weekly entries.

The supplementary instruction is for four hours a week on the company's time and is divided into two-hour periods, seven to nine in the morning for those on day shifts and five-thirty to seven-thirty in the evening for those who are on night duty. The classes run through the usual school year of ten months and continue throughout the four years of apprenticeship. The instruction provided is in drawing, mathematics, and the science related to the industry and trade concerned, in which subjects the excellent books now published are utilized as texts.

It should be noted that, as far as possible, classes are differentiated according to trades. This permits the assignment of problems and drafting of a kind which will have definite utility in the trade which the apprentice is pursuing. Naturally, where the number in a trade is too small to warrant forming a class, the individuals concerned are placed in the class where the instruction will be most closely allied to the work of their respective trades.

The complete record of the apprentice throughout the four years of service is entered on a cumulative blank. Both class and shop records call for exact reports of attendance and estimates of intelligence, attitude, workmanship and speed, while in the shop record an additional rating on general value is called

for. All these ratings are then averaged and provide the combined rating for each term.

**Night School.**—During the past winter the company has for the first time maintained a night school, in which there was an enrollment of 150. The school finished with 45 per cent of the enrollment, which compares favorably with most evening trade extension schools. This represents a fourth type of educational endeavor existing in this corporation, the importance of which may be expected to increase with expanding facilities.

## No. 13

### National Cash Register Company, Dayton, Ohio

The National Cash Register Company have a country-wide reputation for their welfare work. Such phases as may be considered as definitely employee training and education are not so well known. They will be discussed as embraced under the following four heads: (1) Apprenticeship; (2) Upgrading Courses; (3) Health and Safety Education; and (4) Evening Instruction.

(1) **Apprenticeship.**—An elaborate scheme of apprenticeship has been laid out mainly on the cooperative principle, which may be extended by a university course in engineering. The plan calls for the completion of two years of high school previous to entrance. The boy who has made normal progress should then be at least sixteen years of age as required by the indenture agreement and be well prepared to enter upon his apprenticeship which he is to pursue

for two years on the co-operative basis, one week in school and one at work in the factory. It is then expected that he will have completed high school. The alternatives are then open to him either to complete his apprenticeship in two years with part-time instruction one afternoon a week or to follow a five years' course at the University of Cincinnati on a co-operative basis.

The co-operative high school in which the apprentices embark on their apprenticeship by attendance on alternate weeks has some unique features. It is in session throughout the year for fifty weeks, so that the boys have twenty-five weeks of instruction with their twenty-six weeks of practical work at the plant, thus providing for one week of vacation only each year. Moreover, the school is in session for seven hours a day, five days a week.

Saturday mornings of the school week, except during the months of July, August, and September, the boys report to the plant for special instruction in which they are addressed by company officials or shop foremen on Shop Methods, Factory Systems and the like. As these meetings are in the factory school building, which is equipped with moving picture apparatus and reflectors, the subjects presented can be very effectively and entertainingly developed. This is intended to co-ordinate the school and shop.

The course of study at the school seems well planned for the purpose, providing instruction in Mathematics, History and Civics, Drawing, English, Shop Practice, Physics, and Chemistry.

The work in the plant is supervised by a thoroughly experienced mechanic, who superintends the trans-

fers from one department to another and sees that the opportunity is provided for all types of practice.

This practice has been laid out with a great deal of care and a printed chart drawn up which is practically a complete trade analysis calling for a fixed number of months at each operation. This chart is placed in the hands of all the foremen concerned, with the requirement that it be rigorously followed, in order to assure the complete acquisition of the respective trades. This facilitates the handling of the apprentices rather than making it more difficult, as a definite group of machines and operations can thus be set aside for this purpose through which the apprentices progress by orderly schedule.

Previous to the inauguration of the co-operative apprentice course, a survey was made of the toolmaking, machine, and modelmaking departments to discover how many apprentices could be satisfactorily provided for. Based upon this investigation, the following quotas were established:

Toolmaking Department, 20 apprentices
General Machine Department, 16 apprentices
Model-Making Department, 16 apprentices
Special Machine Department, 4 apprentices

As there is a hierarchy of trades in this field, toolmaking being given chief place, an incentive to extraordinary effort is given by promising that any vacancies in the quota of that department will be filled by transferring one or more from other departments. Also, as tool designing offers superior opportunities to the other branches, apprentices to that department are obtained by selecting the most promis-

ing young men from the four departments already mentioned.

Having graduated from high school and completed

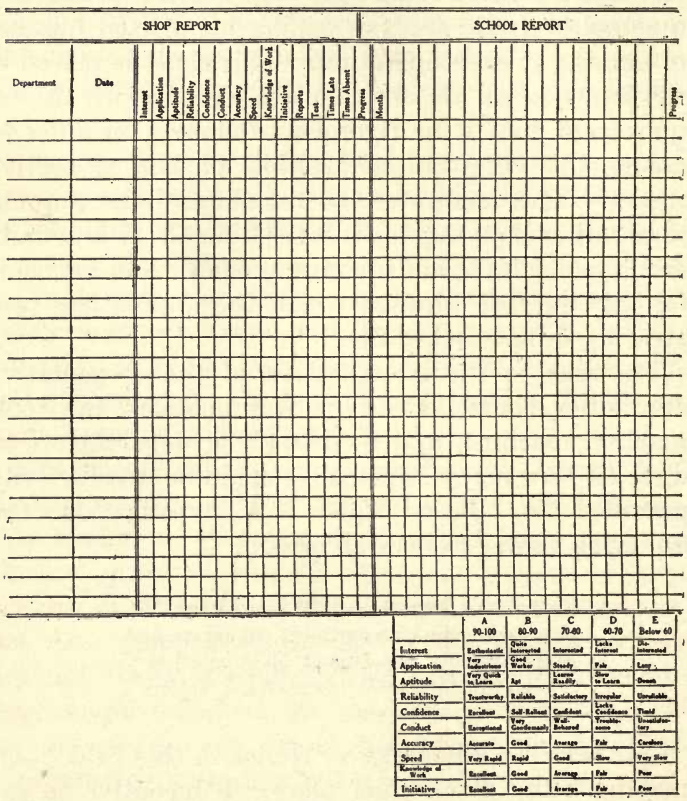


FIG. 1.—Apprentice Cumulative Record on File in Supervisor's Office.

the first two years of apprenticeship, two courses are open either to complete the acquisition of the trade upon which the boy has embarked or to go to the university, as already mentioned.

If he chooses the first plan of continuing in the trade, one afternoon of part-time instruction is provided each week at the school in Drawing, Shop Mathematics, Machine Tools, and a quarter hour of Health Instruction.

The present enrollment based on this program is as follows:

40 co-operative half-time apprentices
21 third and fourth year apprentices
18 co-operative university students

The apprentices are distributed as follows: Toolmakers, 46; Electricians, 2; Draftsmen, 6; Patternmakers, 1; Machinists, 5.

The first group of co-operative apprentices are paid 27½ cents per hour for the time they are working in the shop, with increases of 2½ cents every six months up to their third year. After that they are paid what they are considered worth. This was stated to be usually around 50 cents an hour for the fifty-four hour week. There is no piece work throughout the course.

Careful records are kept of each apprentice on the record card here shown (Fig. 1) and regular reports are made to parents on the Report Card (Fig. 2). Transfers are recorded and handled through the use of the Transfer Card (Fig. 3).

The eighteen university students are divided as follows:

| | |
|---|---|
| Electrical Engineers | 5 |
| Mechanical Engineers | 9 |
| Chemical Engineers | 2 |
| Commercial Engineers | 2 |

It was stated that only two or three had spent their whole five years in the plant.

Quarter ending.....  Date.....192..
Name.....Check No.....  Address.....
Parent or Guardian.....  Address.....

| | A 90–100 | B 80–90 | C 70–80 | D 60–70 | E Below 60 |
|---|---|---|---|---|---|
| Interest | Enthusiastic | Quite Interested | Interested | Lacks Interest | Disinterested |
| Application | Very Industrious | Good Worker | Steady | Fair | Lazy |
| Aptitude | Very quick to learn | Apt | Learns Readily | Slow to learn | Dense |
| Reliability | Trustworthy | Reliable | Satisfactory | Irregular | Unreliable |
| Confidence | Excellent | Self-reliant | Confident | Lack Confidence | Timid |
| Conduct | Exceptional | Very Gentlemanly | Well Behaved | Troublesome | Unsatisfactory |
| Accuracy | Exceptionally Accurate | Accurate | Average | Inaccurate | Careless |
| Speed | Very Rapid | Rapid | Good | Slow | Very Slow |
| Knowledge of work | Excellent | Very Good | Good | Fair | Poor |
| Initiative | Excellent | Good | Average | Fair | Poor |

Signed.....
*Foreman*
_____ Dept.

NOTE.—Please check one classification under each subject which, in your opinion, the apprentice should receive.
Grade last report.....
Grade this report.....

FIG. 2.—Reports of Apprentices.

Their pay starts at 35 cents an hour with gradual increases so that for the third, fourth and fifth years it is 45, 47½ and 50 cents an hour.

Records were stated to show that, so far, 49 per cent of the apprentices, on completing the course, stay with the company.

**THE NATIONAL CASH REGISTER COMPANY**

**APPRENTICE RECORD CARD**

Name_____ Trade_____ Start_____ Finish_____

Address_____ Parent or Guardian_____

Attends Co-operative School, Commencing_____ Finishing_____ Section:_____

Attends Continuation School, Commencing_____ Finishing_____ Day_____

Attends U. of C. Commencing_____ Finishing_____ Section_____

TRANSFERS TO TAKE EFFECT AS FOLLOWS:

| Dept. | Date | Rate | Check Number | Dept. | Date | Rate | Check Number | Dept. | Date | Rate | Check Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Goes to school as { Co-operative apprentice, 2 years yet to go. / Continuation apprentice, 2 years yet to go. / University of Cincinnati apprentice, 5 years yet to go.

REMARKS:

FIG. 3.—Apprentice Transfer Card.

**Upgrading Courses.**—The provision for training repairmen and salesmen offer interesting examples of upgrading or promotional training.

Of the repairmen there are at present 140 following the course, which is ordinarily ten months in length, though if any young man exhibits extraordinary adaptability, he may graduate in as brief a time as

five months. This system of picking the best trained to be transferred to regular work irrespective of length of training acts as an excellent spur to attentive learning.

Those chosen for the course are carefully picked, as the company is at considerable expense in bringing each one up to the desired skill. Many of them are chosen from the assemblers in the plant and some of them are sent in from the company's branch offices.

The age limitations are twenty-one to twenty-five and single men are preferred. The pay while learning is fixed at the uniform rate of $25 a week.

Instruction is provided by an instructor, an assistant instructor, and an inspector for each group of 25 men. The instruction is sufficiently rigorous so that it is expected 50 per cent will be eliminated before completing the course. Each separate device is taught and then the assembling of the various models. It adds considerably to the extent of the course that construction of discontinued as well as modern models must be learned, as, of course, all types are met with in actual practice. After this preliminary instruction is covered, the students spend their time on repairing and rebuilding machines sent in for the purpose, until they are considered competent.

The supplementary instruction consists of an hour a day of motion picture and stereopticon lectures. In these are presented all phases of the work as fully as possible by that means.

Of course, there is a steady demand for all graduates and many find the work a stepping stone to an appointment as salesman, so that an opportunity to take the course is eagerly sought.

Somewhat similar methods are followed in the school for salesmen, although the course is somewhat briefer. Men for the purpose are selected largely by the district managers and put into the field for three months, six months, or a year. If the district manager then decides they are satisfactory material, they are admitted to the school.

Three sessions are held yearly with each group limited to 50 men and the length of the course to five weeks. Students' expenses, except transportation, are borne by the company. The school is in charge of one instructor who is an experienced National Cash Register salesman. There is a carefully prepared course of study which is closely followed. Written examinations are also given to assure that the men work. Diplomas are awarded to show that they have completed the course. After completing this instruction, the men return to the positions from which they came, with the expectation that improved sales will justify the time and cost of the course.

From 1903 to 1908 the policy of the company was to take new men who had made a success of their previous business, put them in school to learn this line of salesmanship and then place them in the field. As a result, but 26.4 per cent made good during that period. In 1908 the new policy was adopted of trying the men out in the field before putting them in the school. Some men do not like the business and quit before they get to the school. Others, the sales managing force do not find desirable and they are allowed to go before getting into the course. By the latter policy they have 78 per cent successful salesmen who have gone through the course.

(3) **Health and Safety Education.**—All progressive companies, particularly under the operation of employer's liability laws, are devoting increased attention to installation of safety devices and publicity campaigns to warn employees against dangerous or unsanitary practices, in all of which this company have been pioneers.

They have, however, also realized that chronic or temporary ill health or low vitality of an employee represents a loss to the company through absences and reduced production when at work. Therefore they have devoted a great deal of effort and money to health education as means of reducing these losses.

Twice a week there is provided a lecture or talk on Health and Safety which new employees are required to attend. This is illustrated by moving picture and steropticon.

In this are explained the assistance provided by the company toward promoting a healthful community and good working conditions: The Visiting Nurse, the Free Dental Clinic, and First Aid facilities. As safety instruction, concrete cases are mentioned of instances which have occurred in the plant where serious results have attended failure to utilize the accident prevention measures. The lecture is also considered a favorable time to present other aids to health and comfort of employees. Among these are bathing facilities, dining halls, the company's extension educational facilities, relief associations, and provisions for employees' social life.

Other lectures are frequently provided on special phases of hygiene as a part of the evening extension education of which a description here follows.

(4) **Evening and Noon Hour Instruction.**—Evening instruction has for a long time been provided under the caption of " Owl Classes." They are noteworthy not so much on account of their variety or numbers in attendance as for the definiteness and practicality of the instruction. Altogether there are 12 courses provided, with four to five hundred registering each year. There is a course on Advertising and Printing for the printers and pressmen, another is in Accounting, a third is in Agency Office Practice, while Mechanical Drawing and Shop Mathematics are provided for those who wish to advance themselves in the shops. Courses in Salesmanship have been particularly useful in aiding employees to enter that field. Other offerings are Public Speaking, Home Economics, and a Spanish Class. A former residence of the company's president provides the down town center for these classes.

At the plant a class for male stenographers has also been provided from four to five-thirty in the afternoon. This was attended by about forty.

Alongside of the factory there is the company's " Schoolhouse," which contains an auditorium seating 1,200 people. Here noon hour or evening movies or lectures are provided daily. Probably the chief virtue of this is the diversion provided, but it has been a convenient means for reaching the employees in the matter of health, community improvement by landscape gardening and the like.

As regards the matter of intensive training in this plant, no vestibule schools are maintained, but the idea of training on the departmental basis is part of the recognized scheme. Throughout the factory

72 " try-out " men or girls act as instructors. Each of these is a skilled mechanic or operative and part of their duties is to aid the operatives in bringing their work up to standard production.

*SECTION II*

# PROGRAMS EMPHASIZING APPRENTICESHIP

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## CHAPTER IV

## TRADITIONAL APPRENTICESHIP MODERNIZED

SEVERAL manufacturing companies in the United States have a long established record for the maintenance of apprenticeship. In general, it has been practiced as a profitable enterprise. It is, however, usually justified as a means of building up a group of loyal skilled workmen among whom can be found foremen with the right characteristics for responsibility and with a knowledge of the traditions and manufacturing methods of the company.

In general, it can be said that there seems to be in these companies conducting apprentice training departments a sincere effort to train skilled workmen. Capable men are ordinarily in charge of the apprentice departments. These are given authority to transfer the apprentices so that they will get experience at all types of machines. None of the five com-

panies cited in this chapter, however, have a separate training shop, which is becoming a prevailing practice in the larger corporations. All, however, provide a good school for the supplementary instruction and, usually, on the company's time.

### No. 14

### R. Hoe & Co. of New York City

R. Hoe & Co. are long established manufacturers of printing presses in New York city. For forty-eight years, since 1872, they have maintained an apprentice school to supplement the acquisition of a skilled trade by the traditional method of working alongside of journeymen at regular factory production.

Ninety per cent of the manufacturing administrative force are said to be graduates of the school as well as all of the 40 to 60 high grade men employed outside the factory in installing their presses. The school has thus high favor with the management of the company, a factor which greatly lessens the danger of exploiting the apprentices by keeping them at machines or processes long after they have completely learned them, as is frequently the case where foremen and managers are not themselves apprentice trained. It is said that overtime production is not allowed to interfere with attendance at the school and that apprentices are never laid off during even the dullest seasons.

To be accepted as an apprentice a boy must be sixteen years to eighteen years of age and a graduate of the elementary school with the preference that he come directly from school rather than after a series of

casual employments during which, their experience leads them to believe, he too frequently contracts habits of insubordination and shiftlessness. In addition to educational requirements, a simple test for mechanical deftness is imposed by requiring the candidate to put together a mechanical construction toy.

A ratio of one apprentice to five journeymen cannot be exceeded by agreement with the machinists' union. On this basis there were on April 16, 1920, when the investigation was made, 173 apprentices. About 60 apprentices are taken on each year, the mortality being heaviest during the first two years.

Apprenticeship is offered in the following trades:

| | | | | | | |
|---|---|---|---|---|---|---|
| Foundry | with 3 | years' | course | and | 2 | enrolled |
| Machinists | " 4 | " | " | " | 160 | " |
| Electricians | " 4 | " | " | " | 1 | " |
| Sawsmiths | " 3 | " | " | " | 5 | " |
| Patternmakers | " 5 | " | " | " | 5 | " |
| Total | | | | | 173 | |

Over 90 per cent of the enrollment is seen to be in the machinists' trade.

Rates of pay for machinists' apprentices are as follows:

| | | | |
|---|---|---|---|
| | 1st year 16¢ per hour | $ 7.04 | per wk. |
| | 2d year 24¢ " | 10.56 | " |
| | 3d year 42¢ " | 18.48 | " |
| 1st six months | 4th year 56¢ " | 24.64 | " |
| 2d " " | 4th year 70¢ " | 30.80 | " |

**Shop Work of Apprentices.**—The shop schedule of the foundry apprentices is outlined as follows: six months helping moulder on the floor, tempering sand, etc.; six months coremaking; six months on bench;

nine months on floor; and nine months on dry sand work. Total, three years.

For the machinists the schedule is divided into four groups. Group No. 1 is for one month at " General " work, Tool Room or Cutting-off machines. Group No. 2 is at Drill Press two months, Vice, two months; Boring Mill, two months, and Key Machine and Hand Monitor, two months, or Slotter, two months. Group No. 3 is at Planer, six months; Gear Cutter, six months; Miller, five months; Lathe, ten months. Group No. 4 is at erecting, twelve months. Total, forty-eight months.

Sawmaking is to be considered a special phase of smithing and an interesting example of surviving hand craftsmanship in industry. The apprentices spend the following periods on the various classes of work: Anvil, six months; Punching, three months; Repairing saws, three months; Shanks, three months; Bit Room, three months; Setting and Filing, six months; Hardening, six months; Anvil, two years six months. This implies that five years are required before reaching full journeyman's standing.

The Patternmakers serve for two years at various classes of work under a master patternmaker followed by nine months in the foundry to learn the difficulties encountered in casting from a pattern, in order that their patterns may be so constructed as to meet these difficulties. They then return to the pattern shop to complete their time.

**School Work of Apprentices.**—At considerable expense the apprentice school has been installed in a section loft equipped with three classrooms, a drafting room and a library, besides a lunch room. The lunch

room was installed so that coffee and sandwiches could be given the boys in the intermission between the closing of the shop at five and the classes which begin at 5.20 and end at 6.45.

The school personnel consists of a supervisor, a drafting instructor and three teachers who handle the mathematics, English, and Mechanics. The supervisor, who divides his time between directing the school and office work in handling the installation crews, is himself a graduate of the school. The drafting instructor is drawn from the company's drafting room staff and the other instructors are technical graduates with positions in the city but not otherwise in the company's employ.

Owing to the relative large size of the school with all students pursuing a uniform course, instruction can be graded to suit the previous training of the apprentice and to provide instruction suited to his attainments, no matter at what time of year he may enter the school. For this reason the curriculum is cut into seven units designated as C-3, C-2, C-1, B-3, B-2, B-1, and A. Ordinary students are expected to complete this in three years, the C units their first year, B units their second year, and A their third year.

The weekly time division is as follows:

| | | |
|---|---|---|
| Class C–3 | | |
| First night. | Freehand Drawing | 1 hour |
| | Mathematics, Review of fractions, decimals, ratio, square root, etc | ½ " |
| Second night. | Mathematics | 1 " |
| | English, Oral and written composition. Punctuation and general expression of thought | ½ " |

| | | |
|---|---|---|
| Third night. | English | 1 hour |
| | Mathematics | ½ " |
| Class C–2 | | |
| First night. | Freehand Drawing | 1 " |
| | Mathematics, Mensuration, Simple equations in Algebra, Problems illustrated by freehand sketches | ½ " |
| Second night. | Mathematics | 1 " |
| | English continuation of C–3 | ½ " |
| Third night. | English | 1 " |
| Class C–1 | | |
| First night. | Drawing—Mechanical drawing commenced. | 1 " |
| | Mathematics, Constructive Geometry. Only such problems considered as can be done with the aid of compass and straight-edge. | ½ " |
| Second night. | Mechanics—Heat, Air, Liquid, Power and work with problems and experiments requiring simple apparatus | 1½ hours |
| Third night. | English continued | 1 hour |
| | Mathematics | ½ " |
| Class B–3 | | |
| First night. | Mechanical Drawing continued | 1½ hours |
| Second night. | Geometry, theoretical with proofs of simpler problems. Trigonometry of the right triangle. Use of tables of Natural Functions | 1 hour |
| | English—Written work, description and exposition | ½ hour |
| Third night. | Mechanics. Mechanical forces and Friction. | 1½ hours |
| Class B–2 | | |
| First night. | Mechanics—Gear teeth and gearing | 1½ " |
| Second night. | Mechanical Drawing—Gears showing characteristics of involute and cycloidal teeth in the general method of designing | 1½ " |
| Third night. | Mathematics—Strength of materials especially applied to proper proportions and materials for machine parts | 1 hour |
| | English continued | ½ " |
| Class B–1 | | |
| First night. | Mechanical Drawing. Freehand sketching. Demensioning and lettering of plans, sketches and data for making prints | 1½ hours |

| | | |
|---|---|---|
| Second night. | Mechanics—Power transmission as used in a factory. Pulleys, shafting, belting, gearing. Electricity—what it is and how it operates | 1 hour |
| | English—Report writing and similar work | ½ " |
| Third night. | Mechanics continued | 1½ hours |

Class A

| | | |
|---|---|---|
| First night. | Mechancial Drawing. Freehand detail drawings for the different parts of a simple machine such as Belt Shifter arrangement and from these make up a general assembly | 1½ " |
| Second night. | Mechanics—Essentials of Machine Designing | 1½ " |

Careful records are kept of the progress of the apprentice, both in his shopwork and in the apprentice school, term reports being sent to the parent and prizes being conferred on those with the best records in both shopwork and school at the annual closing exercises held in June.

The apparent high quality of the apprentices in this plant and the generous provision for their instruction, both in the shop and school, would lead one to believe that the management is employing considerable effort in the training of its future mechanics. The program may be commended as an example of satisfactory modernized apprenticeship.

## No. 15

### The Pratt and Whitney Co., Hartford, Conn.

The Pratt and Whitney Co. has provided apprentice training for fifty-three years. Previous to 1916, for two or three years the boys were sent for supplementary training to the continuation school provided by the public school authorities of the city of Hart-

ford; but, finding the arrangement unsatisfactory, the company again organized its own apprentice school.

There are at present 50 boys in the course. Most of them are in the machinist's trade with a four-year agreement, though there are several draftsmen, usually high school graduates, for whom the course is three years in length, and also one or two in the pattern-maker's trade.

A supervisor who is a technical graduate with an extended shop experience with this company, is employed on full time to conduct the school. With one assistant he teaches the supplementary classes one-half day a week to each with instruction in mechanical drawing, shop-mathematics and science likewise related to industry.

The apprentice wage rate is as follows: 23 cents per hour for the first year; 25 cents for the second; 28 cents for the third; and 32 cents for the fourth, all being based on a forty-eight hour week. A one to six cent bonus is also paid, two to four cents for excellence in shopwork, and one to two cents for scholarship. A $100 bonus is paid at the completion of the course, when promotion is made to the standard wages of the shop.

The equipment of the apprentice school seems notably good. One might mention, for example, the library, a piano, a projectoscope, and standard drafting room equipment. The school area is partitioned off from a section of the plant originally equipped with a variety of machines as a training department, which it seems unfortunate has not been continued to provide initial training for the apprentices.

## No. 16

### Brown and Sharpe Manufacturing Co., Providence, R. I.

No discussion of apprenticeship in the United States would be complete without consideration of the apprentice school provided by the Brown and Sharpe Company. This well known firm, manufacturing machine tools, in order to maintain the quality of its products has been equally concerned in maintaining by apprenticeship the quality of its mechanics. The management is justly proud of its record that for over seventy years apprentices have been trained in their employ.

At present, among a working force of seven to eight thousand employees, there are 200 apprentices, a number which it was stated, however, is at the present time being increased. These are distributed as follows:

| | |
|---|---|
| Machinists | 150 |
| Draftsmen | 23 |
| Patternmakers, Coremakers, Moulders, and Blacksmiths | 27 |
| Total | 200 |

In addition to these there are 25 students employed in the drafting and machine shop departments on the half-time basis through co-operation with the local technical high school.

The supervisor of apprentices states that their records show that 95 per cent of those who sign the indenture agreement remain throughout the course

and that 75 per cent of those who start the trial period finish to graduation. This suggests that the conditions of apprenticeship here provided are satisfactory to the young men in training.

An apprentice school is provided, with classes during work hours, having one two-hour session a week during the first two years of apprenticeship and with two two-hour sessions weekly during the third and fourth years. In order to provide for sufficient individual instruction, the size of these classes is limited to 18 students in each.

A far more careful analysis has been made of all the operations involved in the trades being taught than was found in any other plant visited. Against this analysis the shopwork of the apprentice is checked to insure that not only is the apprentice transferred from one department and one machine to another, but that experience in all useful operations is covered. This requires a considerable amount of recording and use of files which the management believes is justified in order that every element of the trade may be taught. There are also shop instructors provided not to relieve the foreman of any responsibility to the boys, but to act as an additional help to both.

The school course is in the form of lesson sheets, on which the work is done by the apprentices. These become their property at the completion of their apprenticeship, so that they can make use of them in their later work. As far as possible it was stated that there is correlation between shop and school work during the course of apprenticeship. "Problems are approached from a standpoint somewhat

different from that which is usual. Without the use of text-books, and without the learning of rules and formulas, problems are presented as they would arise in the shop, except that they are in regular sequence as to subject and difficulty. They are taken up with such reference books and tables at hand as should be in the possession of intelligent workmen, and the boys are taught to use such means to solve the problems. They are not taught algebra, geometry, trigonometry, etc., as such, but are instructed in the applications of the principles of these subjects to the practical problems of the shop."

One interesting record kept of the apprentice is that of his interviews with company officials. During his last two years of apprenticeship, every six months he has an interview with a company official, who endeavors to discover his possibilities and interests. The impressions received from these interviews form a series of four letters which are filed with the cumulative record of the apprentice. These interviews are intended to serve in enlisting the loyalty of the apprentice to the company through an assurance of their personal interest in his welfare and probably often aid in locating promising material for more rapid promotion.

Apprentices are rated "Excellent," "Good," "Fair," and "Poor," based on work in the shops, class record, deportment, attendance, etc. Those rated "Excellent" or "Good" are rewarded by an hourly bonus varying in amounts up to four cents an hour. Upon this basis rates are at present in force as follows:

| | 1st Yr. | 2d Yr. | 3rd Yr. | 4th Yr. |
|---|---|---|---|---|
| Machinists and Pattermakers | $.20 | $.23 | $.28 | $.34 |
| Good bonus | .01 | .02 | .02 | .02 |
| Excellent bonus | .03 | .04 | .04 | .04 |
| Moulders: | | | | |
| Regular | .28 | .32 | .38 | 3 yrs. course |
| Good bonus | 02 | .03 | .03 | |

| | 1st 6 Mos. | 2d 6 Mos. | 3d 6 Mos. | |
|---|---|---|---|---|
| Core Makers | | | | |
| Regular | $.26 | $.28 | $.32 | 1½ yrs. course |
| Good bonus | .02 | .02 | .02 | |

| | 1st 10 Mos. | 2d 10 Mos. | 3d 10 Mos. | |
|---|---|---|---|---|
| Draftsmen | | | | |
| Regular | $.24 | $.30 | $.36 | 2½ yrs. course |
| Good | .02 | .02 | .02 | |
| Excellent | .04 | .04 | .04 | |
| Blacksmiths | | | | |
| Regular | .28 | .32 | .36 | 3 yrs. course |
| Good | .02 | .03 | .03 | |

The machinist and drafting students of the half-time course in which the company is co-operating with the technical high school receive the same pay for their time in the shops and drafting offices as the corresponding year of the machinists scheduled above.

The company carries out a policy which is not usual in apprenticeship of permitting machinists, moulders,

and coremakers to work at piece work or contract work after the first period of initial training. The supervisor states, however, that this system is not permitted to prevent the transfer of the apprentice even though such transfer would entail a financial loss to the apprentice. The customary piece work rate is 75 per cent of journeyman's rate for the same work.

The company carries out an invariable policy of requiring an indenture agreement which conforms to the usual practice in most respects. The one noteworthy exception is that the apprentice, or rather his father or guardian, is required to pay $50 at the end of the three months' trial period as compensation for acceptance of the young man as an apprentice. The apprentice is also required to purchase a set of apprentice tools costing $11. Correspondingly, the bonus paid at the end of apprenticeship to four-year apprentices is $150. The fee required of drafting, foundry, and blacksmith apprentices is $25 and the bonuses are reduced to correspond to the period of training. The reputation of the company for providing good apprenticeship permits them to make this charge and still secure the more capable young men as apprentices. On the other hand, it probably deters the less serious-minded fellows from starting apprenticeship and provides an incentive to those signing the contract to complete their course, in order to recover their investment by receiving the bonus. That the requirement of the fee may not work a hardship to a worthy boy when he cannot pay the fee outright, he is permitted to make a part payment and to pay the balance in weekly installments.

Another factor which may well be noted is that the year for computation of period of service is considered to consist of 2,450 working hours, which, with the usual working week of 50 hours, is equal to 295 working days, which allows the apprentice a considerable period each year for recreation which may be taken at such time or times as the company may direct.

The employment of technical high school students on a half-time basis offered an opportunity to compare the relative advantages of the co-operative system with regular apprenticeship. The co-operative plan is that of one week in school and one week in shop, provided by pairing boys so that while one is in the plant his alternate is in school. It will be seen that there is no tendency to displace regular apprenticeship by this system, as there are only 25 part-time machinist and drafting students to 150 machinist and 23 drafting apprentices. On the whole, it seems to work better in the case of draftsmen, who cannot well obtain too much technical and general education, and does not there offer any serious difficulty if one member of a pair of alternates drops out. This is a more serious matter in the case of the machinists as, with a well laid out system of progress through the shops, it is not desirable to pair one boy who has, let us say, advanced to the third or fourth year of the course with one just beginning. It was not the opinion of the apprentice supervisor that the co-operative students were more likely to advance ultimately more rapidly than regular apprentices by reason of their more extended general education, though he appreciated the value of good general education promised by the longer continuance in school.

## No. 17

### The Warner and Swasey Company, Cleveland, Ohio

The Warner and Swasey Company offer a superior opportunity for apprentices to learn the machinist's trade. Altogether, they employ 89 apprentices among their working force of 1,400 employees. Forty to sixty are taken on each year and, during the last four years, 41 have graduated, which is thus at an average of about 10 per year. The mortality of apprentices is particularly heavy during the trial period, as an especial effort is made to eliminate all but those who show superior effort and adaptability.

The staff of the apprentice department consists of three men and one supervisor. These have been selected for their technical and mechanical skill and it is believed offer a superior quality of instruction.

The following facts were presented by the management as outlining the conditions of apprenticeship with the company:

No boy under 16 or over 20 years of age is admitted.
A grammar school education or its equivalent is compulsory.
The course consists of four periods of 2500 working hours each.
The hour rate of wages is 25¢, 27½¢, 30¢, and 32½¢, 35¢, 37½¢, 40¢, 42½¢ for each six months respectively for the four years.
Each week's schedule includes 45 hours shop work and 4 hours school work for which wages are paid.
All apprentices work in the following departments of the shop under systematic schedule:

| | |
|---|---|
| Drill Press | Planing |
| Milling Machine | Assembling and Erecting |
| Lathe | Fitting |
| Turret Lathe | Small Tool |
| Tool Room | Grinding |

The four years' course of study embraces Practical Arithmetic, Algebra, Geometry, Trigonometry, Mechanical Drawing, Machine Designing, Physics, Chemistry, and Structure of Metals, Business English, Shop Practice, and Strength of Materials.

An Apprentice Club, affording pleasant social and athletic features, is an additional privilege.

Quarterly reports, giving in detail a complete record of each apprentice's work, are mailed to parents.

Three evenings of home work on school problems are required each week.

A bonus of one hundred dollars ($100) is paid upon completion of apprenticeship, which, with the wages, makes a total earning of three thousand one hundred dollars for the four years.

All graduates, according to their capacity, have first opportunity for all important and responsible positions with the company.

A good paying position is guaranteed a boy upon finishing his course.

However, no boy, upon completion of his course, is compelled to stay, but is free to go wherever he desires.

When an apprentice graduates, a diploma is given him, also a gold pin with the Company's trade mark on the face, and the graduate's name and date of graduation engraved upon the back.

## No. 18

### Yale and Towne Manufacturing Co., Stamford, Conn.

The Yale and Towne Manufacturing Company maintain an Apprentice Training School and a Training School for Productive Employees, both being under the supervision of the Director of Training Schools. The apprenticeship system was established upon the present well organized basis in 1908. There are in the employ of the company about 5,500, of whom a large proportion are of course specialist operatives on the various products of the company, chief among which being the locks and builders' hardware for which the company is so well known.

In the extensive mechanical equipment required there is, however, offered a large opportunity for

training in the tool and diemaking trades. This has occasioned the equipment of separate tool shops for training apprentices. These separate training shops offer the distinctive feature of this apprentice department.

More than one hundred apprentices are at present in training, most of them in the tool and die making courses. Those in other trades include metal patternmakers, tool designers, product draftsmen, power and plant draftsmen, electricians, screw machine operators and specialists in heat treatment of steel.

The courses in screw machine operating and heat treatment of steel cover three years, all other courses being of four years' duration. There is also an apprentice agreement entered into between the boy's guardian and the director of the school as representative of the company.

As nine-tenths of the apprentices are in the tool and diemaker's course their training will first be considered. During the first three or four months a very commendable attempt is made to provide a real trial course, and to that end the work is as varied as it can well be made for beginners. There is much elementary instruction in the care and handling of machine tools and the grinding of cutting tools. With this is provided the varied experience in roughing out of regular stock tools and some operations in the manufacture of small machine parts upon which an estimate can be made of the mechanical capacity of the potential apprentice.

If the young man proves acceptable the next fifteen months are spent on tool work which has been graded into three classes for lathe, three for milling machines,

two for grinders, and one for planer and shaper. Each apprentice completes a definite amount of work in each class but does not cover two classes on the same machine in succession. The purpose of this intermittent training on the various machine tools is to give the apprentice during the early part of his course, a thorough training in the handling of the machines used in his trade. As valuable experience in other types of work each apprentice from this room also completes one month in the millwright department, two weeks in the belt room, two weeks on steam fitting and five weeks in the grinding department.

The next sixteen months are in a separate training shop at more advanced tool work on stock tools. Here the apprentices carry each job through all operations to completion. Work is graded into six classes, and an apprentice is advanced from class to class as rapidly as his ability warrants. During this stage of his training the apprentice has the very valuable experience of one month in the hardening room.

Having thus concluded the time assigned to separate training shops, during the final year of apprenticeship the young man is sent into either the main tool room or die room where he works under the usual shop foremen.

In metal patternmaking the practical experience must of course be gained in the patternshops. However, for at least one month the apprentice is assigned to the iron foundry and likewise to the brass foundry.

For the draftsmen there is a differentiation into machine and tool design, product designing and power and plant drafting. Apprentices in machine and tool design are selected from the tool and die making

course because of their special talent for this work. These apprentices and also the apprentices in product design receive special training in patternmaking, foundry work, and product assembling. The apprentices in the power and plant drafting course receive training in all branches of the power and plant maintenance department including millwrighting, steam fitting, power plant operating, electrical construction, and building layouts.

Finally the one or two apprentices who are working up in electrical construction are given a varied experience in all the power and plant departments and in each machine shop.

This varied basic training is in all cases supplemented by four to five hours per week of technical instruction on the company's time. This instruction is provided in an amply equipped school room under a trained technical instructor.

The following subjects are scheduled with subject matter varied as much as possible to suit the special requirements of each group:

| | |
|---|---|
| Mathematics | Machine and tool design |
| Mechanical drawing | Shop talks |
| Mechanics | Electricity |
| Business English | Metallurgy |
| Talks on subjects of general interest | Chemistry of Iron and Steel |
| | Design of screw-machine cams. |

Training in the regular departments must, of course, be by the shop foremen of those departments but in the special training departments it is given by five specially selected instructor-foremen.

Apprentice pay is now at the following wage rates: 19, 20, 22, 24, 27, 30, 33, and 40 cents per hour for

each of the six months periods into which the course is divided, the rates for the three-year courses ranging from 22 to 40 cents per hour. At the conclusion of the course the usual $100 bonus is paid and a certificate of apprenticeship is conferred.

For the training of both women and men as specialists in the production departments there has been some development of the vestibule school idea. This is also under the director of training schools and is, of course, varied in length to correspond to the difficulties of the particular operation to be learned and to the capacity of the learner in acquiring the necessary skill. During this learning period a fixed minimum wage is paid until standard production is reached and the worker is transferred to regular production and the established piece rate wages.

## CHAPTER V

## SOME SMALL APPRENTICESHIP DEPARTMENTS

THE four apprenticeship departments here described have been studied in an attempt to discover the form which apprenticeship may be expected to take, if conditions are such as to warrant the employment of only a limited number of apprentices.

Each employs the method of transfer from one machine to another at regular production to provide the shop experience. For the supplementary instruction the Air Brake Company utilizes the facilities provided by the Young Men's Christian Association; the Weston Company has a public school teacher provide the desired shop arithmetic and drawing on Saturday mornings. The other two companies have their own school instructors, who also act as supervisors. Provided a man with satisfactory qualifications can be secured, this would seem the preferable plan. The De la Vergne Company accomplishes this by utilizing for this instruction a young engineer who also acts as assistant production manager.

### No. 19

THE WESTINGHOUSE AIR BRAKE CO., WILMERDING, PA.

In the plant of the Westinghouse Air Brake Company, employing a total of about 4,500, there is a

small but, judging by results, highly efficient apprenticeship department with an enrollment of 30 young men distributed among the three usual trades as follows:

| | |
|---|---|
| Machinists | 26 |
| Patternmakers | 2 |
| Moulders | 2 |

This provides a reasonable ratio of nearly one in five to the 150 toolmakers employed, but is only at the ratio of one in twenty-five to the 50 patternmakers in the works, a ratio which must be recognized as too low, since at least one apprentice to eight journeymen are quite evidently necessary to provide for replacements. As regards moulders, here as in general, it has been found impossible to persuade sufficient apprentices to learn the trade in order to even provide for foreman replacements.

The general provisions for apprenticeship are under the direction of the Supervisor, who devotes all his time to this work. He is considered one of the best mechanics in the plant and is apprentice trained. Much of the credit for the satisfactory showing of the department should be given to him. The following quotations from his program show the general plan followed:

"The machinists and patternmaking apprentices are indentured for a period of four years, 10,000 hours. The moulders' apprentices are indentured for three years, 7,200 hours. There is another class of special apprentices who are graduates of approved technical schools, and whose apprenticeship covers a period of two years (but none are at present enrolled on this latter basis).

"The first class, or regularly indentured apprentices, are required to be at least sixteen years of age, of good reputation, and physically suited to follow the trade. All applicants are requested to

present themselves for personal interview. If his general appearance is favorable and he appears to have an aptitude for mechanical work, he is required to take an examination in Arithmetic, Spelling and Writing, and must have a mark of at least seventy per cent efficiency in each study. Accuracy is one of the essential requirements in these examinations. For instance, if the applicant solves a problem, the solution must be correct in both principle and result to receive credit. In other words, if an error in multiplication is made, the applicant receives no credit whatever for the solution of that particular problem. In addition to these examinations inquiry is made of the Principal of the school from which the candidate comes as to his efficiency and general behavior, also as to how the candidate spends his evenings.

"If successful in the above examinations, he is asked to fill out an application blank which afterwards must be signed either by the parent or the guardian. If the application is accepted, he is indentured for class work after which arrangements are made for him to commence work. The indentured forms are made out in duplicate, one copy for the parent or guardian of the apprentice, and the other for the record and file of the Westinghouse Air Brake Company. As stated in the indenture, the first three months of service are considered as a probationary period, the continuation of the apprenticeship depending upon the progress of the apprentice in shop and school.

"The wages are based upon an hourly rate which is as follows:

"*Machinists' and Patternmakers' Rate.* The first six months, 14¢ per hour; the second six months, 17¢ per hour; the third six months,, 19¢ per hour; the fourth six months, 22¢ per hour; the fifth six months 25¢ per hour; the sixth six months, 28¢ per hour; the seventh six months, 35¢ per hour; the eighth six months, 42¢ per hour. In addition to these wages the apprentice receives bonuses as follows: provided his shop and class work records are seventy per cent or above: First year, $25.00; second year, $40.00; third year, $75.00; fourth year, $100.00; or a total of $240.00 in bonuses for the four years.

*Moulders' Rate.* The first year, 22½¢ per hour; the second year, 31¢ per hour; the third year, 39¢ per hour. In addition to these wages the apprentice receives bonuses as follows, provided his shop and class work records are seventy per cent or above: First year, $50.00; second year, $100.00; third year, $150.00; or a total of $300.00 in bonuses for the three years.

"Reports showing the number of hours worked and the class of work performed, also showing the shop progress of the apprentices (signed by the Department Foreman, afterwards signed by the apprentices themselves), are made out on a special form and forwarded the first of the following month to the General Superintendent for approval, after which they are entered upon the office records. This arrangement requires the apprentice to sign his own record and no records are made concerning any apprentice which are not read and signed by the apprentice. Every month a statement is forwarded to the parent or guardian of the apprentice showing the averages attained by the young man in his studies at the apprentice school, which is conducted by the Educational Director of the Wilmerding Young Men's Christian Association, assisted by an engineer from the Engineering Department of the Westinghouse Air Brake Company; also at the end of each quarter a report is mailed showing the school average for the three months and also the progress of the apprentice in the shop.

"In the shop the apprentices are under the care of the Supervisor of Apprentices, also under the foreman of the Department in which the young man may be working, but the Supervisor of Apprentices has general charge of all the apprentices and if they have difficulties to overcome they feel free to go to him for help and instruction. Thus there is someone in charge of the apprentices to see that they receive the proper kind of shop training which finally results in efficient workmen.

"The machinists' apprentice work in the shop is apportioned approximately as follows: drill press, two months; lathe, nine months; shaper, one month; planer, two months; bench, twelve months; boring mill, three months; milling machine, nine months; drawing room, six months; and test department, four months. Total number of hours for four years, 10,000.

"The patternmakers' apprentice work is apportioned as follows: Sand papering, varnishing and plain turning, six months; plain bench work, six months; mechanical drawing (Engineering Office), six months; helping moulder and coremaking (Iron Foundry), six months; pattern shop, advanced work, twenty-four months. Total number of hours for four years, 10,000.

"The moulder's apprentice work in the Foundry is apportioned as follows: Core making (Iron Foundry), 1200 hours; cupola,

200 hours; bench moulding, 700 hours; general moulding, 4,900 hours; general moulding (Brass Foundry) 800 hours. Total number of hours for the three years, 7,200.

"The Westinghouse Air Brake Company, recognizing the importance of the apprentice advancing as far as possible in his school work, instituted a day school educational department, in connection with the apprentice system which has been in force since September, 1906, with very satisfactory results. The school work is conducted, as before stated, in the Wilmerding Young Men's Christian Association, and amounts to approximately eight hours per week for each apprentice running nine months of each year of the four years, September to July. The regular shop hourly rate is allowed while attending school."

The amount of class work is shown by the following schedule in which the figures represent the number of hours in recitation per week:

| | Monday | Wednesday | Friday |
|---|---|---|---|
| First Year | Algebra (1)<br>Arithmetic (1)<br>Spelling (1) | Algebra (1)<br>Arithmetic (1)<br>English (1) | Mechanical Drawing (4) |
| Second Year | Algebra (1)<br>Physics (1)<br>Spelling (1) | Algebra (1)<br>English (1)<br>Shop Math. (1) | Mechanical Drawing (3)<br>Slide Rule (1) |
| | Tuesday | Thursday | Friday |
| Third Year | Geometry (1)<br>Physics (1) | Shop Math. (1)<br>Physics (1)<br>Geometry (1) | Mechanical Design (1)<br>Slide Rule (1)<br>Shop Math. (1) |
| Fourth Year | Geometry (1)<br>Electricity (1)<br>Trigonometry (1) | Business English (1)<br>Trigonometry (1) | Geometry (1)<br>Mechanical Design (3) |

One interesting feature in connection with the class work is that these classes are conducted the first hours in the morning, so that the apprentice who has class work will come into the class before he goes into the shop for the day, a feature which should result in better recitations. Also it will be seen that the apprentice is allowed three mornings a week for this school work.

"Upon satisfactorily completing the terms of the indenture, the apprentice is given a diploma properly filled out signed by the officers of the Westinghouse Air Brake Company designated and the company seal attached to the diploma."

The quality of the instruction in the shop and school is best shown by the product. This may be gauged from a tabulation by the Supervisor of the exact location of each graduating apprentice under date of February 6, 1919, which includes all of the 74 graduates with the exception only of four whose location could not be discovered. The writer has summarized this record as follows:

| | | |
|---|---|---|
| *Number completing each course* | | |
| Machinists | 61 | |
| Patternmakers | 7 | |
| Moulders | 1 | |
| Special course in Mechanics | 5 | |
| Total | | 74 |
| *Present employment of these graduates* | | |
| Administrative | | 14 |
| General Manager | 1 | |
| General Superintendent | 1 | |
| Assistant General Managers | 2 | |
| Manager | 1 | |
| Superintendents Tool Design | 2 | |
| Foremen | 6 | |
| Assistant Foreman | 1 | |

| | | |
|---|---|---|
| Technical | | 18 |
| Layout Engineer | 1 | |
| Efficiency Engineer | 2 | |
| Mech. Engineers and Tool Designers | 3 | |
| Instructors Manual Training | 2 | |
| Steel Inspectors | 2 | |
| Physical Laboratory | 3 | |
| Draftsmen | 3 | |
| Machinery Salesman | 1 | |
| Clerk, Cost Department | 1 | |
| Skilled Trades | | 34 |
| Machinists | 18 | |
| Toolmaker | 6 | |
| Patternmakers | 6 | |
| Diemaker | 3 | |
| Installer and Demonstrator | 1 | |
| Miscellaneous | | 2 |
| Physician | 1 | |
| Farmer | 1 | |
| Deceased | | 2 |
| Whereabouts unknown | | 4 |
| Total | | 74 |

Another matter of interest brought out by this compilation of the present location of graduates is the proportion who have remained with the company. Of the 72 living graduates, the record shows that 29, or 40 per cent, are still in this same plant. This seems somewhat better than the condition in some plants and probably all that should be desired, as it is frequently to the apprentice's interest in acquiring a varied experience to take, upon completing apprenticeship, employment in several and diverse plants.

Analyzing the summary of present employment, we see that 14, or 20 per cent, are now holding execu-

tive or foreman's positions and that 13, or about the same percentage, technical positions; showing that, in view of the fact that all these apprentice graduates are still young men having in every case completed their apprenticeship since 1906, a very creditable number have found apprenticeship the first round of the ladder of industrial advancement. This may be accounted for in part by the careful selection of superior boys who would have gone ahead anyway; but, no doubt, in part by the greater amount of supplementary school training than is provided in many apprentice schools. It is believed, however, that much credit should be laid to the fact that good apprenticeship during the sixteen-to-twenty age-period provides the discipline and industrial intelligence that, for the purpose, cannot well be acquired by other means. Of the remainder, practically all are at skilled trades and many of these with maturity will doubtless advance to positions of responsibility, but even though they do not, are in highly useful and productive employment.

## No. 20

### Weston Electric Instrument Co., Newark, N. J.

The Weston Electric Instrument Company make high grade electrical measuring instruments. About 900 are ordinarily employed, of whom 60 per cent are men. Of these, a considerable number are instrument makers and at present 55 first grade toolmakers. Apprenticeship of a rather informal type is provided in the latter trade, in which there are at present 15 enrolled.

The number taken on varies with business conditions, but there is said always to be a waiting list. Entrance is at ages sixteen to eighteen, though they prefer that the boy begin directly upon leaving school. Good references are required and at least graduation from elementary school, though many have had one or more years of high school, which is considered desirable. No preference or advanced standing is given to graduates of the vocational school.

The third year may be spent in the drafting room, if the apprentice desires, but most, however, do not so elect. The remainder of the time is given to instruction under production conditions on machine and tool work in the tool department. Supplementary instruction is provided by a three-hour class in the shop on Saturday mornings in drafting and shop arithmetic. This is provided by a teacher from the city public school system.

The wages begin at 17 cents an hour, or $8.16 per week of forty-eight hours, and are scheduled by graduated increases every six months to advance to 45 cents an hour, or $21.60 per week, though as high as 65 cents an hour is being paid during the fourth year. A $100 bonus is also paid upon satisfactory completion of the course.

While no indenture is required, yet it is believed, upon observation of the large amount of individual supervision with the strong tradition favorable to apprenticeship founded in the fact that most of the foremen and administrative force are apprentice trained, that apprenticeship in this shop is producing good toolmakers.

## No. 21

### De la Vergne Machine Co., New York City

The De la Vergne Machine Company offers an excellent opportunity to study apprenticeship applied in a plant somewhere near the lower limit of practicability as regards the number of employees. About 200 first class machinists are employed with 40 apprentices in this trade. This includes 25 toolmakers in which special branch there is only 1 apprentice. Also, corresponding to their 20 patternmakers, are 3 apprentices. It is thus seen that a standard ratio of one in five apprentices to journeymen is maintained in the machinists' trade and of nearly one in eight among the patternmakers. The products of the factory are oil engines and ice machines, the manufacture of which offers ample variety of experience at the standard machines on the test floor and in assembling. This, no doubt, accounts for the fact that a system of apprenticeship has been maintained since the inception of the company in 1868.

The apprentices are under the general supervision of the assistant production manager, who is a young mechanical engineer and seemingly well fitted to handle the school which is provided to supplement the practical work. For the latter the apprentices are grouped under selected gang-bosses in the ratio of about one to six apprentices. A schedule card is kept of each apprentice, assignments being approximately as follows: As tool boy, 25 to 30 weeks; at cold saw, not more than 10 weeks, but eliminated altogether for most boys; progress through different

engine lathes, 40 weeks; Gisholt turret lathe, 20 weeks; drill press, 20 weeks; milling machine, handy, 4 weeks; all sorts (including universal) at least 20 weeks; shaper or planer, 10 weeks; bench work and assembly, 10 weeks, but if the apprentice shows an aptitude and inclination to become a mechanical engineer, 25 weeks; boring mill, 10 weeks; test floor, if machinist, 15 weeks, but if specializing on gas engines, 30 weeks; at forge and steam hammer, 5 weeks; and in the foundry, 3 weeks. Regular periodical ratings are made of progress as regards workmanship, deportment, and in the class work in mathematics and drawing.

For this class work the apprentices are divided into two groups of about twenty each with regular assignments in the excellent texts at present available, in shop mathematics for two hours a week and in drawing for a second two-hour session. As there is considerable variation in the advancement of the apprentices, the instruction of the advanced students is largely individual, though the four hours of school are required of them the same as for beginners.

Compensation reflects the improved rates of pay of machinists. As recently as 1912 the apprentice started at eight cents an hour with two-cent increases every six months to a maximum rate of 22 cents. The rate now starts at 22 cents with an increase of 2 cents every three months, reaching a maximum of 52 cents in the last period of the fourth year. Upon graduation, a certificate is conferred and a bonus of $200 is paid while full advancement is made to first class journeyman's rating.

Another phase of employee instruction provided in

this plant has been voluntary trade extension classes, after-work for the adult workers, which are not in operation at the present time, owing to lack of available space for holding them, but which are to be resumed in the early fall.

The method of administration is worth noting, as it seems to have met with general satisfaction. This consists in placing the responsibility for the conduct of the apprentice system in the hands of a committee of three members, made up of the Works Manager, the Supervisor, who is Assistant Production Manager, and a Journeyman Machinist in the company's employ and in whose choice the apprentices were consulted. This committee passes upon the apprentices at the conclusion of the trial period and signs the agreement then entered into, as well as the boy, his parent, or guardian, and the General Manager as representative for the company. It also may recommend changes in the procedure of apprenticeship and, in general, provide a clearing house for the discussion and initiation of any new features in the program.

The *esprit de corps* of the apprentice department is also promoted by encouraging athletics. Each season the boys have their baseball, football, and basketball teams, in which the usual amount of interest is taken by the management.

The general impression gained of the opportunity offered by the plant for apprenticeship is that the boy's interests are being considered, and that from the standpoint of the company apprenticeship is abundantly justified in spite of the relatively small numbers who can be provided for.

## No. 21

### Hyatt Roller Bearings Division, General Motors Corporation, Harrison, N. J.

The Hyatt Bearings Plant, employing approximately 4,500 men and women, has an Apprentice Department in which 38 boys are enrolled. A supervisor devotes his whole time to their instruction. The policy of the plant as regards apprenticeship is laid out by a committee of foremen and the superintendent of the mechanical division.

A schedule of transfers has been drawn up as follows: Miscellaneous, two months; Drill Press, one month; Lathes, ten and one-half months; Shaper and Planer, three months; Milling machine, ten and one-half months; Automatics, one month; Bench Work, nine months; Tool Grinding, two months; Surface, External, Internal, and Universal Grinding, one month each; Gauge Making, three months; and Drafting Department, two months.

Supplementary instruction for two hours per week during work hours is provided, the time being chiefly devoted to reciting and receiving assignments on Shop Arithmetic and Drafting, the preparation of which must be done outside of the class.

Rates of pay begin at 15 cents an hour with increases every three months until 40 cents an hour is reached in the last six months of the fourth year. Upon completion of apprenticeship, a bonus of $150 is paid and a set of tools and the Machinist's Handbook is presented to the graduate. Also the $25 deposit required upon signing the agreement is returned.

To insure that the schedule of training laid out above is substantially carried out, a monthly report card is filled out and signed by the foreman under whom the apprentice is employed, after which it is tabulated and filed by the supervisor. The quarterly report is made out every three months and sent to the boy's parent. Upon this record "Excellent" was said to correspond to 100 per cent, "Good" to 75 per cent, "Fair" to 50 per cent, and "Poor" to 25 per cent.

One means used in this plant for creating an *esprit de corps* among the apprentices is the provision of a button which is worn by all apprentices and graduates. Another is to organize the graduates as an Apprenticeship Committee which votes on all matters pertaining to the course. These graduates exercise this function until replaced by other graduates. Athletic teams are also formed among the apprentices, which are managed by officers elected by the student body. Also, there is a provision of two visiting days each year, when student's parents and relatives are invited to visit the plant and see the students at their work and in classroom.

## CHAPTER VI

## APPRENTICESHIP IN SHIPBUILDING

THE apprentice program of the Fore River Shipyard and of the Brooklyn Navy Yard are alike in their thoroughgoing acceptance of the principle of apprenticeship. They both extend the policy to all trades or crafts employed in the respective plants. In the case of the Fore River plant there is an attempt at the closest correlation of shop and school instruction extending, where possible, to the utilization in both the school and shop of the same instructor. In the Navy Yard, on the other hand, the two are wholly distinct with no encouragement even for co-operation. The school instruction is provided by the public school system and need have no relation to the work progressing in the shop.

An intermediate plan would seem desirable, with the problems of school instruction based on the actual job experience of the craft involved. There are, however, serious difficulties of administration encountered, if we attempt to utilize these shop instructors for the school instruction. One difficulty is that a good shop instructor does not necessarily have the requisite academic training to handle the book instruction. It may be desirable, for example, to teach some drawing and the shop instructor may have only an indifferent

grasp of blue print reading. He may be able to handle the arithmetic actually utilized in his trade, but be unable to teach the elementary trigonometry and the algebra and geometry requisite to satisfactorily teach the angle functions. In short, for the school instructor some technical training coupled with shop experience and teacher training seems desirable, which can best be provided by school instructors ordinarily technically trained provided for that purpose. This may, however, be to a large degree obtained by the careful selection of the shop instructors and their training for the purpose, as is the plan of the Fore River Ship Yard.

The two programs should be contrasted with study No. 27 of the Submarine Boat Corporation, where intensive training rather than apprenticeship is wholly employed. In the latter case the work has been reduced to the standardized product and the specific operations required of the various specialists employed can be taught in a relatively short time.

## No. 23

### Bethlehem Shipbuilding Corporation, Fore River Plant, Quincy, Mass.

The Fore River Shipyard is probably the first plant engaged in shipbuilding in America to introduce apprenticeship for training its craftsmen when they enter the trades required in the shipbuilding industry. This has been their established policy since 1900, but since the conclusion of the Great War their well organized department of apprenticeship has been under the process of being enlarged and improved.

The outstanding characteristic of this newer apprenticeship program is the provision of special instructorial training for the sub-foremen under whom the apprentices are employed for their practical work who are also to provide the supplementary school instruction. To bring this about, sub-foremen who were considered most adaptable to the job of apprentice training were selected from the various crafts required in the yards and put through a rigorous course of instruction for the additional job of teaching their respective trades. For this purpose the supervisor of apprentices got them together two nights a week after the day's work for about six weeks and from four until nine o'clock they studied the problems of trade teaching. With the help of the supervisor, each went through his trade and drew up an analysis of all the operations involved, and linked up with each one the technical problems which were to be taught in the supplementary or apprentice school. At the same time these instructor-foremen were instructed in effective methods of teaching.

They were then ready to take over their classes, which are found in the following fourteen trades:

| | | | |
|---|---|---|---|
| 1. Blacksmiths | 6 | 8. Inside Machinists | 70 |
| 2. Coppersmiths | 22 | 9. Boilermakers | 0 |
| 3. Electricians | 12 | 10. Outside Machinists | 18 |
| 4. Shipwrights | 4 | 11. Shipfitters | 18 |
| 5. Joiners | 11 | 12. Mold-loftsmen | 32 |
| 6. Patternmakers | 14 | 13. Layer-outs | 12 |
| 7. Sheet Metal Workers | 8 | 14. Draftsmen | 16 |
| | | Total | 243 |

The figures after each trade or craft mentioned represent the number of apprentices enrolled. It

was stated that this is at an average ratio of 17½ per cent of apprentices to first-class mechanics.

One-half day each week the apprentices are to meet with their instructors for the supplementary instruction. At this time the apprentice files a report in the supervisor's office of the work upon which he has been engaged during the week. This report calls for entries as to whether the apprentice worked alone or with a mechanic, independent work being considered to his credit. When the plan is perfected this is to be entered on the individual cumulative record sheet of the apprentice which is to show his progress in covering all the operations making up the analysis of his trade. As this record is to show the quality of his work as well as the operations involved, the supervisor will be able to obtain a constant rating on his progress in arriving at satisfactory workmanship. This it is planned to consider in determining the length of apprenticeship, so that by superior workmanship the apprentice will be able to shorten his period of service. The supplementary training is to consist of instruction in trade nomenclature, sketching, drafting, and the mathematics of the trade involved. These classes are in every case to be small with never more than twelve to be assigned to each.

Apprenticeship in this plant conforms to the standard practice of admitting only boys over sixteen years of age and, while grammar school graduation is desired, the completion of the sixth grade is required with the usual stipulations of sound health, average height, and good moral character. There is also a plan under consideration to shorten the period of apprenticeship, as recognition of graduation from an ap-

proved high school or for having had previous experience.

The pay was stated to be at present at the following rates:

| | |
|---|---|
| First year | 28¢ an hour |
| Second year | 34¢ " |
| Third year | 40¢ " |
| Fourth year | 46¢ " |

There is, however, a tentative plan under consideration to establish the pay of apprentices upon the basis of a fractional ratio to that of the corresponding journeymen. Under this provision the rates would be determined upon the following basis:

| | | |
|---|---|---|
| First six months | 35% | of the first class mechanic's wages |
| Second six months | 40% | " " " " |
| Second year | 45% | " " " " |
| Third year | 50% | " " " " |

The latter system of payment (with an added item to provide for a fourth year) seems the more reasonable, as the earning power of an apprentice at any period of his contract is evidently to be determined equitably by the amount paid to journeymen for performing the same work. How much this journeyman's rate will be cannot be known four years in advance. Because of dissatisfaction with the fixed rate, undoubtedly many apprentices failed to complete their periods of service during the frequent wage increases of the late war and it is to be expected that there will be many readjustments during the unsettled labor conditions of the next few years which will be required to recover normal conditions of production.

**School for Draftsmen.**—It should be stated that the sixteen drafting apprentices mentioned in the summary of apprentices were promising individuals

selected from the other crafts and given a four months' intensive training course previous to their transfer to another plant of the corporation. It is now planned to develop a regular drafting school under the direction of a skilled naval architect. The plan is to make a careful selection of apprentices, graduates of high schools being preferred, give them at least one year's practical experience in the shipbuilding crafts and then two years of naval drafting under intensive training. Mathematics, mechanics, strength of materials and the various phases of ship design are to be given in classes held twice daily, one in the forenoon and the other in the afternoon. This is now planned as an emergency measure to meet the present very serious shortage of draftsmen of all kinds, but which is particularly acute in the field of naval design with the sudden impetus given to shipbuilding in the United States.

Later, when the urgency has become less acute, it is planned to make the course somewhat more extended and to introduce a plan whereby the drafting students will be formed into pairs, alternating one week in the drafting room under the course outlined above, and the following week at work at the various crafts about the plant, so that the future draftsmen may become conversant with all phases of shipbuilding. This is a highly interesting development of the cooperative idea for training technical workers, in which the plant's management will supply both the school and the shop practice, and seems to promise ideal conditions for learning this highly technical vocation.

**Comment.**—While the complete development of some phases of the apprentice training outlined awaits the construction now in progress of the building neces-

sary to satisfactorily house the supplementary school, the programs have been described as fully as possible when in only partial operation. Other phases of special training have been projected and were in partial operation during the past winter. Among these should be mentioned foreman training and the teaching of English with civic training for the alien employees. These also await the completion of the projected training school.

## No. 24

### The United States Navy Yard of Brooklyn, New York City

In the Brooklyn Navy Yard is provided an example of apprenticeship on an extensive scale in which the public school authorities coöperate by maintaining part-time instructional classes. While apprenticeship has been for a considerable time the established policy of the navy yards, these Industrial Continuation Classes, as they are designated by the public school authorities, were only established in February, 1917. There are now more than 400 apprentices in the navy yard, all of whom are required to attend the classes provided.

They are found in the following seventeen trades:

1. Boatbuilders
2. Boilermakers
3. Coppersmiths
4. Chippers and Caulkers
5. Die Sinkers
6. Electricians
7. Joiners
8. Machinists
9. Moulders
10. Painters
11. Patternmakers
12. Plumbers
13. Sheet Metal Workers
14. Shipfitters
15. Shipsmiths
16. Shipwrights
17. Sailmakers

Trade practice is taught under the direction of a master mechanic. Method of teaching, of course, however, varies to suit the conditions imposed by the trade. The general practice is for the apprentice to work as helper to a skilled mechanic for about one year, while the remainder of his apprentice period he is allowed to work by himself under the direction of a leading man. Furthermore, in each distinct trade there is a shop instructor who is a skilled mechanic with special qualifications for handling apprentices. His duty is to see that the apprentice is transferred at specified times to different types of work to insure all-around training. In addition, this shop instructor gives talks on related shop knowledge, so that the apprentice should be made familiar with all machines, processes, materials, and tools used in the trade.

Apprentices are admitted by Civil Service regulations with requirements which wisely vary for the different trades. Thus, for the electrical trades candidates have usually finished one or two years of high school, while in painting and sailmaking the completion of only the sixth grade is required. In 1917, when the classes were formed of the 214 then on the registry, 105 or about 50 per cent, were not graduates of the elementary school; 64, or about 30 per cent, had completed the elementary school only; and 45, or about 20 per cent, had attended high school for a time. Sixty, or more than one-fourth of the 214, had attended night school sixty nights or more.

**Industrial Continuation Classes.**—In considering the work of the continuation classes provided by the city education authorities, the following note relative

to *Trade Practice* was inserted in the school program and it is believed rigidly adhered to:

Trade practice is taught in the shop by the masters, quartermen, and leading men. All information and questions relating to trade practice are to be answered by the shop supervisors and under no conditions are to be discussed in the school.

At the start the apprentices were divided into five groups based on their previous school attainments:

Class A. Those with two or more years of high school.
B. Elementary school graduates.
C. Those with seventh grade completed.
D. Those with sixth grade completed.
E. Those who lack an elementary education.

Eight hours per week of instruction are provided through three years of forty-eight weeks each, divided as follows: English, one hour; Mathematics, two hours; Science, one hour; Drawing, four hours. In first year classes science is omitted and English is given for two hours a week.

The aim in the English instruction was stated to be to teach the apprentices to express themselves intelligently in oral as well as written composition. Reading before the class is required and spelling is introduced " by giving words in the form of a sentence which is a bit of useful information about the trade." For the mathematics course the three years of instruction are divided into six terms, each term into forty-eight one-hour periods, for which a progressive course covering arithmetic, algebra, geometry, and trigonometry has been arranged. The mechanical drawing course of study calls for: " drawing from blueprints and objects or both. Use objects where possible."

The course in science is wholly formal, and while the time allotment permits but one hour per week during the second and third years of apprenticeship, practically the same topics are scheduled as appear in the usual high school courses of Physics and Chemistry. Thus, sound (inclusive of musical instruments) is one element of the course. Another is static electricity. The magnetic units (weber, gauss, oersted, and gilbert) are another and under electricity the eight types of batteries are called for. The final topic is Power Transmission, which for certain trades probably offers the greatest utility.

## CHAPTER VII

## PROGRAMS IN RAILROAD SHOPS AND LOCOMOTIVE WORKS

THE similarity in the apprenticeship of the railroad shop and of the locomotive works seemed to warrant the presentation of the studies together. Of course, however, a large part of the work in the railroad shops is of a maintenance nature, while in the locomotive works it is largely upon production. This accounts for the fact that no patternmaking or foundry apprentices are employed on the Santa Fé system, while in the locomotive works, 27 out of the 83 apprentices employed, or about one-third, were in the pattern shops and foundry.

The difference in the number of apprentices in the railroad shops and in the locomotive shops should also be recognized. This will be discussed at greater length in the chapter on Apprentice Training in the final section.

### No. 25

### ATCHISON, TOPEKA, & SANTA FÉ RAILROAD SYSTEM *

The Atchison, Topeka, & Santa Fé Railroad system offers the outstanding example of apprentice training

* Compiled from Official Proceedings of the New York Railroad Club, Vol. XXVI, No. 9, and Western Railway Club, Vol. 29, No. 7.

in railroad shops. The railroad, as is well known, has a system the western portion of which traverses a sparsely settled and almost uninhabitable country, with no nearby roads, shops, or manufacturing plants from which to draw mechanics. Their lack in the face of rapidly expanding business in 1907 led the management to decide that, if they could not hire the machinists needed, they would train them. An apprentice system was forthwith inaugurated by the appointment of a Supervisor of Apprentices. At present, in their thirty-six railroad shops scattered from Chicago to San Francisco, are being trained over 1,300 apprentices in the following trades: Machinists, 795; Boilermakers, 175; Sheet Metal Workers, 79; Car Carpenters, 234; Electricians, 12; Blacksmiths, 22; Painters, 13.

**Shop Instructors.**—Under the direction of the general supervisor of the whole apprentice system, in each center is found one or more Shop Instructors at the approximate ratio of one instructor to twenty-five apprentices. These have general charge of the apprentices while at work, both instructing them and arranging their transfers from one type of work to another. It should be stated that in no case is the training and transfer of apprentices left to the shop foreman. It is believed that this system of shop instructors is a noteworthy feature of this railroad's apprentice program. "He is selected from the ranks, a man of character, skilled in his trade, patient in his teaching and capable of imparting his knowledge intelligently to the boys in his charge." By the plan in force the shop instructor ranks along with the department foreman and both report to the same shop officer.

If the foreman is temporarily absent, the instructor takes his place.

If the shop is large enough to afford ample facilities, a fixed schedule is outlined for each apprentice to pursue. This is so arranged that he may complete the course in three years, six months, leaving six months for review or specializing.

**Apprentice School.**—In the midst of the shops, preferably in a separate building, there is fitted up a schoolroom for the supplementary instruction. The apprentices here assemble in classes at stated hours for instruction in mechanical and freehand drawing, practical shop arithmetic, mechanics, some descriptive geometry, algebra, etc. A treatise on the respective trade being taught, the materials used, and a little railroad business letter writing also form elements of the course. By a generous equipment of charts, working models, and reading matter, different auxiliary devices are studied—injectors, lubricators, safety valves, and air brakes. The apprentice is also required to learn company and Federal rules pertaining to his trade. Everything used by the apprentice in this room is provided without cost to him.

As this school is intended to be a center for the whole shop where foremen, mechanics, officers, and clerks can and do obtain information and help upon any mechanical device or question, the school instructor must necessarily possess a good technical training in addition to an extended railroad and practical experience.

**Selection of Apprentices.**—Apprentices are selected in the order in which their applications are filed. Each applies to the local Master Mechanic or Shop

Superintendent, who turns him over to the apprentice instructor for an examination. Educational qualifications of an applicant are not iron clad, as some of the applicants have had but limited opportunity and yet are considered good material, provided they are industrious, ambitious, and of good habits. If, on the other hand, plenty of opportunity has been available for schooling, the examination is rigid. In age the sixteen-year-old applicant seems to get the preference, except in California, where a minimum age of eighteen is fixed by law. In freight car work the minimum is, however, nineteen; but the course is only two and one-half years in length instead of the four years required in other trades. The average schooling for the machinist, boilermaker, and blacksmith is about eight and one-half to nine years and in some places a little better, while the freight car carpenters average in preparation between the sixth and seventh grades and have probably been out of school since they were fourteen.

**Apprentice Board.**—The successful fitting of apprenticeship into the production and maintenance work of the shop without friction is ascribed to the Apprentice Board. This is composed of the General Foreman, department and gang foremen, the shop instructors, and the school instructor. Every apprentice, either in person or by name, is brought before this board every six months during his entire apprenticeship. All matters in reference to the proggress, discipline, transfers, etc., of the apprentices are handled by recommendations from this board to the Mechanical Officer of the shop for his action and finally by reference to the Supervisor of Apprentices.

This administrative plan is particularly stressed as essential to the successful working of the system, as it leads each shop officer to take a personal interest in the apprentices. It is also said to have "created an interest in the other shop employees by the foreman, a personal interest and desire upon the part of each foreman to treat all his men with that interest and feeling which begets loyalty and service." It would seem that this secondary function paralleled that of the foremen's school now found in so many progressive plants.

**Apprentice Pay.**—The pay of the apprentices on this road is at the following rates: first six months period, 29 cents; second period, 31½ cents; third period, 34 cents; fourth period, 36½ cents; fifth period, 39 cents; sixth period, 41½ cents; seventh period, 46 cents; eighth period, 54 cents.

**Special Course for Graduate Apprentices.**—Engineering college graduates are also admitted to a two years' course, one year on machines and one on the erecting floor. While in this course, they are known as *special apprentices.*

A selected group is then made up of those who have made a satisfactory showing in this two-year course for college men and from the regular apprentice graduates. These picked young men who are designated graduate-apprentices, are then put through a year's training for development into future company officers.

This year's training is made up as follows:

(1) They serve two months in the boiler shop, where they familiarize themselves with flues, patches, front end, Federal laws, etc., taking at the same time a course of reading and study on boilers and equipment.

(2) Following this they next enter the freight car shops to serve two months on trucks, body, air brakes, and inspection, while at the same time pursuing a course of study of standards in car work.

(3) Their next appointment is for four months in a round house, where they are taught the complete operation from the time when an engine enters until when again in shape it is headed out. This includes cleaning fire, fueling, watering, repairing when necessary and the " paper work " of despatching and handling reports. This is accompanied with the study of text on locomotives.

(4) The Traveling Engineer next takes them in charge, teaching them to fire, with a study of fuel economy, to operate the engine, make out the Road Foreman's report, and at the same time make a study of the individual parts of the machinery—lubricators, safety valves, and the like. Along with this they must be absorbing Federal and company rules for the inspection and care of locomotives.

(5) Their last assignment is for one month, each inspecting incoming and outgoing locomotives. This brings to a close the year's graduate apprentice course.

Each month each graduate apprentice must write a letter to the supervisor covering the work done and offering a criticism of shop methods, when he can suggest some remedy. In each branch he must, in these letters, answer 150 questions bearing on the work.

While it is planned to be and is considered a very difficult course, more than 80 per cent starting it complete it. It is advocated as providing the essential experience in the departments other than the one where experience through apprenticeship had been

gained. Thus, two months in the boiler shop does not make a boilermaker, but it does provide knowledge essential to the future roundhouse or shop foreman.

To justify the apprentice system, the following figures were presented by the supervisor:

Seventy-two per cent of those graduated were still with the company.

Twenty-five per cent had been appointed to some position of responsibility.

For six years no mechanics have been employed other than through the apprentice route.

Apprentice wages the first six months are about one-third of journeymen's rates, while they produce about 75 per cent, on an average, of the amount accomplished by the adult workman. Much of the apparent profit, it should, however, be recognized, is absorbed in the increased and higher grade supervision as well as the somewhat greater amount of spoiled work, broken machinery, and general inconvenience attending the utilization of apprentices. The real profit comes through the building up of a superior group of responsible mechanics.

To show what is being accomplished by another railroad, there is appended extracts from a letter under date of April 28, 1920, from the General Superintendent Motive Power of the Southern Pacific Company to the author:

"Our first apprentice schools were established in January, 1912, and today we have apprentice instructors at ten of the principal shops. We have two general shops on this system: Los Angeles and Sacramento. In the former we now have employed 140 apprentices and in the latter 223. On the system we have a total of 730 apprentices employed at this time and about 50 per cent of these are taking up the Machinists' trade. The other trades represented

are Boilermakers, Blacksmiths, Sheet Metal Workers, Electrical Workers, Carmen, and Molders.

"Since the establishment of apprentice schools on this system in January, 1912, we have graduated in the neighborhood of 500 boys and about 80 per cent of these are still working for the company as mechanics.

"In addition to receiving several hours of instruction each week in mathematics, drawing, etc., in the classroom under the supervision of the apprentice instructor, the apprentices are under the observation of and receive instructions from the various shop foremen."

## No. 26

### The American Locomotive Company, Schenectady, N. Y.

The American Locomotive Company has a normal capacity for employing 5,500 workers. At the time the plant was visited about 3,500 were on the payroll. It is this fluctuation in employing capacity, dependent on the demand for locomotives, which probably accounts for the only partial development of apprenticeship in this plant in spite of the fact that the company has the avowed policy of fostering this method of training and employs an apparently capable man as apprentice superintendent.

The enrollment of apprentices was as follows:

| | |
|---|---|
| Drafting | 38 |
| Machinists | 17 |
| Foundry | 15 |
| Coremakers | 6 |
| Moulders | 9 |
| Electrician | 1 |
| Patternmakers | 12 |
| Total | 83 |

In this plant it is the policy to place apprentices in a single department for their entire apprenticeship.

Thus, the machinist apprentices were distributed, four in the toolmaking shop, two in brass finishing, two in die sinking, one with a repair gang, and eight listed as all-around machinists

In the shops the pay is uniform, starting at thirty cents an hour and increasing by two and one-half cents every six months until forty-seven and one-half cents is reached for the final period. A bonus of two cents an hour is also paid those who maintain "B" grade of work and of four cents an hour for "A" grade. For the draftsmen the pay starts at twenty-eight cents and increases to forty-five cents with similar bonuses for superior work.

In the apprentice school there is a carefully laid out course of related work for the draftsmen for which three hours of company time is set aside each week. This consists of locomotive design, mathematics, and such elements of mechanics, physics, and chemistry as find a direct application in the construction of locomotives. Related work instruction is limited to one hour a week for both machinists and patternmakers, while apprentices to the other trades are not required to attend classes.

It should be noted that there are no indentures or signed agreements with the apprentices, so that the company is free to suspend or drop apprentices if the lack of orders makes it desirable. The apprentices are, however, paid a bonus of $150, if they complete the four years of service. Also, in that event, a certificate is conferred, which is in duplicate, one being of usual size and the other of about postal card dimensions, so as to be conveniently carried in the pocket.

## CHAPTER VIII

## AN APPRENTICE PROGRAM IN THE PRINTING INDUSTRY

THE Lakeside Press of Chicago is the only one discovered which had developed an apprentice system by which it could itself provide the supplementary instruction. [1] In New York City the Hudson Guild (a philanthropic institution) provides a school for compositors which is coöperatively maintained by the employers and the unions. The pressmen maintain their own school by utilizing correspondence courses. [2] In Chicago there has also been developed a coöperative school among the publishers for training their apprentices.

### No. 27

R. R. DONNELLEY & SONS COMPANY, CHICAGO, ILL

The R. R. Donnelley & Sons Company are proprietors of the Lakeside Press in which a school for apprentices has been conducted since 1908. In this school the outstanding feature is the length of the course since it totals a period of seven years of production under instruction with classes to provide the

[1] Industrial Education Survey of New York City, p. 29.
[2] National Association of Corporation Schools, 8th Report, p. 213.

related academic and technical phases of the highly skilled trades embraced. This is divided into a two years' preapprenticeship and a five years' regular apprenticeship course before admission to full journeyman's standing. There are now about fifty pre-apprentices and 100 apprentices in all stages and in all departments.

**Pre-apprenticeship Course.**—To enter a boy must be a grammar school graduate between fourteen and fifteen years of age—the nearer fourteen the better. He must show good standing in his studies and when necessary a physical examination will be given. Selections are made with considerable care only after the boy has applied by letter and then passed a satisfactory interview with the supervisor. The latter even visits the boy's home that he may obtain assurances of the parents' coöperation in looking after their son's welfare and to satisfy himself of the boy's satisfactory moral character and genuine desire to learn the printing trade. If everything is satisfactory the boy serves a trial period at the conclusion of which if agreeable to all parties the boy and his parents sign an agreement with the company for the whole seven years' term of apprenticeship.

During the pre-apprenticeship period the boys spend each day three and one-half hours in the apprentice school and four and one-half hours in the shop. The shop work is either at machine operation or in the counting-room.

The course of study in the school seems eminently suited for the purpose, better than would probably be provided in the public schools and at the same time the boys are making some progress toward the acquisi-

tion of their trades and earning something toward their own maintenance and allowances for diversion.

Thus as is desirable for compositors, English is given particular emphasis with stress on spelling but recognition is also given to grammar, composition and oral reading. Training in the use of the dictionary is mentioned. Also as it is recognized that in these trades a literary background is desirable each student is required to read and report on six volumes of standard literature.

An introduction to the technical phases of the trades is also made with study of proofreading, the signs used in printing and an extended study of type as to its chemistry, and the history of its development as determining its style. Some study is also made of paper so that the student has as a background the history of this element in his trade, knows something of its manufacture and all the varieties and qualities which he will have occasion to use.

There is also provided a history of printing and of the printing press as a second year course. Some of the technique of composition is also taken up—the design of a well proportioned page, the cost of composition of a given job and the amount of stock necessary.

The trade instruction is mainly of work in composition-spacing, justification, taking a proof, and correcting. In the second year the making of a book and the insertion of engravings are also presented.

Considerable attention is also properly given to art features—layouts, designs, and color. All of these are illustrated by concrete examples of advertisements, cards, title-pages and covers. In color the names of

the standard tints and shades, of harmony by gradation and contrast and the use of colored inks on tinted paper are taught.

**Apprenticeship Courses.**—The regular apprenticeship period of five years follows the preliminary course. "Each department has a special course based upon the needs of the apprentices in that branch of the trade. The work is almost wholly individual and is adapted to the needs of the learner. No absolute set time is planned for each subject as factory conditions do not allow such a procedure. Each apprentice is required to complete the work outlined for a department before graduation from the course. By excellence of work the period of apprenticeship may be shortened."

The practical work and supplementary instruction is differentiated for the four major departments: Composing Room, Press Rooms, the Bindery, and the Photo-engraving Departments.

In the *composing room* the trade work is closely supervised and of course provides the main body of instruction. It is, however, supplemented during all the five years by much related work as is desirable for the high-grade compositor. In the first year this consists of some of the non-productive work of the pre-apprentice course in review such as proving job work, handling materials, and the composition of both plain matter and job work. More advanced problems form the basis of the second and third years in the composition of tabular and catalogue material and book make-up. In the fourth year the apprentices are finally worked into the department for which they show the greatest aptitude and

interest. This includes the selection of operators for linotypes and monotypes. The fifth year provides for specialization in the department selected with study of layout to develop originality and character.

In the *press rooms* the related technical instruction consists of a study of the terms used, materials, paper, forms, inks and rollers. The parts of the press are carefully studied with their care and effect of weather and climate. The duties of the feeder and pressman are also considered and a great deal of attention given to color which is, of course, the important technical element of this department.

For those in the *bindery* evening classes are provided from 5:45 P.M. to 7:15 P.M. in the school room. The academic work covers about the same field as given the apprentices in the other departments being based on the work done in the pre-apprentice classes.

There are also evening classes with the same general outline of work provided for the apprentices in the *photo-engraving department.* As applied chemistry forms an important element in the trades of this department apprentices are encouraged to study that subject in the public evening high schools. The apprentices are given a general idea of the different operations in the department but can learn but one of the trades involved. In Commercial Photography they are taught the preparing and mixing of chemicals used. Study is also made of the problems arising in interior and exterior views, in copying, enlarging, and reducing. In Line Photography study is given to sensitizing plates, timing exposures, developing,

clearing with cyanide, etc. In half-tone photography, the printing, etching, finishing, and drawing all have their respective technical phases taken up with appropriate instruction.

**Courses for High School Graduates.**—Special courses for high school graduates are also maintained in the school. Each year a group of carefully selected young men who have completed a high school course are employed and spend some time in learning how printing is produced in order to prepare for executive positions in the offices or the factory. Every opportunity is given to learn the business, the length of time served depending upon the line of work selected, for some it is one and one-half years, while others require three years to complete their course.

**Apprentice Pay.**—The pre-apprentice starts at $6.00 a week. If during the first three months a standing of 90 per cent is maintained, during the next three months the pay is raised $0.50 and a like raise on the same basis is provided for the second six months.

During the second year the students who maintained the 90 per cent standing during their first year start at $8.00 a week and are promoted to $8.50 the second half year. All others receive $7.00 and $7.50 respectively.

Apprenticeship starts at 20 cents an hour with three-cent increases every six months during the first two years and four-cent raises during the last three years of apprenticeship. A special advance of three cents an hour may be made during the first year of apprenticeship as reward for exceptional merit and ability. Also in place of the usual bonus at the termination of apprenticeship, the company deposits

$2.00 a week at the employee's mutual earnings association and while the apprentice receives the bank book covering the account as an aid in establishing the saving habit, he cannot withdraw the account until the apprenticeship is completed.

## *SECTION III*

## CHAPTER IX

### PROGRAMS EMPHASIZING SPECIAL TRAINING

MANY corporations for whose purposes apprenticeship seemed unsuitable have nevertheless found it desirable to introduce special training. Six special examples of this have been studied. The Submarine Boat Corporation provides an outstanding example from the boat building industry which was so quickly developed by this means during the war. The Gisholt Machine Company offers an example by a machine manufacturer of upgrading training for its customers. In the Sperry Gyroscope study is described a plan of curtailed training of adults for toolmaking. The United Shoe Machinery Company provide an example of intensive training of machine operatives and of the coöperative system of training young workers.

No. 28

THE SUBMARINE BOAT CORPORATION, NEWARK, N. J.

The Submarine Boat Coporation's Newark Bay plant is in present proportions an outgrowth of the Great War. When it became evident that one of the great contributions of the United States was to be "ships and yet more ships," this corporation con-

tracted to provide one hundred and fifty ships on a new basis. They were to be fabricated to standardized dimensions of ordinary structural steel 95 per cent of which could be rolled and shaped at various points from Milwaukee to Boston. The remaining 5 per cent it was decided could be most expeditiously shaped to special needs at the Newark works. The unit was to be the 5,350-ton steel cargo carrier for which ways were constructed so that twenty-eight could be built at such a rate that a ship was to be launched every two days.

They had the capital, organization and location at hand,—labor it might be said was almost wholly lacking. The United States had never embarked on shipbuilding in the proportions now suddenly demanded and could of course not draw on European sources for labor as had been our practice in inaugurating new industries in previous times. Men had to be drawn from all fields of peace-time industry. There was not even a supply of workers in steel from other industries as obviously army, navy, and munition requirements were absorbing more than all peace-time industry had trained. Some could be obtained by conversion from more or less closely related trades but most must be wholly inexperienced workers in this field. The problem was obviously greatly simplified by the fact that construction of the fabricated ship obviated the necessity for a considerable force of *mold-loftsmen* and *layer-outs*, craftsmen for whom apprenticeship is as essential as for patternmakers and who are indispensable in the traditional type of shipbuilding in which any model of ship is constructed to order. Essentially the difference is between

readymade and custommade tailoring, the number of skilled craftsmen being obviously greatly reduced in the former case.

**Intensive Training.**—Special training was inaugurated in December, 1917, by sending fifty mechanics to a government training center for a brief training in instruction methods. This number was subsequently increased until the force of instructors on September 15, 1918, consisted of 130 men. Actual training by these men started March 1, 1918, and a force of 14,000 specialists in all the trades required was built up. The instructors it should be remarked were selected as superior mechanics and paid a salary in excess of that to regular foremen. The raw material on which they had to work were recruits drawn from all departments of labor, such as painters, bell boys, street car conductors, wiremen, salesmen, and gardeners, whom the attractiveness of the industry, hopes of big pay, or "work or fight" social pressure made available. It is the remarkable fact that records show that in a relatively short time the newly trained men were working at standard production rates.

The number trained for each operation may be seen from the following table of totals to July 1, 1919:

| | | | |
|---|---|---|---|
| Bolters | 4,000 | Pipehangers | 84 |
| Heaters | 1,720 | Erecting Machinists | 77 |
| Reamers and Drillers | 1,591 | Packing, Marketing, Bending and Tool Repair | 70 |
| Riveters | 1,174 | Electric Welders | 50 |
| Holders-on | 1,081 | Pipe Coverers | 52 |
| Chippers and Caulkers | 486 | Painters | 41 |
| Regulators | 244 | Plumbers | 38 |
| Pipefitters | 162 | | |
| Shipfitters | 124 | | |
| Linermen | 109 | Total | 11,109 |

It will be seen that bolters and the workers at the several operations of riveting constitute the major portion of this list. It, however, includes electric welders whose work was much more utilized than had been the previous practice in shipbuilding.

Our present interest is in the fact that it has been found practicable to continue the method under peace-time conditions, and that lack of urgency has not greatly changed the methods of procedure. It may be said that the chief difference is a present tendency to utilize two or three times as many days in training in some of the operations in order that complete learning may be assured before the transfer is made to the regular production departments.

At present (May 1, 1920) the staff consists of forty-two instructors giving training to two hundred and fifty men. This is some one hundred and fifty below the number possible with the present staff, as experience shows that an average is required of about one instructor to ten learners. In some trades the best proportion is one to five; in others one instructor can efficiently handle fifteen learners.

The average period of systematic training in the respective trades, based on the practice followed during the stress for quick preparation, was as follows:

| | | | |
|---|---|---|---|
| Riveters | 24 days | Chippers and Caulkers | 42 days |
| Holders-on | 18 " | Reamers and Drillers | 12 " |
| Heaters | 25 " | Electric Welders | 30 " |
| Bolters | 9 " | Pipefitters | 40 " |
| Regulators | 19 " | Pipe Coverers (asbestos) | 20 " |
| Shipfitters | 33 " | Outside Machinists | 32 " |
| Linermen | 16 " | Painters | 40 " |

Training for regulators and linermen is being discontinued and it has been found possible to fill all requisitions for erectors from the structural steel workers in general industry who presumably follow prevalent practice of gaining experience by being employed as helpers.

The wastage in the product by riveters in training has been found to be at the rate of $2\frac{1}{2}$ per cent while 5 per cent is the corresponding average of ordinary production, showing that from the start the men in training are held to greater exactness in execution than are the ordinary workers. This has been the practice throughout of insisting on quality with the expectation that speed would come with experience. This relative rate of work is shown by the analysis of rivet driving, the week ending November 29, 1919, being taken as example:

| | |
|---|---|
| Average per hour for total yard | 46.5 |
| Skilled average per hour | 54 |
| Training average per hour | 15 |

While the policy of the training department is to carry on training under exactly production conditions, efficient training makes it desirable to start the men in the way yards but always on production jobs. Thus at present fifty are being started on the ground while the remainder of the two hundred and fifty in training are at work on the ships under instructor guidance. In this way full experience is gained of work on scaffolding and upon the more difficult bottom shell before going over to the hull department. After this transfer they are given a week's tryout by the latter department with the understanding that they are to be returned to the

training department if unsatisfactory. This opportunity has been utilized in only 4 per cent of all cases.

**Foreman Training.**—The special training outlined of course only provides for the rank and file employed. The training department is also engaged in improvement work for the foremen. This was originally planned by the management to be compulsory, but the success of the program has quite clearly vindicated the opinion of the director that it should be optional.

The work began in May, 1919, and since then about two hundred seventy-five have attended or are attending the classes. This is from a total of five to six hundred foremen and pushers, all of whom are eligible to take the course. Approximately one hundred are at present in the classes while one hundred thirty have already been graduated.

The course lasts eighteen to twenty weeks for two hours per week. The foremen are divided into nine groups of twelve men each. For these three intsructors are employed to hold the classes with an additional instructor for follow up work. Their large amount of free time all these instructors spend in gaining contact with the men and their administrative problems.

For the purpose of instruction, foremanship is considered a distinct trade which has been analyzed into fourteen jobs or responsibilities, such as inspection, distribution of labor, securing coöperation, attendance, reducing turn over, selection, planning, etc.

To illustrate the content and manner of handling—in coöperation, the following phases are considered:

Coöperation with superintendents
" with other foremen
" with pushers
" with men
" between men in the gang
" with the Company
" with other departments

The method in the class is essentially the case system. The instructors do no lecturing but direct and supervise discussion. To give an idea of this the following cases are taken from different parts of the course:

*Inspection*

1. A berth was turned over to a foreman as completed. This foreman put a gang to work on it. After the men had been working a short time they discovered that the berth was incomplete and so were forced to stop. What trouble was probably caused by this situation? Who were to blame? How could it have been prevented?

*Selection of Men*

2. One foreman believes it is a wise plan to work a lazy man with a man full of " pep." Do you agree with him? Why or why not?

*Coöperation*

3. A foreman was unable to put a gang on a certain berth because it was not in proper condition. He immediately reported it to his superintendent and asked him to order the preceding craft to make it right. Would you handle a similar situation in your

trade in the same way? Give reasons for your answer.

It will be readily seen that such a course is very concrete and well fitted to prepare the foremen to think out their proper procedure whatever the situation that may arise and perhaps to revise their previous practice. Moreover, such a course is less likely to arouse undesirable antagonism in the minds of men perhaps long accustomed to handle men, whether or not satisfactorily, than one in which an instructor merely lectures the men as to what are their duties.

**Instructor Training.**—It is the opinion of the Director of Training that too much emphasis cannot be placed on the necessity for adequacy in the training of the instructors. Their initial training at a government training center has already been mentioned. It is his present plan to supplement this by a course of training somewhat similar to that just sketched for foremen.

Similarly, two hours a week for four or five months would be given to a man and job analysis of the elements essential in training. As with the foremen the instructors would be divided into small groups and the instruction would be largely in the form of discussion.

Thus *skill* as an element in the man-training program would find its counterpart in the selection of a suitable series of jobs which provide for increasing difficulty of *execution*. Similarly to train for *confidence*, graduated increases in the element of *danger* would be required; for *agility*, the counterpart is in the increasing difficulty to overcome *inaccessibility*.

These elements mentioned are of course but illustrative of the process by which an analysis of the problems of training is developed and applied and are seen to represent elements common in general to the trades represented in this type of shipbuilding. The program provides a novel example of the development of the theory of training in what must be the keystone of the system—the adequate training of the instructors.

**Organization of the Training Department.**—The training department is organized as a distinct department from the employment and production departments, with both of which it of course must closely coöperate. At its head is the director, a man apprentice trained with a long practical experience in production as well as in industrial education. His staff of forty-two full time instructors has already been mentioned. Such an organization, coördinate with the other major departments, naturally possesses the dignity and is assured of the proper support essential in providing the training for recruits and the "upgrading" for the foremen.

No. 29

DENNISON MANUFACTURING CO., FRAMINGHAM, MASS.

The Dennison Company offers an example of what may be considered as the normal course of development of special training in an industry. It is a concern with approximately 2700 employees about equally divided between the two sexes. Its products are a variety of paper specialties such as shipping tags, crepe paper, and various art-paper products requiring

a large number of specialized machine operators and hand manipulators. In many cases these require considerable skill of a highly specialized sort but in no case of a type to warrant apprenticeship.

For about six years the policy of the corporation has been developing of providing special training for the recruits to this industry and for upgrading superior employees selected for promotion or for improvement of such employees as show inferior production.

The development in the plan of organization for training is interesting as perhaps significant of the usual course to be expected in a corporation adapting a training policy. When originally established it was under the direction of the personnel manager as coördinate with employment and employee service activities. An experienced teacher was employed as supervisor for its development.

This system has now been superseded by a department of education and training formed distinct from the employment department, which still handles the other activities. As head of this new department is the personnel manager of the previous plan of organization. In a table of organization for the whole plant the department as now organized is coördinate with production and employment departments. In the department are being developed about seven major types with supervisors over each, but of these training fields only two are wholly organized, which are tag and baggage-check-making and table or bench work bundling. Others to be developed are such fields as novelty work and printing. These supervisors are to devote their attention to training for

instructors selected expert operators in the specialties in their fields.

The usual practice is to set aside on the regular production floor three or four machines for instructional purposes rather than providing a segregated training department. It does not seem to be established whether an instructor after being selected and trained shall be occupied solely with teaching his specialty. Probably it will depend on circumstances. If the specialty employs a very large number of operatives the stream of recruits will doubtless keep the instructor continuously busy, but if his specialty requires a more limited number of workers with no serious turnover his ordinary employment will be regular production from which he will be withdrawn for instructional purposes when required.

Foreman training seems to have gone through a first stage and now to be in a second stage of development much as is to be expected of this department of corporation educational activity. Two years ago a thoroughgoing program of instructional classes for the foremen was put in operation. Now that all the plant's foremen have gone through this training that work has been displaced by the second stage, that of monthly conferences of the foremen and administrative force assembled as a unit. The first stage was found desirable to adapt the foremen to a changing conception of his duties as a leader rather than a pusher or driver and to define his responsibilities under a functionalized scheme of plant organization which brings limitations to his authority which he frequently resents unless in some way he is persuaded of the reasonableness of these limitations.

At present, investigations are being conducted in the plant to establish correct principles for the selection of individuals for training, the relation of training to promotion, and of the period of learning to rate of pay.

No. 30

GISHOLT MACHINE COMPANY OF MADISON, WIS.*

The Gisholt Machine Company furnishes an example of a well formulated "up-grading" school. The principal product of this firm is a Turret Lathe, the setting up for performing a particular job and care of which has been found sufficiently complicated to warrant the training of specialists for this purpose. The company therefore organized some six years ago a training school at their manufacturing plant to which their customers were invited to send selected employees with several years of shop experience who were to be placed in charge of the new machine when installed.

When projected the course was expected to require a year for completion but was later reduced to six months and a careful analysis of the operations to be taught has reduced the course to eight weeks or less comprising in all 25 separate processes, all of which the student must not only learn for himself but must teach to another learner, both because that is most surely believed to prove that he has himself, mastered each operation and also because he will have to direct the operator of the machine in his own plant when later he has the responsibility for its satisfactory performance.

* F. H. Colvin, *Am. Machinist*, Vol. 43, pp. 645–647, 813–819.

The following divisions are embraced in the course:

1. Dismantling a Gisholt Tool Grinder to learn its construction.
2. Assembling, adjusting and oiling the grinder.
3. Grinding a set of standard tools on the grinder to learn clearance and rake.
4. Brushing and cleaning the grinder to teach care and neatness.
5. Dismantling a standard Gisholt Turret Lathe.
6. Scraping bearings, V's, etc., for use in overhauling machinery.
7. Assembling, adjusting and oiling the lathe to learn construction and care.
8. Operating 28" lathe on countershaft pulleys as per time study.
9. Heavy cuts on lathe to see execution.
10. Placing tools on lathe as per layout sheet for machinery countershaft pulley.
11. Operating 28" lathe on countershaft pulleys as per time study.
12. Dismantling tool set-up to teach proper disposition of tools.
13. Cleaning lathe and tools to teach care and neatness.
14. Boring jaws on lathe for practice.
15. Cutting threads on lathe to learn method and practice.
16. Turning tapers on lathe to learn method and practice.
17. Placing tools on the lathe as per layout for drilling, boring, and reaming.
18. Operating the machine on a steel piece for experience on steel work.
19. Dismantling set-up and cleaning tools to teach care and neatness.
20. Placing tools on the machine as per layout sheet for making.
21. Operating machine on crosshead pins for experience with bar stock tools.
22. Dismantling and cleaning up tools to teach care and neatness.
23. Cleaning up machine to teach care and neatness.
24. Estimating—the basis for planning method and tooling of work.
25. Taking a new man for a trip through all departments of the factory.

The only supplementary training is provided by evening classes in free-hand sketching which is found particularly useful in designing tools and discussing projected jobs for which the machine is to be utilized.

Forty to fifty men are being trained at all times which would provide for five to eight being graduated

each week. It is stated that investigation has shown that 40 per cent of the men trained are promoted to foremenships within a year of graduation.

It should be noted that the training is for the mechanic who is to have the responsibility for setting a job up on the machine and for keeping it in repair and not for the tender who requires chiefly experience and but little training.

### No. 31

### J. & T. Cousins, Shoe Manufacturers, Brooklyn, N. Y.

The Cousins Shoe Factory is a plant of 450 to 500 employees engaged in the manufacture of ladies' high-grade shoes. Finding itself involved in labor difficulties, arising it was believed from too extensive employment of irresponsible foreign labor, in January, 1919, the company embarked on a labor training policy to build up as high grade and permanent a personnel as could be attained. This has consisted (1) of weekly meetings of the foremen with the company officials in which the problem of handling workmen was analyzed and improved methods inaugurated, and (2) of training every new recruit to the skilled specialties of the plant.

Thus far in the fifteen months since the new program was inaugurated some one hundred persons have been trained. Methods seem very simple and an outsider would not be conscious that anything other than ordinary production was taking place. The old process had been to replace a man who quit or was fired by the first applicant who offered him-

self as proficient in the operation involved. This had been the means of introducing the preponderance of undesirable foreigners. The new method was to accept a novice who seemed to the employment department satisfactory as to general physical and intellectual qualifications but with no requirement of previous experience in the shoe industry, preference, however, being given to native Americans. Owing to the large number of ex-service men released during the past year by discharge from the army, this has led to the recruiting of a very large percentage of these young men who had never previously established themselves in any trade.

Ordinarily the practice has been to segregate those in training, starting them to work under one experienced in the operation. Best results are said to be obtained with a small number, ordinarily five or six to one instructor for several weeks of intensive training. The learner is then placed at work at regular production alongside of an experienced man who gives the new man such hints as he needs to continue picking up the process and the foreman also devotes to him whatever free time he has at his disposal. In exceptional cases where only one or two are being trained it is considered impracticable to start the beginner in a segregated department and the teaching process is initiated as just described on the regular production floor. While the novice under training receives a fixed wage, the experienced man is paid on a piece work basis and it would seem that he could be expected to give but little attention to the learner, but it is said that no difficulty has arisen from this source as there are always free moments between the

operations required in regular piecework. It should be noted that the training here mentioned has been at various types of hand work incidental to fine shoe production and not in machine operation as is frequently found in other plants.

In three to four months time the learner is said to be at 60 to 70 per cent of standard production and frequently the new men come up to the standard of quantity and quality of experienced men within a year. The training process was observed in the one case now going on, that of the rather difficult process in fine shoemaking of turning and shaping the turned shoe and the progress of the learner showed that proficiency in this process could be attained in three to six months, but this length of time of course depends on the aptitude of the learner.

In only one department is no attempt made at special training. That is in producing the bench or handmade shoe. There all workmen are Italians—craftsmen who learned their trade presumably by apprenticeship in their native land and it would seem that apprenticeship either in the plant or as at present by hiring those who have previously learned their trade elsewhere would be the only means for recruiting this force. About 5 per cent of production is on this basis, a proportion much larger than of the industry in general in this country where machine production has practically displaced handicraftmanship.

Owing to the disappearance of labor unrest which the service manager attributes in large measure to the two means of training outlined—that for the foremen and for beginners, the latter by intensive train-

ing as described has practically been discontinued, an eventuality which may be expected to ensue in the smaller plant where conditions do not warrant expansion.

It may also be mentioned that the service manager assists and encourages adoption of American citizenship. No classes are conducted either in English or for civic training in the plant though the coöperation of the Young Men's Christian Association is enlisted to this end and assistance is given to those who desire to secure either the first or second papers needed for this purpose.

No. 32

THE SPERRY GYROSCOPE CO., BROOKLYN, N. Y.

* The Sperry Gyroscope Company has a splendid new machine shop plant in the city of Brooklyn employing in the neighborhood of a thousand men. Their products are the Gyro Compass, a special type of search light, gun fire control instruments, and radio apparatus, though chiefly the Gyro Compass for whose production the plant was primarily established.

A special training department has been established under the administration of the employment department with an experienced mechanic in charge. Equipment is provided for training fifteen to twenty men at a time. This consists of the usual machine shop tools with space and provision for bench work and assembling and some tool making practice. Several skilled workmen are also employed in the department to work alongside of the men in training and to assist in

* Ref.: *Industrial Management*, Aug., 1919, Vol. LVIII, pp. 100-103.

their instruction. This department is intended to serve two purposes: (1) as a "vestibule school" chiefly at times when considerable additions are being made to the company's force and (2) for "upgrading" of selected employees during normal or slack periods.

**Vestibule School.**—As a "Vestibule School" it offers an opportunity to try out the fitness of men seeking positions and to give them a brief initial training in the practices peculiar to this plant. Upon this basis a workman ordinarily remains from only a few days to several weeks. He is then either rejected as unsuited to the requirements of the plant or if satisfactory transferred to regular production. It is apparent that such a practice relieves the production department of the trouble of testing the qualifications for a new employee and of supervising his initiation into the special methods utilized by this company.

**Upgrading School.**—At the time of the investigation the second purpose, however, of upgrading was being stressed. The men were detailed for a fifteen months' course and were receiving pay at approximately 80 per cent of production ratings. Several were at about third or fourth year apprentice age but most were somewhat older though still young men. About half of the time was said to be spent on jobs selected particularly for value in training and the rest of the time at small tool work of the regular production department. No organized part-time supplementary instruction in the way of drafting and shop arithmetic was provided by the company though of course there was a larger amount of this instruction incidental to the assignment of jobs than would be customary in regular production.

The coöperation of the city public school system, however, afforded provision for this purpose. The classes were held in the nearby vocational school directly after work hours rather than in the evening, an arrangement much more convenient to the men. The following classes were provided: Industrial Arithmetic with fifteen enrolled, Mechanical Drawing with twenty-three, and Applied Electricity starting with fifteen, which had grown to an attendance of thirty each night. Enrollment was not limited to those pursuing this special training but was open to all employees.

**School on Company's Products.**—A rather unusual school has been developed for the Foremen, Supervisors, and Inspectors. One hundred eleven of these are enrolled with meetings held twice a week from 4 to 5 P.M. directly after work. These meetings are given up to lectures by representatives of the engineering force on the products of the company, chiefly the Gyro Compass, a knowledge of whose highly intricate construction and uses is both interesting and very essential to those whose duties consist in the production and assembling of the several thousand parts involved.

No. 33

THE UNITED SHOE MACHINERY COMPANY,
BEVERLY, MASS.

In the United Shoe Machinery plant are to be found two distinct types of industrial education and training. On the one hand we find the Beverly Independent Industrial School with its special training

department provided in the company's plant now operating in its eleventh year and on the other a newly inaugurated intensive training department.

**The Coöperative Industrial School.**—The Industrial School is included in this discussion although having its own board of trustees and receiving support in the main from public school funds, since it functions as the exact counterpart of the corporation apprentice school found in so many plants. The school is conducted on the coöperative half-time principle—one-half of the boys being in the school while the other half is in the training department at the factory and the two groups alternating the following and each successive week.

At the present time there are seventy boys enrolled, thirty-five in each group. The school staff consists of a director, two machinist instructors, a science instructor and a shop foreman. Each machinist instructor devotes all his attention to a single group, accompanying it back and forth as it transfers alternately from school to shop and can thus effectively tie up the instruction in the school to the shop problems that arise at the work.

The pay given the boy for his twenty-five weeks of shop-work per year is 50 per cent of the standard piece-work price paid regularly in the plant. The remaining 50 per cent is credited to the school fund of the company to defray upkeep and depreciation of the section of the plant turned over to the training department.

Instruction in the school proper in addition to essential trade training and mathematics is in applied science, drafting, English and citizenship, which has

been organized into a teaching program to suit the needs of boys whose interests are primarily industrial. At the start a four years' course was planned but apparently experience has shown the advisability of transferring to full time at the plant those who have attained efficient production, usually at the completion of the second year. Owing, however, to state laws relative to minors operating power machinery graduation to journeyman's grade never takes place until the age of eighteen is reached no matter how capable the boy may have become.

In the last report published, that for the tenth school year ending in July, 1919, when the war may have still somewhat adversely disturbed normal conditions by making extraordinary demands for labor even though still immature, the enrollment according to ages was as follows:

| | |
|---|---|
| 14 to 15 years of age | 0 |
| 15 to 16 " " | 38 |
| 16 to 17 " " | 37 |
| 17 to 18 " " | 12 |
| 18 to 21 " " | 11 |
| 21 to 25 " " | 2 |
| Total for year | 100 |
| Average for year | 58 |

The half earnings for the year 1919 were $4,614.47 with a rate per hour paid to the pupil of $.112, the actual rate earned being $.224. Dividing the half earnings by the average enrollment for this period (53) we find that average yearly earnings of each student was $87.06. It should also be noted that whereas twelve were promoted to full time by completing the course, twenty resigned to enter upon

regular production with course uncompleted, suggesting that the institution was being utilized as a kind of vestibule school. Altogether from the opening of the school August 2, 1909, to July 20, 1919, the graduates have numbered one hundred, all being in the machinists' trade. It is also stated that the last seventeen promoted to full time in the factory, who during their first year are transferred about the plant for experience started with a rating of 55 cents an hour.

**Intensive Training.**—The Intensive Training department is newly inaugurated and to some extent still in an experimental state. It has a corps of four instructors selected from among the best foremen in the plant and a superintendent with a long practical and theoretical experience. The following equipment is being used to capacity to train recruits:

Fourteen Horizontal Millers, 3 Vertical Millers, 10 Four-Spindle and Single Spindle Uprights, 12 Lathes, and 2 Plain Grinders. Besides the 41 men thus provided with a machine whose operation they were learning there were 12 additional men receiving bench instruction, making 53 in all.

The ordinary period of training is three months though this is naturally subject to adjustment, as obviously the most skillful would be promoted to regular production whenever a vacancy occurs irrespective of length of training period. Pay in this department is fixed at fifty cents an hour irrespective of amount of production, and it was stated that those transferred to regular production on a piece work basis were having no difficulty in maintaining a rate in excess of the minimum fixed for the plant.

In the main the instruction is confined to teaching the skill necessary to successfully operate the one machine or the bench operations in each case being taught. Supplementary to this, however, either individually or in small groups, the superintendent gives oral instruction on the following topics:

(1) Plant layout, (2) Department location, (3) Object of department and results expected, (4) Company expenses on equipment and maintenance, (5) Brief outline of methods of transportation, (6) Methods of accounting for work charged to department, (7) Brief outline of methods of tooling, (8) Application of drawing and operation sheet to work, (9) Necessity for interest, accuracy, discipline, and self reliance, (10) Necessity for quality first and quantity later, (11) Explanation and application of simple tools, such as scale, micrometer, etc., (12) Scale and decimal equivalents, (13) Hospital, location and purpose, (14) Find out natural inclination of new employee. This brief supplementary instruction should materially aid in orienting the recruit in his new environment and the opportunity offered by the separate training department of providing this instruction is one of the strong recommendations for such provision.

*SECTION IV*

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## CHAPTER X

## PROGRAMS OF PRIMARILY TECHNICAL INSTRUCTION

Two companies have found it desirable to introduce primarily technical courses which bore no necessary relation to the work on which the student was employed. In one case it was an electrical cable company where it was believed the supervisory force should have more extensive technical training than is at present the practice.

The other is an isolated machine shop plant where the evening classes provided offer a diversion as well as possible employee improvement.

While it could probably be stated as a general rule that technical instruction only in a general way related to the present or anticipated employment of the student should ordinarily wisely be provided by public or semi-public educational institutions, local conditions may justify a company's embarking in this field of instruction.

No. 34

HABIRSHAW ELECTRIC CABLE CO. OF YONKERS, N. Y.

The Habirshaw Electric Cable Co. are manufacturers of electric cable of varying size and material. On an average 600 to 700 men are on the payroll.

With the object of training for higher intelligence in those to become foremen and assistant foremen, the company has this year inaugurated a training department, the supplementary instruction being of the higher technical sort. While older men are at the start in some cases admitted, it is said to be planned for boys aged sixteen to nineteen at entrance with a starting rate of 34 cents an hour. A man with technical training and some experience at teaching is devoting his entire time to the teaching. The factory work consists of the testing, winding and similar work necessary in the production of electric cable. No permanent contract or apprentice agreement is required. Classes meet for one hour recitations five days a week. In the two sections at present organized 26 are enrolled.

An outline of the course follows:

First Year

First Term

| | |
|---|---|
| Algebra | 2 rec. |
| Trigonometry | 2 " |
| Correlation Problems | 1 " |

Second Term

| | |
|---|---|
| Geometry (Mechanical Analysis) | 2 rec. |
| Calculus | 1 " |
| Elementary Electricity | 1 " |
| Correlation Problems (Electricity) | 1 " |

Third Term

| | |
|---|---|
| Geometry | 2 rec. |
| Calculus | 1 " |
| Elementary Electricity | 1 " |
| Correlation Problems (Electricity) | 1 " |

Second Year

First Term

| | |
|---|---|
| Electricity (Generation of Current) | 1 rec. |
| Physics (Mechanics; Work) | 2 " |
| Chemistry (General Chemistry) | 2 " |

Second Term

| | |
|---|---|
| Electricity (Distribution of Current) | 1 rec. |
| Physics (Liquids; Gases; Heat) | 2 " |
| Chemistry (Chemistry of Metals) | 2 " |

Third Term

| | |
|---|---|
| Electricity (Commercial Uses) | 1 rec. |
| Physics (Sound; Light) | 2 " |
| Chemistry (Chemistry of Hydrocarbons) | 2 " |

Third Year

First Term

| | |
|---|---|
| Electrical Wiring and Use of Cables | 3 rec. |
| Political Economy | 1 " |
| Business and System | 1 " |

Second Term

| | |
|---|---|
| Cable Testing | 3 rec. |
| Political Economy | 1 " |
| Business and System | 1 " |

Third Term

| | |
|---|---|
| Cable Calculations, Specifications, Costs | 3 rec. |
| Political Economy | 1 " |
| Business and System | 1 " |

## No. 35

### Shepard Electric Crane and Hoist Co., Montour Falls, N. Y.

The management of the Shepard Crane and Hoist Company believe that they are justified in providing their own night school rather than leaving the provision to the public school authorities. One should recognize their position. It is a company of about 700 employees, the only industrial plant in a moderate sized town. The school authorities had made no move to adequately provide the desired evening classes. Hence four years ago the manager decided that by conducting their own classes the company could effectively reach a larger number of employees and utilize the high grade engineering force employed by the company as instructors. Altogether the desired educational provisions have been made at a very modest cost, not more than $3,000 being required for the 220 students registered last year. Of these 126 satisfactorily completed their courses. The classes are held two evenings a week for about one hour each night.

Twenty instructors were used, their services being secured for the modest sum of $1 per night. Students are required to make a deposit of $1 which is returned at the end of the season if attendance is satisfactory.

The usual subjects are provided: Machine Shop Practice, Blue Print Reading, Shop Drawing, Shop Mathematics, Shop Mechanics, Machine Design, Practical Electricity, Typewriting, Stenography, Office Training, Cost Accounting, Structural Design, and Hygiene and Health.

The course in Structural Design was conducted as a seminar among the young engineers in the company's employ and was remarkably successful.

Hygiene and Health, conducted by the nurses in the company's hospital, proved a very popular course among the wives of the employees. Local physicians were enlisted to add to the regular course by special lectures. This was conducted in the afternoon rather than the evening.

*SECTION V*

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## CHAPTER XI

### APPRENTICE TRAINING

**Present Scope.**—Confining our attention wholly to the fields of iron and steel working, shipbuilding and the railroad shops, this study should effectively controvert the rather prevalent opinion that apprenticeship is wholly dead. We have found in twenty-six manufacturing concerns studied, in most cases, small but usually well organized apprentice departments. It will be noticed that the practice extends to some of the smaller machine-tool making plants, in some cases those with only several hundred employees.

There are, of course, still smaller plants with only a few journeymen where occasionally an excellent all around experience may be gained by the one or two apprentices employed. The trouble with these latter plants for learning purposes is that frequently no one takes a personal interest in the young man and everything depends on his own personal initiative.

Altogether there were found in the plants visited or whose supervisors were interviewed, a total of 6,510 apprentices.

It should be repeated that this is by no means a complete survey. In the report of the Committee on Trade Apprenticeship Schools of the National Association of Corporation Schools for 1917 in the railroad shops alone 170 apprentice schools were located. Many of these, it is true, were discontinued during the war owing to the disorganization attendant upon government control and the general overturning of conditions favoring apprenticeship by wage abnormalities, but which may now be expected to resume. This report covers fifty of these schools in two railroad systems with 2,050 apprentices. Another railroad system reported 900 apprentices. If we may assume the same average enrollment of forty apprentices per school in the total, 170 schools of the United States and Canada, there would be 6,800 apprentices in these shops alone. Even if this figure is higher than the actual situation, it is a very modest estimate of the normal demand of the railroad shops.

While only four of the major electrical plants were visited, most of the other plants of these same corporations are committed to a policy of apprentice training which would account for several hundred more under training.

In the steel production industry, however, apprenticeship seems to be fostered with difficulty. As a matter of fact, the number of skilled artisans is limited. Those whose training seems advisedly by apprenticeship are confined chiefly to the small groups en-

gaged in maintenance work. In the Carnegie Steel plant visited here were 70 apprentices, another plant visited had 46 apprentices among a total of 5,000 employees.

The Fore River Shipyard had 243 apprentices and the Brooklyn Navy Yard 450. In contrast with these the Submarine Boat Corporation had not a single apprentice. Definite data have not been obtained but it is believed that there are upwards of 1,000 apprentices in the other shipyards whose production is not confined to the standardized fabricated ship. In most yards each ship is a new problem requiring a considerable force of skilled workers in all the crafts which compose the traditional shipbuilding industry.

In the building of machine tools there is considerable employment of skilled workers and therefore the demand for apprenticeship. It is true that machines are becoming more and more automatic, hence requiring less and less skilled operatives, but the more automatic a machine is usually the great skill is required in its design and initial production and incidentally in its maintenance recommending apprentice training for a limited group in the machine tool manufacturing plant. This would probably account for upwards of a thousand apprentices in machine tool plants unvisited.

Altogether then it is believed to be a conservative estimate that there are over 10,000 apprentices under well organized instruction in the United States in the field covered by this investigation.

This estimate should be compared with the data available from the 1910 United States Census:

| | |
|---|---|
| Apprentices in Iron and Steel Industries: | |
| Car and railroad shops | 395 |
| Ship and boat building | 576 |
| Iron foundries | 2,619 |
| Agricultural and implement factories | 95 |
| Automobile factories | 1,096 |
| Blast furnaces and steel rolling mills | 1,313 |
| Wagon and carriage factories | 627 |
| Other iron and steel factories | 12,494 |
| | 19,215 |
| Apprentices in Printing and Publishing establishments | 11,376 |
| Total number of workmen at above trades: | |
| Blacksmiths | 232,957 |
| Machinists | 460,784 |
| Boilermakers | 44,761 |
| Other iron and steel workers | 900,443 |
| Toolmakers, diesetters and diesinkers | 9,243 |
| Pattern and model makers | 23,006 |
| Compositors, linotypers and typesetters | 113,538 |

In considering the above data the following factors should be considered. In the census no distinction is made between the apprentice on the one hand and the helper and inexperienced machine hand or operative on the other. Also it should be noted that there has been a very considerable reorganization of apprenticeship in the past ten years. In the railroad shops and the boat building industry there has been a decided increase in the number of apprentices. Probably most of those in training as moulders and blacksmiths should be classed as helpers. A very large number of those classed as apprentices in iron and steel factories should probably also be considered as merely inexperienced machine hands. The comparatively small number of tool makers and patternmakers should be contrasted with the number of

machinists as the two former trades are outstanding examples where apprenticeship has survived because no adequate substitute has been found.

Approaching the matter from another standpoint we can divide those employed in the metal working trades under consideration into four categories:

(1) On initial production and toolmaking.

(2) Piece production or single operations.

(3) Assembling.

(4) Repair or maintenance work.

(1) If no new designs were got out there would, of course, be no work for the patternmaker, but as a matter of fact all larger plants are constantly remodeling their products in the keen competition to produce the best article for the purpose. This requires the work of the patternmaker, diemaker, diesinker, etc. The toolmaker is also constantly in demand to provide the requisite tools. All these trades are of the skilled nature which we have come to associate with apprentice training.

(2) In actual quantity production specialization is found to be so much more efficient in obtaining both output and quality that all around training for stock production has practically disappeared. There are two types of workers in this field, however, who do need the all around training. These are the supervisory force, superintendent, foreman, sub-foreman, and inspector, and the substitute man, the one who can fill in at any machine. Naturally, if the latter has the capacity to lead he may be expected to be promoted to the supervisory force when vacancies occur.

This category of piece production is by far the most

numerous of all and aside from the very limited number of foremen and substitute men, just mentioned, is ordinarily recruited from the unskilled group by being taught one machine or process after which the worker is recognized as belonging to the semi-skilled class.

(3) Formerly assembling was considered a type of skilled work. Recent developments in the way of standardized products are making it possible to permit this work to be performed by unskilled workers who are taught to do just one or two operations when the partially completed production passes on to another who in turn adds his one or two parts to the whole. Of course, if the product is intricate the inspector may profit by the all around training predicated by apprenticeship, but as a matter of fact his knowledge needs to be chiefly of the product inspected which may often be quickly learned. Of course there is much assembling of the old-fashioned type by building up the complete product where all around capacity may seem desirable, and hence apprenticeship be urged. The facts are that the inexperienced starting at this type of work are usually adults who perhaps slowly and clumsily work at it until they learn the knack of putting together completed parts and of making the slight adjustments always necessary at the end of every fabricating process.

(4) Finally there is the maintenance work which in a large number of cases seems to recommend the all around mechanic for whose training apprenticeship is usually urged.

As a whole, then, accepting the estimate that there are approximately ten thousand apprentices in the

fields investigated, the question naturally arises whether this is ample. Most manufacturers would answer in the negative. Usually there is lamented the shortage of toolmakers, of the all-around mechanics for repair work and of suitable material for foremen. It should also be recognized that these plants studied are the outstanding examples of corporations which have introduced well-organized apprentice training. Many of their competitors make a practice of " stealing " the skilled mechanics they require. For example, the two automobile companies cited are among the few automobile concerns who have paid serious attention to apprentice training and yet owing to their large amount of developmental work, of intricate assembling, and increased demands for foremen to supervise their expanding factories, most automobile manufacturers could use a far larger number of apprentice trained mechanics.

**Trades Affected.**—It has just been estimated that there are more apprentices in the railroad shops than in all other fields. If we may assume the Santa Fé shops as typical of railroad shops: Of the 1,330 apprentices in their shops, 60 per cent are in the machinist's trade, 13 per cent are boilermakers, 6 per cent sheet metal workers, 17 per cent carpenters, 1 per cent electricians, 2 per cent are blacksmiths, and 1 per cent are painters. In this list there are probably a larger proportion of carpenters and painters than will be found in most shops as in general those two trades are recruited by taking on men as helpers rather than as apprentices.

In the Brown and Sharpe plant which is to some extent typical of the machine tool manufacturing

establishment of the 200 apprentices, 75 per cent are machinists, 12 per cent draftsmen, and 13 per cent are patternmakers, moulders, and blacksmiths. In the smaller apprentice departments, which are often maintained largely as a training field for future foremen, there is a preponderance of machinists. In some plants requiring work to precision this may take the form of toolmaking, in others it will be maintenance or repair work, and it will be called apprenticeship in the machinists' trade. In some cases both designations are given to the trade taught as implying both types of training.

In an occasional plant, of which the model department of the engineering office of the Western Electric is an example, a few apprentices are being trained as instrument makers. This is a refinement and specialization to minute work of the toolmaker's art and trade. A skilled worker in this field can usually command a premium over other toolmakers.

In the shipbuilding industry the Fore River Ship Yard investigated provided training for fourteen separate crafts. Twenty-eight per cent were preparing to become *inside machinists*, which approximates the trade as found in other industries; 7 per cent were to be *outside* or *erecting machinists;* the same percentage were being trained for *ship fitting;* 13 per cent were to become *mold-loftsmen;* 5 per cent *layer-outs;* 2½ per cent *blacksmiths;* 9 per cent *coppersmiths;* 5 per cent *electricians;* 2 per cent *shipwrights;* 4½ per cent *joiners;* 6 per cent *patternmakers;* and 3 per cent were in the *sheet metal workers'* trade. Temporarily, there were none training as *boilermakers,* though that was considered a trade warranting appren-

ticeship. As regards *drafting,* 8 per cent of the total were under training for that field. It was, however, recognized that that department was of the nature of a profession where high school graduation should be a minimum academic preparation upon which should be built a broad practical experience at all the crafts involved combined with a technical course in the mathematics and applied science required for adequate preparation.

In the Navy Yard visited, in addition to the trades already mentioned for the shipyard there were apprentices enrolled under the following trade designations: *Boatbuilders, Chippers* and *Caulkers, Diesinkers; Moulders, Painters, Plumbers, Shipsmiths,* and *Sailmakers.* Some of these are, of course, combinations or differentiations of the same trades as mentioned for the ship yard under other names. Some, such as painters, chippers and caulkers, could also be prepared for perhaps advisedly by the intensive training practiced by the Submarine Boat Corporation.

**Why Apprenticeship?**—The argument for apprenticeship is briefly this. Such employments as have an extended recognized field of practice which enlist the better grade of workingman, utilizing both his technical knowledge and manipulative skill, which require an extended period of participation for mastery and which can be embarked upon in the simpler processes by the immature worker, can be economically prepared for by apprenticeship. The patternmaker's and toolmaker's trades are outstanding examples suggested by this study. Another is the hand compositor's trade in the printing industry. There

are, of course, the other somewhat similar trades of the shipbuilding industry and of the railroad shops.

In the Vocational Education Survey of Minneapolis* the following reasons are advanced for apprenticeship:

"(1) A more careful selection of men who want to follow the trade results.

"(2) The apprentice advances into journeymanship with more interest in his calling.

"(3) The best time to get full knowledge of different machines and processes is while the learner is young. With proper apprenticeship training the youth learns best methods at the outset, instead of unlearning bad practices later.

"(4) Where school training accompanies shop practice, the youth gains technical mastery over processes which would otherwise be mechanical, and learns to adapt himself to changing conditions as the untrained machine worker never can.

"(5) Wider knowledge of all processes gives him an understanding, even in specialized work which machine hands cannot have.

"(6) Apprentices of the future, if some better method of teaching can be found, will be not only all-around men, able to cope with every situation, but also men from whom the shop can obtain foremen and technicians.

"'Modern industry may even complete an organization in which all the work is done by machinery made almost automatic and operated by machine hands, but will always have a need of the men who are masters of its processes to bind them all together and to direct the labor of the machine worker.'"

**Conditions for Good Apprentice Training.**—It should be stated, that the first requirement for satisfactory apprentice training is adequately varied shop experience under good shop instruction. Advocates of the continuation schools for trade training would frequently have one believe that the problem of instruction in the skilled trades is solved by the estab-

*No. 199 U. S. Dept. of Labor Bureau of Labor Statistics, p. 124.

lishment of such schools. There is no attempt to belittle the utility of that movement in stating that the best of instruction in such schools will never make efficient mechanics without adequate experience in the manipulative phases of the trade which under apprenticeship can only be obtained in actual shop production.

Two methods are possible for this shop experience. One is to provide a separate training shop equipped with all the standard tools of the trade where general experience may be obtained for at least a part of the apprenticeship. The other is to arrange an orderly progress through all the various types of employment at the trade in the regular production shops of the plant under adequate supervision to see that the shop foremen do not interfere with the satisfactory learning of the trade by keeping the apprentice at jobs unprofitable from the standpoint of learning or long after the process or operation has been thoroughly learned.

The separate training shop seems of particular importance in teaching the machinists' or toolmakers' trade, though where there was good coöperation from the production departments it may not be necessary. In one plant the apprentices were in the separate training department throughout their apprenticeship. In other plants the period was one year or two years after which they were placed at regular production but under supervision for varied experience.

A matter of prime importance is the quality of the apprentice supervisor. In many of the plants visited he had had technical training but it is probably of greater importance that he have the qualities of a

good teacher, a strong human interest in the apprentices, a thorough knowledge of the trades taught, and considerable practical experience in at least one of them himself. Also he should have a personality which will secure him recognition as on a par with the shop superintendents.

Of almost equal importance is the quality of the shop instructors. It goes without saying that they should be first class mechanics, chosen because of their liking for the work of teaching and desirably given some instruction in their teaching. In the Santa Fé shops they were provided at the ratio of one instructor to twenty-five apprentices. A ratio of one to fifteen or twenty apprentices is sometimes recommended. In case there is no separate training department their position is usually that of assistant foremen.

**Apprentice School.**—For the supplementary instruction provided in the apprentice school there seems considerable variation in the amount of time allotted. In some plants only about two hours is provided per week; in others as much as eight hours is given to it. The modal seems to be four hours a week.

However, it would seem that the amount should vary with the technical content of the trade. If it is the tool or instrument maker's trade six or eight hours per week is not too much. If it is one of the maintenance trades or one where there is no necessity for acquiring skill in drafting, two or three hours per week may be sufficient for the phases of instruction directly related to the trade in hand.

In many apprentice schools there does not seem to

be given sufficient attention to this relating of the school instruction to the trade involved. In many cases all are given the same course no matter what their trade may be. If only machinists, draftsmen and patternmakers are concerned, there may be some reason in that practice as the instruction should in large measure be similar but blacksmiths and foundry men have little use for some of the instruction in drafting and advanced mathematics and are frequently unable to grasp it as usually they are boys with very meagre educations. For them, coupled with fundamental trade arithmetic, there are possible units of applied science, iron and steel metallurgy and the like which are both interesting and within their grasp as explaining phenomena which they have observed in their own trades. The amount of this instruction required by them, however, it should be recognized, is very limited.

There is an opinion among many supervisors that there should be some instruction in the civic-moral field to combat the present industrial unrest, and to prepare the apprentices for their approaching duties as citizens, a matter which may be of greater interest to them at the time of apprenticeship than earlier when they were in public school. To quote from the 1920 report on trade apprenticeship of the National Association of Corporation Schools:

"A system for teaching industrial economics is of vital importance and would, if properly carried out, probably do more to create satisfactory industrial relations than any other single subject." *

Of course the matter needs to be handled with much

* Cf. National Association of Corporation School. 8th Annual Rept. p. 203.

perspicuity as there would doubtless lurk a suspicion of capitalistic propaganda in the minds of many of the boys, if the instruction were introduced in a school which they were attending under compulsion as a part of their apprenticeship. It should be said that while practically no courses of this sort were found in the apprentice schools visited the importance of the type of instruction was generally recognized.

In Industrial Economics the following program was submitted in the 1920 Report on Trade Apprenticeship just referred to:*

Outline:

1. Stages in the development of civilization:
   *a.* Primitive
   *b.* Pastoral
   *c.* Agricultural
   *d.* Industrial
2. Origin of capital (story form)
3. The capitalist, how developed
4. The worker
5. Ownership, barter or exchange
6. A medium of exchange (money)
7. Government (autocracy, democracy)
8. Rent, interest, taxes
9. Wages (in primitive society)
10. Increased production
11. Value (supply and demand)
12. Inventions (factory life)
13. Management (modern industry)
14. Modern capital (the capitalist)
15. Wages (*a*) Various theories
    (*b*) Methods of payment
    (*c*) Real, nominal
16. The corporation (stocks, bonds)
17. The owners (stockholders)
18. Employer and employee
19. Stockholders (managers, employes)

*l. c. U. A. C. S. 8th Ann. Rept. p. 214.

20. Cost of production (material, wages, rent, interest, insurance, taxes, heat, light, depreciation, management)
21. Profits (how figured, how distributed)
22. How costs are figured
23. Cost of production (actual cost, overhead, surplus)
24. Methods of management
25. Distribution (methods of)
26. Banking.

The law of New York State, passed in 1919, establishing part time and continuation schools, states that the courses of study " shall include among other subjects instruction in American History, the rights and obligations of citizenship, industrial history, economics, the essential features of the laws relating to the industries taught."

The report of the Committee on Education of the New York State Federation of Labor for 1919 contains the following item: " We recommend that courses of study be organized in history, civics, labor, health and compensation laws, and economics, under the guidance of the State Department of Education. If labor is to intelligently exercise its fullest political power, the members of unions and other wage earners should have exact and scientific knowledge of the subjects mentioned."

It is thus seen that both organized labor and the public education authorities endorse such instruction. The citations from the law for part-time schools of one state and from the recommendations of a committee of the labor federation refer primarily to public education but are believed suggestive of the attitude of the public and hence worthy of consideration in planning the program of an apprentice school whether under public or private auspices.

In several corporation schools there is an attempt to rate the apprentice on his qualities of character useful in his employment. These are, of course, but estimates of his instructors, supervisor and foremen but may be highly useful in stimulating the apprentice's recognition of the relation between his work efficiency and his moral qualities and to the management in selecting individuals worthy of promotion to positions of responsibility.

While adequate shop instruction was urged as of prime importance the related work of the apprentice school is of sufficient importance to recommend teachers of the first quality. Ordinarily in the schools investigated they were technically trained and usually had first hand experience at the trades whose book phases they were to teach.

In the introduction, the formula $E=M+(T+1)$ was quoted. In some cases it may be wise to differentiate in the instruction the " T " or elements of specific trade technical content in the particular trade from the " I " or those of general trade content. At least that seems the practice in several apprentice schools. The " T " instructor will be in close touch with the actual work the apprentices are doing while the " I " instructor will contribute the factors of more general nature and common to all the trades taught.

In this practice there is sometimes urged a warning against " cold storage" * teaching, i.e., of providing instruction which we have a faith will sometime be useful to the student but which has no immediate application. There is much cogency in the warning as there are apprentices who will become excellent me-

* Allen, "The Instructor, the Man and the Job," pp. 336–341.

chanics but who are incapable of assimilating instruction beyond that of immediate application in their work. The solution of the problem may be that worked out at the West Lynn plant of the General Electric Company where an Engineering School has been provided for the high school graduates and simpler apprentice courses for those who have no aptitude for the advanced work. This has been shown to have been very successful in training the more capable while offering ample opportunity for training the mechanic of average ability. The Westinghouse Electric Company provides for the advanced instruction in a voluntary evening technical school. Many progressive communities provide the additional opportunities in public or semi-public evening technical schools.

The practice in the apprentice departments studied was to provide the class-rooms inside the plant and as near the shop as possible. It should be noted that an extensive or expensive equipment is not absolutely necessary. For drafting instruction only suitable drawing space with materials are required and for the other classes comfortable seats and a black-board. Of course it probably adds somewhat to the popularity of the apprentice department to provide the equipment equal in quality to that of the public schools. In two plants moving picture equipment was available as used for the mass education provided for all employees. Another has a projectoscope. The railroad shop schools were stated to have gathered much illustrative material. This additional equipment may be justified as placing the apprentice school on a par with the public high school with which it must com-

pete to secure the better type of boys for whom it offers equal or superior opportunities to the free public school. But it should be recognized that the apprentice is paying for all elaborateness of equipment in the difference between the wages paid to apprentices and to those at regular production but with no supplementary instruction; for apprentice instruction must in general be a profitable venture in order to justify it to the directors of an industrial corporation.

**The Apprentice School on Company or Student's Time.**—The increasing practice seems to be to place the supplementary instruction during the regular working hours. There are some distinct advantages in this practice:

(1) It permits the full time utilization of school instructors most advantageously.

(2) It lessens the possibility of overworking the apprentices by requiring class attendance after they have been exhausted by their shop work and provides for more time for recreation after work hours.

(3) More is accomplished in the school studies if the students are fresh and it provides a welcome break in the shop work.

It should, however, be urged in favor of the after-work school:

(1) There is less reason for placing the school instruction during working hours with an eight hour day than in the former nine or ten hour day. In one plant the shop ceased work at 3.45. It would be quite possible there to provide from one to two hours' instruction directly after work and still give the apprentices time for some recreation. Another company

where work ceases at five provides a lunch for the apprentices after which an hour and twenty minutes class is provided which permits the boys to leave at 6.40.

(2) The after work school permits the employment of instructors on a part-time basis. Usually in this way members of the engineering or drafting staffs or a skilled mechanic can be utilized for the instruction.

(3) There may be so much disorganization of the work of the plant by withdrawal of the apprentices for shop instruction that the manufacturer may prefer not to employ any apprentices if part-time instruction is required and an opportunity of learning a trade will thus be lost to the young men concerned.

(4) The apprentice must expect to pay by proportionately reduced rates of pay for his reduced production resulting from being withdrawn from the shop to attend classes, for the overhead on his idle machine, and for the attendant disorganization of the shop. This disorganization is particularly apparent when, for example, an apprentice is a member of an assembling gang.

One solution of the problem devised at the Watervliet Arsenal is to require that the instruction shall be half on company time and half on the apprentice's, by requiring that on his instruction days he quit at six rather than at five.

As the disadvantages seem greater when the apprentice is at regular production than when working in the training shop it might be possible if a training department is utilized to provide the school instruction while working in that department on company time and in the advanced years when at regular production

on the student's time. This would lessen the likelihood of over fatiguing the younger apprentices with whom there is doubtless greater danger and still not unnecessarily disorganize production.

**Apprentice School under Plant Auspices and Public Part-time School Compared.**—In the plants investigated the apprentice schools provided by the company seemed in general markedly better than where provided by the public school authorities. (1) Teachers conversant with actual shop conditions were employed. (2) They could be enlisted from the personnel of the company or if employed at full time, were selected for thorough competency. (3) There was a more harmonious working with the company's administrative force and a greater assurance of so arranging the apprentice's employment in the shops to assure optimum learning conditions.

(4) Moreover, the general management took a greater personal interest in the apprentices which should assure their meritorious advancement when opportunity afforded.

Arguments in favor of the part-time school provided at public expense are:

(1) It is held a function of the democratic state to provide, as one goal of its educational program, such instruction as will increase the vocational competency of its citizens. (2) The civic-moral instruction desirable can be provided by the authority of the state presumably neutral as regards capital-labor conflict without a suggestion of capitalistic bias accompanying the corporation school. (3) The expense of the instruction under corporation auspices is really borne by the apprentice as it is to be expected that appren-

tice training will be a profitable enterprise and the manufacturer passes on the cost of instruction to the apprentice by reduced rates of pay. (4) In the smaller plants there are no facilities for instruction in the way of a drafting room and classroom, and (5) the small number of apprentices does not warrant the employment of an instructor, or (6) to properly supervise his instruction.

**The Plant School vs. the Continuation Class in a Public School.**—Somewhat the same discussion recommends the class rooms as conveniently accessible to the shops as possible inside the plant.

(1) There is little loss of time in passing from shop to school and no necessity is felt for changing from work to street clothes.

(2) There is greater coördination of school with shop instruction and a single supervisor may direct both types of instruction.

(3) In some cases it may permit the employment of the same instructor for both the shop and school. This practice was noted in the shipyard investigated.

If, however, the plant has no available space or is hostile to supplementary instruction and unwilling to provide it, the public school may be utilized. This is, of course, recommended where there are too few apprentices in one plant to form a class or to differentiate the apprentices into classes suited to their varied attainments. In most cases under these circumstances one or two half days are taken for the instruction.

When after-work instruction is provided one plant had arranged that the classes come directly at the close of work rather than in the evening. This prac-

tice is recommended when some or all of the apprentices live at a considerable distance from the plant.

**Indentures or Apprentice Contracts.**—Where well organized apprenticeship is practiced the usual procedure is to execute an indenture stating the conditions of apprenticeship as to length of service, varieties of experience provided, amount of supplementary instruction, and rates of pay. While there is usually a clause relieving the corporation from full responsibility to execute all provisions and even to suspend or totally terminate the contract should commercial conditions necessitate such action, observation of the workings of apprenticeship with and without contract leads the author to believe that the good faith of a responsible corporation is thereby enlisted to insure the satisfactory instruction of the apprentice.

It is believed also to act as a moral restraint upon the apprentice against terminating the training program under temporary dissatisfaction with some instructor, a foreman, or certain phases of the work. The parent, both parents, or in case of their decease, the apprentice's guardian, is ordinarily made a party to the contract. While modern social phenomena suggest that the influence of parental authority is much less effective during adolescence under modern industrial conditions than was the case in a more primitive and stable social organization the practice would seem to have in many cases a wholesome effect.

In the state of Wisconsin the contract is under the supervision of the State Industrial Commission. Such a disinterested authority may be highly useful in insuring the satisfactory working of the indenture plan.

It should be stated that the control of an apprentice agreement is chiefly moral and not ordinarily enforced by legal measures as the attitude of the company is ordinarily that if an apprentice breaks his contract he is lacking in the moral qualities which they desire in the mechanics to be provided by the means. On the other hand, the contract is so loosely framed that it is not enforcible by legal measures if the company is not living up to the implied terms so that the recourse of the apprentice when dissatisfied is not to the courts but to withdrawal on his part and seeking other employment.

**Age Period of Apprenticeship and Normal Length of Service.**—The general practice seems to be to prefer and in many cases to limit apprenticeship for those with an elementary education to boys sixteen to eighteen years of age at commencement with a four year period of service. For high school graduates and in certain trades requiring mature strength the period is ordinarily three years in length and the age of entrance eighteen or over.

The arguments adduced are that state laws relative to the employment of minors do not permit the employment of boys under sixteen in the handling of machinery and it is desirable to commence the apprenticeship directly upon leaving the public school as the boy under those conditions has not lost the habits of study and of regularity and punctuality to which the school has accustomed him by a period of shifting in the more or less irresponsible casual employment open to juveniles.

For the machinists, patternmakers, and most of the trades of the railroad shops and shipyards also, the

work is not too heavy or exacting for these immature workers. That the course should be four years in length for the sixteen year old upon entrance arises from the fact that it is not desirable to promote to journeyman's wages and responsibilities those less mature than the journeyman who has attained his majority. Moreover, there is sufficient content in the trades considered both of manipulative skill and of related technical knowledge, if imparted upon the desirable part-time basis, to require the full four years.

Sometimes the period of apprenticeship is shortened several months as a reward for unusual capacity and competency. This is a practice which seems desirable as an encouragement to effort and offers no radical departure from the standard policy. For high school graduates the age minimum of eighteen is established in general by the fact that such a course cannot be completed before reaching that age and the three year apprentice period is justified by the same arguments that recommend the four year course for grammar school graduates.

It seems unfortunate that statutory prohibitions as to the employment of minors in some states prevent the employment of apprentices under eighteen years of age as these limitations have prevented the normal development of apprenticeship in the trades where the sixteen year old may safely be employed. The chief difficulty is that in the initial stages of learning a trade the productive worth of the apprentice does not warrant payment of wages over about one-fourth paid the adult mechanic and a young man who has reached eighteen is usually unwilling to forego the more attractive wages paid the operative special-

ist. Moreover, he has often been knocking about at various juvenile employments for several years so that he has lost a desire or willingness to study, some of which is essential for the acquisition of a skilled trade.

**Rates of Pay and Bonuses.**—Just antedating the recent World War the prevailing rate of pay for apprentices started at about twelve cents an hour for the first year and increased to about twenty cents an hour for the fourth year for a week ranging from fifty to sixty hours. It is now extremely varied depending upon locality and occupation but in general it can be said to have increased from 50 to 100 per cent or more, the improvement being most apparent in the third and fourth years. The working week is, however, shorter, varying from forty-four to fifty hours, the week being longer in but one or two plants visited. There should also be noted the increasing amount of company time, for which regular pay is granted, devoted to related technical instruction in the shop school.

During the war there was much dissatisfaction among the apprentices with the fact that owing to their indenture agreements their pay did not advance as rapidly as the corresponding journeymen's wage and the increasing cost of living. A solution, devised by the Mergenthaler Linotype Company and stipulated in their " conditions of apprenticeship," which may be expected to automatically adjust to changing rates of pay in the plant, is to pay on the basis of a percentage of the prevailing or basic hourly rate fixed for journeymen of the trade involved. This is 25 per cent of the prevailing rate for the first six

months of service; 31 per cent for the second; 37 per cent for the third; 50 per cent for the fourth; 55 per cent for the fifth; 60 per cent for the sixth; 75 per cent for the seventh; and 85 per cent for the eighth.

One advantage of such a variable rate at the present time is that it would adjust as easily to a decreasing scale of pay which may come in the next few years and it would be an undesirable anomaly to find apprentices paid during their fourth year as much as or more than journeymen. Another practice to be commended in some plants is the payment of a premium of two to four cents for superior work in school and shop.

It is a tradition of apprenticeship that a bonus is to be paid the apprentice at the conclusion of his term of service. This sets a prize on the completion of the course which has doubtless been of great value in holding the apprentice particularly toward the end of his apprenticeship. The traditional amount is $25 for each year of service, $100 in the four year course, $75 in the three year course. Many plants have found it advisable to increase this amount. In one case a second bonus of $100 was paid if the apprentice continued with the company one year after the completion of his apprenticeship with them. The company already referred to carries the percentage policy to this matter of bonuses as well and pays 10 per cent of all wages received by him during his term of service.

**Deposits.**—Two companies required the deposit of $25 in one case and $50 in the other as guarantee that the apprentice would remain throughout the period of apprenticeship. It is, of course, returned with

interest when apprenticeship is completed. A company with a long tradition for good apprenticeship may find that this works efficiently in holding their apprentices through the course, but a company just embarking upon apprenticeship would probably find it undesirable as many suitable young men would hesitate to venture even $25 of their funds on an apprentice program of whose merits they are uncertain. It should be said that there seems no tendency to increase the practice which in general should be condemned.

**Certificate of Apprenticeship.**—The practice seems to be general of conferring a certificate of apprenticeship upon completing the course. As there are, however, no uniform standards its value depends much on the standing of the company conferring it, much as does a college diploma. Three national organizations have, however, been active in promoting more uniform requirements: The National Metal Trades Association, The National Industrial Conference Board,* and National Association of Corporation Schools.†

The American Locomotive Company, in addition to the usual diploma conferred, issues a duplicate of pocket or post card size which is intended to be a convenient means of establishing the completion of apprenticeship in seeking a position. Others issue buttons for coat lapel which are useful in identifying the apprentice graduates among the working force and of course would be an equally useful proof of apprentice training in an employment office of another plant when seeking relocation. In this connection it should

* See Conference Board on Training of Apprentices.

† N. A. C. S. all annual reports on Apprenticeship.

be recognized as valuable experience to leave the plant where the apprenticeship was served to learn the practice of other shops and in related industries. It should be recognized that, if all companies in proportion to their force in the skilled trades practiced apprentice training, none would suffer by this practice.

**School Substitutes for Apprenticeship.**—The Report of the Federal Board for Vocational Education for 1919 states the following enrollment in Smith-Hughes Aided Schools, which includes the building trades, automechanics, etc.

| | |
|---|---|
| Evening | 42,094 |
| Part-time | 17,276 |
| All-day | 15,111 |
| | 74,481 |

The night school should not be considered as making a serious contribution to the manipulative phases of the skilled trades we have been considering—that is, toolmaking, diemaking and die sinking, patternmaking, the all around machinist in the maintenance department, and the crafts of the shipyards and railroad shops. Assuming that a workman attended fifty nights for two hours per night he would have put in at a maximum one hundred hours, the equivalent of two weeks in a shop. This would be largely work of an exercise sort which would in no sense approach trade mastery. Such shop work may function to some extent for trade extension and trade conversion purposes. Thus it may be possible for a workman to learn enough to become a lathe or miller operative and hence to broaden his adaptability in a shop so that it is possible he might become a substitute hand in piece production as already referred to.

The shop arithmetic and drafting classes may contribute to the technical training of the adult workers as trade extension but all consulted in the industries were agreed that this should be considered but as crutches to insufficiently prepared mechanics.

There has already been discussed the essential conditions for effectiveness of the Part-time schools, to train skilled craftsmen, which is varied experience at all manipulative phases while at regular shop production. Of course this amounts to apprenticeship even though unorganized and it should be remarked that there has been established no authority in administration of the law to insure such transfer and it is doubtful if there can be without cordial coöperation of a plant's management.

The All-day Vocational Schools scheduled for the fourteen to sixteen age period, if provided with sufficient equipment for experience at all operations and machines utilized in the trade and with a source of production jobs sufficient for experience at all types of practical work could probably take the place of the separate training shop already referred to as desirable for the first year or two of the apprenticeship course. Those conditions seem satisfactorily met in the Trade School described under the study of education in the Henry Ford plant. There all types of jobs can be secured from the parent plant, and in sufficient quantities so that an average of $80 per month of salable products is made by each of the students in the two-thirds of their time which they are in the shops. This permits the payment of reasonable apprentice wages, which has been attempted in no public trade school.

With, however, the usual inadequate equipment of the machine shop and no attempt at quantity production, the ordinary graduates of the machine shop departments, if they finally enter industry, do so as lathe hands or as other specialists. The management of several companies in stating their attitude toward the vocational school usually mentioned instances where graduates admitted that their experience on the miller had been confined to cutting a few teeth on a gear. This experience should be compared to the three months of continuous practice at the milling machine for adult learners in the vestibule school of a Machinery Company. Furthermore, other than the repair and upkeep of the school machines there can be no experience of the nature of maintenance work.

Another element that should be considered relative to the vocational school is that not sufficient effort is made by them to select the boy with superior mechanical ability. While this may come about to some extent through the working of the inclinations of the boys concerned it is too often apparent that the vocational schools are largely the dumping ground for the less capable. Of course this condition is probably as it should be if the function of the vocational school is to give a brief initial training for machine shop operatives and other semi-skilled specialists. It should be clearly understood also that no attempt is here being made to pass upon the efficiency of the vocational school in training for the building trades and the independent service employments such as that of the automechanic referred to in the introduction.

About the same discussion holds, however, relative

to the printing trades as for metal working. In large printing centers the trade of the all around printer has ceased to exist and in its place we have clearly defined definite trades such as that of the hand compositor, the linotypist, the pressman and feeder, the lithographer, and bookbinder. Some of these are well adapted to apprentice training of which hand compositing is an outstanding example. Others lend themselves to intensive or to part-time training depending upon whether the training is for the novice or one already engaged and seeking training for promotion. All suggest the vocational school closely linked to a friendly large publishing company or to a coöperating group of associated smaller printing plants such as are partially developed in Chicago and New York.*

**The Coöperative Trade School.**—The plan of education by which the student spends one week in school and one week in the shop has been described under the study of the educational and training program of the United Shoe Machinery Company. It is based on the assumption that school progress and shop practice are of exactly equal importance in the acquisition of the trade involved. The modification worked out in the Ford Trade School of two weeks in the shop to one in school assumes that for the acquisition of a trade the shop practice is the more important element in attaining trade mastery. This conforms to the experience acquired by the now long developed apprentice schools which have been studied.

It is also believed that a corporation coöperating in maintaining such an institution can afford to

* Ref.: Ind. Ed. Survey of N. Y. City.

pay the same piece price for the production of the training shop as in its regular production departments as by that means the better class of boys will be induced to take the course and the company will benefit in the superior quality of future mechanics graduated and recruited to its force of skilled workmen.

It should be said for the coöperative school that thereby full time utilization can be made of the expensive equipment of the training shop. This is a matter of no mean economic importance when it is considered that a half million dollar plant is necessary to train 300 boys for the machinists' and toolmakers' trades.

**The Endowed Trade School.**—In many of the larger cities are found well endowed private institutions usually designated Institutes or under the older name of Mechanics Institutes. These in some cases have made marked success in their work, particularly in such vocations as possess large technical elements. In the trades we have here been considering they have been successful in providing usually superior extension instruction in evening departments. They have also been useful to provide the promotion training for superior young men who had already considerable practical experience and desired by a brief course to prepare for advancement or to develop from a specialty to the all around skill of the toolmaker. They would be probably the chief reliance for this purpose if the apprentice method completely disappeared.

In some cases the vocational departments of Technical High Schools have approximated this service. The unsatisfactory condition in them is that ordi-

narily owing to academic restrictions they have not lent themselves to aid the student who has considerable practical experience but not the required book instruction laid out for entrance and advancement. It is believed they would function more efficiently if they were organized to operate continuously throughout the year and encouraged, by adjusting their courses for that purpose, the student to utilize one or two terms each year at study and training in their classes and shops from the time when he graduated from the elementary school until he was twenty while he put the two or three other terms each year in productive employment. This would provide practical work in regular production at the manipulative phases of the trades concerned. This could also be provided on the coöperative basis of a week in school and a week in shop which is now being successfully worked in some of them. Their marked success has, however, been in preparing for the more technical or engineering employments such as that of draftsman or electrician discussed in the next chapter.

No discussion is here made of the engineering college as it is generally recognized that their field is preparation for professional engineering and executive positions.

**Correspondence Schools.**—Probably more men in American industry have gained the technical phases of their trades from correspondence schools than by any other means. Their text books are prepared to be read by the student with limited knowledge of mathematics and the lesson sheets provided permit study at any free time. Moreover, the teaching manual in pamphlet form can readily be carried in

the pocket and studied in direct relation to the tool or problem to be met. The requirement that all problems must be completely solved is in contrast to the evening school where regularity in attendance is frequently the only check on progress and assimilation. They, however, lack the contact of teacher and pupil wholly and there is of course no organized method to provide the varied experience desirable in the manipulative phases of the trades involved. They should also be condemned for exploiting ignorant laborers who have been induced to purchase their courses by their field agents who have covered the country and painted rosy pictures of munificent engineer's and manager's salaries to those who have not the rudiments of an elementary education. This is of course in direct contrast to the University of Wisconsin Extension Courses where the texts have been admirably prepared for study and there has been no promotion among those incapable of their use.

## CHAPTER XII

## TRAINING OF TECHNICAL MEN IN THE INDUSTRY

In the program studies it was observed that various corporations were making it a practice to recruit high school graduates and to train them for certain types of technical positions, many of which might ultimately lead to promotions ranking as engineers.

The rather more frequent practice was also noted of absorbing college men, ordinarily technical graduates, into the organization under some supervision which may properly be designated as training.

The plans investigated may be reduced to three categories:

(1) Provision of both technical instruction and practice.

(2) Coöperative employment of engineering students in industry.

(3) Employment of technical college graduates under supervision for experience and adjustment to positions in the corporation's personnel.

(1) **Provision of both Technical Instruction and Practice.**—When any industry attempts to provide both technical instruction and practical experience in order to develop inside the industry men for the technical departments, there are ordinarily selected

high school graduates and preferably those who have had a technical course. As such they have had under more favorable conditions some training in drafting, a year or more of instruction in each of the two sciences most useful for the purpose, physics and chemistry, and probably a four years' course of mathematics. It is also to be expected that they have had at least some rudimentary shop practice. They are ordinarily then about eighteen years of age and are willing to start at ten to fifteen dollars a week, which is probably all their production will warrant at the start. It should be recognized that they consider the training provided a large part of their remuneration. The usual course is three years in length.

In one plant these young men are indentured in the same manner as are the trade apprentices and start with the latter for a year to a year and a half in the apprentice training shop to obtain a varied experience at regular machine production. Some are enrolled to become Draftsmen, others to become Electrical Testers, and there is a course scheduled for Technical Clerks but apparently this is not much developed. Draftsmen in particular should benefit by the machine-shop experience as the utility of a tool or machine design depends on its practicality from the standpoint of economy and ease of production. After the initial experience in the machine-shop training department the draftsmen then enter the drawing office and the testers for the remainder of their three years' course shift by periods three to six months in length, in a regular schedule through the winding department, the drafting office, and the assembling and testing departments for electrical machinery.

In what is called the Engineering School, all receive about an hour and a half of instruction each day in mathematics, mechanics, electricity, machine and dynamo design, chemistry and metallurgy, drafting, and Business English.

The success of the course is attested by the number of graduates who have become engineers in their fields, tool and machine designers, testers, draftsmen, or have been selected for supervising positions.

Another company has recently instituted in its engineering office a somewhat similar course for the large number of assistants which can there be utilized. An electrical cable company has organized during the past year a class among its high school graduates and others with sufficient preparation for a technical course. One electrical manufacturing company has maintained for its employees a voluntary evening school in Fundamental Principles of Engineering during the past eighteen years. That of the nearly 200 graduates about one-half should already have reached responsible technical or supervising positions suggests the value of the course.

Two companies are working out educational programs on the principle of alternate weeks at instruction in a company school and at production. One is in a shipyard for nautical draftsmen the other in an important manufacturing plant as a means for recruiting the design, sales, and supervisory staffs.

A considerable number of companies provide more or less formal instruction for their draftsmen as it is readily recognized that a man's value in that field depends largely on his technical and practical knowledge. The latter can of course best be obtained by a

temporary shift to regular production and preferably under such conditions as will permit the greatest possible variety of useful experiences in the limited time which can be thus utilized. This would suggest the use of the shop-training department if available.

It is difficult to estimate the number now under organized training on this basis but it is safe to say that the number is not large. The largest number are probably draftsmen as it is very easy to arrange that the beginners meet one or two of the older men for regular instruction in useful related technical subjects. This is of course in addition to the regular office supervision and in most cases is arranged for after work periods.

On the whole the number is probably far short of present industrial demands and in no way equal to the quota of worthy graduates each year coming from the technical high schools.

It is a pertinent question whether a company can thus afford to provide the supplementary technical instruction and subject its production departments to the inconveniences of being troubled to train for a short period a young man who will not be a permanent acquisition to its working force. Experience seems to answer in the affirmative. The young man who at the start is more concerned with getting a wide experience than a large salary will willingly work for much less if he has provided for him a well laid out training program and he can probably earn at varied production the relatively small amount paid him.

It should be recognized that design for each industry is to a considerable degree particularized. The regular technical school, day or evening, in gen-

eral only provides the fundamental training after which there is often a considerable amount belonging to each individual industry which can best be learned therein. While it is possible that the better men will obtain this information on their own initiative, the special instruction helps to insure this result.

In considering the utilization of the plan in a drafting office it should, however, be borne in mind that in many plants there is wide fluctuation in the size of the personnel. Usually there will be a small permanent force which will be greatly augmented to get out some new designs or to provide for an expansion of business. Usually this demands expedition which will only warrant employment of draftsmen already competent. Any scheme of systematic training is chiefly useful then in recruiting the permanent personnel, which would presume a department of some size in a plant warranting a large engineering office where design is a major interest.

It is a debatable issue if the alternate week plan where the company provides both the instruction and the productive experience will ever develop to any degree. In the shipyard, for example, it is open to question if it would not be more economical from the earning standpoint for the future draftsman to go into the mold loft or pattern shop and work continuously until he had attained the experience considered desirable.

**The Corporation Technical Night School.**—The advantages of the technical night school for future engineers under company auspices have already been suggested. The faculty can be readily recruited from the company's engineering staff, the instruction

can be adjusted more readily to suit the company's products and requirements for future promotions and such a school can probably be made to develop a company *esprit de corps.*

That we do find company technical night schools does not of course warrant the assumption that there is no need of engineering university extension or of the Institutes and public evening technical schools which in some cities have proved their large usefulness. As a matter of fact a major part of the technical instruction in this field is now provided by these institutions and will doubtless in the future in increasing measure continue to be so secured.

One should not ignore also the possible contributions of correspondence instruction in this field of supplementation for work in the technical departments. The high school graduate it may be expected has sufficient educational background to assimilate what is clearly presented in a book and if he has sufficient application to stick to a course he should benefit thereby. It doubtless assists if someone in his department is delegated to assist him over difficulties, offer him encouragement, and provide recognition for accomplishment. This is a proper function of one delegated by the company's education department.

The thorough development of a corporation school in this field will probably be limited to the larger corporations and in particular to such occupations as require large units of instruction peculiar to the industry or where public or endowed educational institutions are undeveloped or unavailable. Isolated plants belong in particular to this category.

**Relation to Trade Apprenticeship.**—The shop experience of trade apprenticeship coupled with the supplementary instruction of drafting and mechanics given in the better apprentice schools is clearly excellent preparation for work in design. This has led in some plants to the practice of recruiting their small drafting departments from the trade apprentices who showed an inclination to enter that field. This is probably a commendable arrangement if the small number of draftsmen required does not warrant organizing a separate training department for that field but it is believed that in general the preliminary education presupposed by high school graduation is a desirable prerequisite to drafting.

(2) **Coöperative Employment of Engineering Students in Industry.**—That engineering students benefit by gaining some practical experience before completing their course has been increasingly recognized by educators in this field. Commonly it is provided by the student's securing whatever job is obtainable in the line of work he hopes to follow during his summer vacations.

There are several advantages advanced for this practice. It aids him in deciding whether he really has a taste for the work he had previously contemplated and whether he is at all suited physically and mentally to it. It helps him also in the choice during his final years of electives which will best prepare for the work to which he finds he is adapted. It gives him some experience at both the mechanical conditions involved and dealing with the men with whom he must later earn his living—with the rank and file and with foremen and executives.

In the belief that this experience is of equal importance to the technical instruction of the school, the coöperative method of engineering school organization has been developed at the University of Cincinnati. By the plan developed there the students are organized in pairs, each of which arrange for employment in one of the coöperating corporations. Thus there were eighteen employed in the National Cash Register plant—nine being at the plant while nine are studying at the university. Every two weeks the pairs shift their positions, those at the plants returning to the university and their alternates taking their places at work in the industry concerned. The courses on this basis are five years in length. If there is a genuine coöperation on the part of the industry so that the student is shifted through various departments and at such operations as will add to his equipment of skills, he undoubtedly will later utilize the training in his engineering or supervisory work. The difference between this coöperative method and that of utilizing summers is of course chiefly in amount.

The other developments of the plan are found in the small engineering department recently established in the municipal University of Akron, where the practice is identical. In the University of Pittsburg engineering school a modified form is practiced. The year is divided into four terms corresponding to the seasons, four of which during the four years' course must be spent in industrial establishments at practical employment. In the Massachusetts Institute of Technology a coöperative plan has just been inaugurated during the past year (1919–20) with the General Electric Company. This is arranged at pres-

ent to provide for forty electrical students from each class during their junior, senior and a graduate year. There would thus be a maximum of 120 students there on this basis or deducting withdrawals probably not over a hundred. This is arranged with alternate terms in the plant and at the school of thirteen and eleven weeks respectively.

In the new Harvard Engineering School the plan is to be tried in the junior year only.

Consequently there are probably not over 1,000 students being trained in coöperative engineering colleges throughout the United States at present.

As the plan seems to be somewhat slowly spreading it is a pertinent question if it will ever become the general practice. The practical difficulties involved would seem to demand a negative reply. Cincinnati is at the center of a considerable number of large industrial plants which could probably utilize all that might wish to follow an engineering course based upon the plan in that institution. The dean of the engineering school at Akron reported that there were openings in the local plants and engineering fields for several times the present number of students upon that basis in his school. There are, however, large and useful engineering schools to which no important industrial plants are accessible, that of Cornell University being a good example. In fact it is by no means clear that the plan possesses sufficiently greater merits than that where the student engineer spends his summer vacations in industrial work with the year or two following his graduation, a matter which is discussed later.

The biweekly transfers from school to plant should

be compared with the plan of alternating by terms. It is argued for the former that with the shorter periods the student more closely relates his shopwork to his technical instruction than if the shopwork extended through thirteen weeks. Also by the shorter breaks he is not so likely to lose the continuity of the educational subject matter. The advantages of the two weeks' period over one week were on the other hand held to be that there was less lost motion in readjusting from school to shop and again from shop to school if those readjustments occurred only thirteen times a year instead of the twenty-six which would be required with alternating periods of one week only.

From the administrative standpoint there seem to be obvious advantages in the three months' term for the alternating periods.

(1) It permits the instruction of the coöperative students in the same classes as the regular full time students as it is fairly easy to revise the instruction so as to divide the academic year into three terms instead of two, and to add a summer term.

(2) Students may be placed at employment several hundred miles or more from the educational institution. The desirability of this has been pointed out in connection with schools not located with suitable plants immediately contiguous. In railroad and mining employment the desirability is equally evident. A mining school located let us say in New York city might find it desirable to place some of its students for practice in Canada, Upper Michigan, or Montana. Railroads should offer a profitable field for experience to civil, mechanical and doubtless soon for electrical engineers and would hesitate to guarantee employ-

ment within 100 miles of the engineering school, a distance limitation which would seem desirable with the biweekly schedule.

(3) The term period obviates the necessity for absolute pairing which is always an awkward matter to administer. One member of a pair may show ready adaptability to the work and become sufficiently experienced to warrant a generous increase in remuneration while work of his alternate would only warrant the payment of the minimum wage scale. One alternate may withdraw, making it necessary to pair an experienced man with a thoroughly green man.

(4) Three months is a reasonably satisfactory period for a working unit as well as for a teaching unit. It is the period worked out as satisfactory for teaching milling machine operation under intensive training, and for assignment to the electrical winding department for students in the technical training course. It would probably be equally suitable for assignment as chainman or assistant transitman for a civil engineer.

Moreover where a considerable number of students are employed in the same plant or on the same engineering undertaking it would probably be possible to get them together occasionally, perhaps one or two evenings a week, for coördination purposes as was the case in the General Electric plant for the Institute of Technology students. This would probably be possible in plants employing over twenty students or where a like number were employed in a given locality or city.

If the plant had a man capable of handling the matter in its educational department (presuming that

it possesses such a department) it would probably be in its interest to handle the matter itself, or at least in coöperation with the educational institution. It was found that without this linking up of the student with the plant's organization the work was in general looked upon as a wholly temporary arrangement to be terminated at graduation. Of course the student should be free to leave if he chooses when he desires but men well suited to the corporation's work might thus be saved as valuable additions to its personnel. As at present conducted the acceptance of coöperative students seems too often to be considered as purely a concession to the university and to the students employed with no accruing benefits to the corporation.

The conclusion of this study is then that if coöperative instruction is to be more generally adopted by educational institutions of university grade, the term rather than the biweekly arrangement will be better suited to the larger number of institutions. This does not, however, presume that the Cincinnati plan is not working well under the conditions there prevailing.

(3) **Employment of Technical College Graduates under Supervision for Experience and Adjustment to Positions in the Corporation's Personnel.**—The very extensive employment of student engineers during their summer vacations has already been pointed out as a desirable rounding out of the young engineer's equipment. There has also been noted the very general policy on the part of the larger corporations of taking on a considerable number of college graduates for a period of practical experience and as a means for securing desirable additions to the com-

pany's personnel. Thus the Westinghouse Electric Company receives each year about 300 engineering graduates for a year's course. The Schenectady plant of the General Electric Company starts approximately a like number in its testing department. From there they are transferred as required and as they show particular aptitudes and preferences to the engineering, production and sales departments. The Goodyear Tire and Rubber Company has 350 college men in its engineering squadrons who are being shifted about the plant by their squadron plan for a three years' training in preparation for appointments in planning, supervising or sales departments.

When the training for these college men closely resembles that provided for trade apprentices it is frequently designated as *special apprenticeship* and ordinarily extends through a two year period. On this basis previous to the war a large number were being trained for the railroad service by the Santa Fé system. At the conclusion of the two-year period a selected group from these special apprentices and the regular trade apprentices were put through a year's additional all around experience for promotions to executive positions. These latter men were known as *graduate apprentices*. The Packard Motor Car Company has about twenty in training on the basis of *special apprenticeship* as outlined above. Their designation is either that of *Advanced Training for Executives or for Mechanical Men. Training for Minor Executives* is the title given the course provided in some plants. The Winchester Repeating Arms Company for example has about twenty young college graduates being shifted about the plant to gain a knowl-

edge of the business as a whole before being assigned to any definite department.

It would seem that all types of training for college graduates in the plants investigated could be reduced to these four groups, on either a productive or non-productive basis:

(1) Gaining insight into the business as a whole.

(2) Employment under supervision in one of the technical departments.

(3) Employment in the production department, sometimes called *special apprenticeship.*

(4) Schools for salesmen.

**Instruction on a Productive Basis.**—In general this training is on a productive basis. The college men are required to punch the clock with the other workmen and in general obey the rules of the plant. That it really means valuable experience to the young man is probably chiefly dependent on his own initiative and capacity to observe. It is expected that he will gain under these uninterrupted conditions the benefits arising from practical work that have been claimed to accrue from the coöperative plan of college organization.

Ordinarily there is or should be someone to give sympathetic explanations of the difficulties met with for while the student may be well equipped technically, in manipulative skills he may be not much better off than an unskilled apprentice, for it is to be remembered that a great deal of the specialized equipment of a plant is not and cannot well be duplicated in the school shops.

In some cases there are regularly scheduled conferences of these young engineers. These provide for

an exchange of ideas on practice and offer a convenient opportunity for a superintendent to explain the work of his department by a talk or lecture.

The courses are quite varied in length. As has been stated those preparing for employment in productive departments and leading to positions in the management are ordinarily the longest. For these two years is a common length of training. In other departments the period which may properly be designated as training is commonly terminated within a year of enrollment. Of course the slower men may serve a longer novitiate. It should be said that the men are under constant scrutiny by the corporation's officials and many are rejected as unsuited to the company's needs.

A new field which is enlisting a greater number of technically trained men is found in the employment, training, and employee service departments of the corporation. The capacity to deal amicably with the working force, select employees with special qualifications suited to particular jobs, and to train them for these jobs require special aptitudes and an intimate knowledge of working conditions in the plant and methods of production and distribution which can probably best be gained by actual participation.

Experience also shows that specific instruction for the different fields in hand is desirable but ordinarily the only provision for such instruction is through the director of the department. If all these activities are merged in the manager of industrial relations it would seem advisable for such an individual to possess proved educational capacity as well as intimate knowledge of industrial conditions.

In the selling department there seems to be an increasing recognition of the value of an intimate knowledge of the raw materials, their reduction to the finished form and assembling in the finished products to be marketed. This information in many plants is gained by employment under frequent transfers throughout the plant. In one plant this experience seemed best gained by employment for about a year in the department where the tool to be distributed was under utilization in the manufacture of the company's own product. Sometimes this experience seems best gained in the repair department.

In only one plant did the stress seem to be laid alone on acquiring successful selling methods instead of on the technical and mechanical elements going into the products structure, use and readjustment when out of repair. This may arise from the fact that in most of the products there was a highly intricate construction and the good will of the customer promising future sales was best enlisted by providing him with expert technical service in the possible economies to be derived from utilizing the product sold and its maintenance in satisfactory working conditions.

**Training on a Non-productive Basis.**—While in general as has been remarked these technical men in training were employed on a productive basis, there were examples found of men learning the business as a whole, or preparing for a technical or the sales department where no production was expected and their time was solely devoted to instruction, observation under direction, and occasionally to experimental investigation. This opportunity is given for intensive preparation for definite particular positions and

is ordinarily of relative short length. As the cost must be charged to the general expense of training, some definite objective must be predicted and in the maximum number of cases realized in order to justify it.

A good example of non-productive instruction of college men to learn a business as a whole was found in a large electric lamp works. It was at present employing about 7,500 of whom a very large percentage were women specialty operatives. To provide for an anticipated expansion thirty-five young college men had been carefully selected and were being given daily instruction with observation about the plant in order to gain an insight into the whole process of manufacture. Had the work been of a nature to require male operatives doubtless these college men would have taken a hand at the work themselves but under the circumstances this was naturally inadvisable. Later they would start as inspectors, subforemen, in the planning department, or at the other types of work that carry the rank of minor executives.

In the Westinghouse Electric Company those selected for the design and sales departments after several months of preliminary experience about the plant are in each case given a three months' non-productive training.

For the design engineers this of course takes the form of a more intimate study of the company's products than had been possible in the theoretical university preparation and for the future salesman a similar training but with the selling end in view.

**Sales Training.**—In general it should be said that the university training was ordinarily considered de-

sirable but by no means indispensable. The pleasing personality, address and the intelligence which we associate with an educated man which were considered essential qualities it was recognized were frequently to be found in non-college men. Occasionally greater stress was placed on an extended practical experience in manufacture or in one case on previous successful salesmanship, presumably gained in a less important line. In many plants the chief endeavor seemed to be to improve the quality of those already in the field. Two methods were being employed. Short schools were being conducted in which the technical and mechanical phases of their product were emphasized and correspondence courses were being conducted for the men in the field. Of course all companies have a well-developed literature relative to their products. This effort seemed to be directed chiefly toward the intelligent utilization of this material. Sometimes conferences were held at the central plant for discussion of selling methods but in general such training was left to the district managers.

**General Conclusion.**—As a whole it should be noted that the effort in this whole field of training college men for the various departments of manufacture—executive, design, production and sales depends on business conditions. If there is a steady growth of business there is a constant recruiting and training in progress. If, however, the success of the company warrants sudden expansion there may be the most intense interest and even lavish expenditure. In a period of depression or decided retrenchment no department reflects changing conditions more quickly than training for superior positions. Only in the

sales department may there be expected the same interest to continue and to some extent perhaps the design department to overcome the effects of unfavorable competition.

It should also be pointed out that many companies do not depend much on college men as a source for company officials. Many prefer to promote chiefly from the ranks and where apprenticeship survives frequently graduates of that department are given especial preference. The more progressive companies seem to utilize both sources—promotion from the ranks and enlisting of college men utilizing whichever source seems to provide the best man for a particular position.

## CHAPTER XIII

## SPECIAL TRAINING

It is safe to say that the experience gained in the shipyards, created to develop an American merchant marine under stress of the late war, has introduced a new principle into American vocational education, that of special training.

The term means essentially delegating to individuals chosen for the purpose as particularly competent the instruction in their duties of new workers and of old workers for better performance of their present work or in new duties. Of course in certain isolated fields this had been practiced before the war. The telephone companies for example had long had their schools for operators. The general applicability of the idea had not, however, been given much consideration.

It was the tradition that every trade should be learned by apprenticeship, that is by the worker's starting as a boy and working under the direction of an experienced mechanic until he reached manhood and it was presumed had been initiated into all the "arts and mysteries of the craft."

Now everyone knew that in only a few limited fields did this method survive and those who did not understand that under present industrial conditions

all around craftsmanship could only be utilized in a few limited fields expected our industry to be beaten hopelessly in competition for the world markets. Instead the amount of our manufactures had been steadily mounting each year.

The inference is that in some way the workers were at least in part learning their duties. What are the possible means by which this is accomplished?

(1) **The "Pick-up" Method.**—Where this method is practiced there is really no training whatever. A man * is hired to do a certain type of work which he has never done before. He uses what knowledge he has gained from previous employment in other lines and from the friendly or gruff assistance of fellow workmen learns soon sufficient to hold his job or is fired. (It should be remembered that fellow workers are not paid to help the new man but to get out production.) If the man is fired, he may try another shop and even a third until he can hold the job down. If the employment is dignified with being designated as a trade, this is called "stealing a trade." This may be called self-training or could be described as "training by absorption" if there was really any training taking place.

It should be recognized that this method is expensive to the employing company for several reasons. There is much spoiled work, sometimes machinery is broken, accidents are occasioned both to the inexperienced man and his fellow workmen. There is always an unnecessarily long period of unprofitable employment of the machinery involved and the excessive

* "Man" is here employed as generic word signifying man, woman, boy or girl.

labor turnover occasioned by the " hiring and firing " which all recognize as costly.

(2) **Training by the Foreman.**—By this method the foreman is expected, in addition to his responsibility for getting out the product, to train his new men. If he has a teaching capacity he personally instructs them, keeps track of them, constantly checking them up. Now it should be recognized that many foremen have been very successful in thus training their men and with some natural aptitude have developed excellent methods. Probably in many types of work this will continue to be the prevailing method. It fails when a foreman perhaps excellent in other respects is a total failure as a teacher or has too many inexperienced men scattered through his department for instructing whom he has not sufficient time in addition to his other duties.

This method can doubtlessly frequently be made to function more efficiently if the foreman is taught how to teach his new men, or better, if already overloaded with responsibilities or unsuited to teaching by temperament or otherwise, is provided with an assistant foreman who has this instruction of new men as a sole or chief responsibility for which he has been given suitable training.

(3) **The " Helper " Method.**—Frequently the unskilled worker is put under the charge of a competent workman and gradually the new man with some assistance " catches on " to his duties. The satisfactoriness of this method is variable. Sometimes the workman delegated to teach the new man has no taste or capacity for the teaching job or through traditions of his union is hostile to any new men learning the trade

or job. Furthermore aside from spoiled work records and of quantity of production (if such are kept) there is never any thorough going test of the man's actually acquiring the trade. He has worked at it so many months or years and is therefore supposed to be a workman of that much experience. Under unsatisfactory conditions it of course degenerates to the " pick-up " method first described.

(4) **Special Floor Training.**—The fourth plan has been described in part under the second method. When this method is in complete operation certain skilled workmen are chosen for the exclusive job of instructing the new men in their respective trades or duties.

They make an analysis of all the operations and " special kinks " that the workman must know in order to accomplish his tasks efficiently and reduce it to the best learning order. They then instruct the new men following this teaching plan at regular production and under normal working conditions. The teaching program is not considered complete until the new workman demonstrates that he can produce to a certain standard of quality and quantity. For convenience those under instruction are usually brought together in a group but otherwise all conditions are those of regular production. Ordinarily also by this plan training is administered as a division of the production or manufacturing department of the plant.

(5) **The " Vestibule School."**—When this special training is provided in a department distinct from regular production it is ordinarily designated a " vestibule school." The conditions are intended to be as

nearly identical with those described above under special floor training as possible. There is the same trained competent instructor, the work is at regular production on jobs requisitioned from the production departments and the output passes the same inspections as normal production with which it is then merged. Moreover the workman is given the same ultimate " tryout " to establish his competency before being transferred to the production department. The administration of this plan is ordinarily under the employment manager or the more comprehensive department of industrial relations. There may, however, be a separate coördinate department of education and training in general charge of this and all other instructional activities.

Eliminating the " pick-up " and " helper " methods (if without instruction) as in general unsatisfactory we have left training by foremen, by instructor (usually an assistant foreman) in the shop, and in a vestibule school. What seem to be the conditions which recommend each?

It is believed from observation in the plants visited that training in a large number of cases and particularly for the simpler operations will continue to be given by the foreman. This of course assumes in most cases that it is more economical to provide training " on the job " than in a separate training shop. Several reasons, founded on observation in various types of plants from training of riveters in shipyards to that for a specialty operation such as for female armature coil winders in an electrical manufacturing plant, lead to this conclusion.

(1) There must always be expected a very *wide fluctuation in the number to be trained.* The extreme case is a wholly new department to be opened. Obviously the natural place to provide for their training is in the shop where they are to start their work for it would be too slow a starting process to build up the working force by waiting for them to be trained in a separate vestibule school. Let us suppose there are thus a thousand armature coil winders to be trained. Assuming that the foreman and assistant foremen have been trained in instructing new workers how to do their work, they will temporarily add to their teaching force such experienced winders as can be taught how to teach sufficiently to show the new workers how to do their jobs and for this temporary employment as teachers the experienced workers will be paid a special instructor's bonus. Of course it is desirable that this instruction work should be under the direction of a supervisor of training who would have worked out the best teaching order and the elements in the process to be emphasized in quickly bringing the new workers up to standard quality and quantity of production.

For normal turnover it may be urged that the separate training department is desirable. It is easy to figure that if the average training period for this work is one month and the average working period for the girls employed is six years the total number of employees should be divided by seventy-two to find the average number to be in training at all times, to provide for this normal turnover. Assuming a department of 1,000 girl employees we should then expect to be training fourteen at all times. Might there not

be provided the vestibule school to train these new workers?

Experience in training shipyard workers seems to argue against the vestibule school. There in all the yards the training was done on ship material, in the shops or on the ways, no practice work being done.* Segregating the learners on a " school ship " (essentially a vestibule school) was found to increase the average training period for five trades in several yards from 25.98 days to 44.62 days and to reduce the number of learners per instructor from 8.09 per month to 6.26 per month.

" In explaining why training on the school ship is less efficient than that conducted alongside of regular gangs, it may be pointed out that several training factors are violated.†

"(1) The men are not trained under regular working conditions.

"(2) The program of the ship requires the doing of jobs that are not in proper sequence for the learner's advancement.

"(3) Coöperation with the ship construction department is usually lacking, causing difficulty in getting material and tools and also in preventing the trained men from being turned over promptly."

Other arguments against the vestibule school are:

(1) The production demands and hence *requirements for newly trained workers of the plant constantly fluctuate.* First there is a rush of orders then a depression in which there is not enough work for all. Much production is seasonal, demanding a large num-

* "The Training of Shipyard Workers," p. 12.
† Ibid. p. 64.

ber at one time and perhaps complete cessation at another time. There are times when more workers leave for personal reasons than at other times. In some departments winter is the preferred season for work, in others it is summer and the working force must be recruited accordingly by training new people.

(2) *Much machinery can be worked economically only in conjunction with the other departments* which in the manufacturing process it follows or precedes.

Only the duplication of the whole plant in miniature, obviously impracticable, would provide the equipment for much of the training.

(3) *Much of the machinery is too expensive to be duplicated* for only occasional use in training. A vestibule school has been described to the author in which a milling machine was being brought in at one door while a planer was being carried out at another to provide training facilities. Had the training been carried on in the regular floor all that trouble and expense could have been avoided.

(4) The learning process is not completed until regular production is achieved *under production conditions.* This is more pertinent when work has to be performed under difficult or hazardous conditions. It may be possible to start a ship riveter on the ground but the training process should not be considered complete until the learner can work satisfactorily on the ship.

There are, however, conditions that seem to warrant a vestibule school.

(1) Where the *process is fairly intricate* requiring an especially *skilled instructor* it may be advisable to provide a separate training department. Thus the

making of rubber overshoes requiring a set series of operations and a deftness of handling was being taught in a vestibule school. Operators of the standard machine tools are frequently trained in a vestibule school. In both cases it might be possible to provide this training on the regular production floor, but as the number under training, however, was sufficiently uniform the training could be in each case provided more economically by being grouped in a separate shop. It is thus under skilled instructors and instruction probably is provided more efficiently than on the production floor.

(2) In some cases a vestibule school is advisable *in the case of women or minors* when first starting work. An excellent case of this sort was furnished during the war when women were introduced into the machine shops as ammunition makers. Difficulties were probably avoided by giving the women their initial training separate from the male workmen at regular production. Of course later the new workers would have to enter the regular shops but by that time the embarrassments due to the novelty of their situation would in large part have been overcome. Occasionally for the young workers the regular shop will offer so many distractions that the learning process is unnecessarily slow. Another reason urged as regards both women and minors is that they are often discouraged by their apparent incapacity to produce in comparison with the experienced worker and occasionally by the taunts and ridicule of the latter.

(3) Sometimes *instruction is impossible* on the regular production floor. Frequently this comes from the noise often necessarily there which makes voice teach-

ing impossible as well as proving extremely annoying to the worker until the difficulties of learning are past.

(4) If in the future it should be found sufficiently in the interest of society to provide *special training at public expense* it will probably be provided in a vestibule school. Such a separate training department permits the exact determination of cost of instruction as distinct from raw materials, wages and overhead. It might of course be made distinct in control also from the parent plant where it would receive its raw materials, sell its finished products and where the trained workers produced would be absorbed as required. Necessarily there would needs be much coöperation as there must be a ready flow of raw materials and finished products and it would be folly to train a hundred workers where only twenty were demanded.

In this discussion generally favoring floor training not much distinction has been made between training by foremen and by delegated instructors. In fact it is not believed possible in a general discussion to arrive at any invariable rule as to which practice shall be followed. If training proceeds satisfactorily under the foreman, the practice should be continued of recognizing his responsibility for such training in addition to handling the regular problems of production. If, however, there are unsatisfactory labor conditions—an unreasonably high labor turnover and great disparity in production between various workers—it is a reasonable presumption that the department would benefit by improved training facilities.

Functionalized supervision has shown its utility in many industries and in some departments of more in-

dustries where it is not practiced in all departments. It is one of the phases of this plan of organization to recognize that training is a function of one foreman just as inspection is that of another or the general progress of raw material to finished product through the department is the responsibility of the general foreman.

**Upgrading or Promotion Training.**—The training so far discussed has been for the large number of industrial employments in which no previous experience is presupposed. In the highly differentiated employments of a large industry there are usually some occupations for which training is practicable for those who are competent at some lower grade of employment. It is also possible in some cases to provide training which will assist workers to achieve a more satisfactory production either in quantity or quality while still remaining at the same employment. In either case such training as provided may be designated as upgrading. Where it leads to a new occupation or specialization of the trade at improved remuneration it may also be called promotion training.

**Floor Upgrading.**—In some plants there were discovered plans by which upgrading, without any change of occupation being contemplated, was provided. This might be through the training instructors whose duties were divided between training inexperienced workers and inefficient workers who had been working for some time at the specialty. It might be through requiring the rate setters at piece work operations to demonstrate the most efficient methods of doing the work to those who were not getting satisfactory results. Such methods can usually be prac-

ticed satisfactorily as the rate setters are ordinarily the more capable workers and are paid day rather than piece rates so that this responsibility may be required of them in addition to their usual duties. For satisfactory functioning as instructors, however, they need special instruction in the art of this specialized teaching.

**Upgrading or Promotion Training in Special Shops.**—It is sometimes an economical arrangement to provide the special training for upgrading or promotion in a separate shop. Good examples of this were found in the school for repairmen in the National Cash Register plant and that for turret lathe operators for customers' employees in the Gisholt plant and for linotype operators in the Mergenthaler Press plant. One automobile firm also provided a similar school for garage mechanics. The Sperry Gyroscope company similarly provides a school for toolmakers.

In general it can be said that the objective is very specific. There is an established standard of workmanship to be attained. The primary product is the worker competent to do a certain type of work. Depending upon conditions the period of attendance may or may not be fixed. Where the employee is to be reabsorbed in the working force of the company the period is usually indeterminate and completed when the desired efficiency has been attained.

Pay depends on circumstances. In cases where a customer sends in his employee for training the customer usually stands the expenses and wages of the employee while learning, the company only providing the school and instruction which is borne as an element in expense of marketing. When the school is

provided for the company's own employees usually there is paid a flat rate somewhat below the prevailing piece rate as the instruction is considered a part of the employee's remuneration. In one plant this pay was stated to be about 80 *per cent.* of the basic rate for that particular grade of employee.

**Supervisory Training.**—No discussion of special training would be complete without some discussion of supervisory training of which it is an element as of course a type of upgrading. Also as a general program of special training for all types of work must frequently be initiated by " selling " the idea to the supervisory force it frequently precedes any other program of special training. This condition arises from the hostility which a foreman entertains for any policy which would seem to result in depriving him of his prerogatives. This has frequently led to the introduction of foreman training contemporaneously with supervision on a functionalized basis.

In general it should be said that the introduction of special training seems to proceed best when starting at the top and working down through all grades to the specialized operatives. Thus in several plants the special training program started with conferences of department superintendents in which the training idea was effectively presented. The meetings were also considered valuable as an opportunity for exchange of methods for employee improvement and were conducted by the director of training. They were followed by similar conferences for foremen, inspectors and assistant foremen which were known as the foremen's school.

Three types of supervisory training have been found practiced in American industry at present: (1) A brief extension course; (2) An extended extension course; (3) An intensive course for selected employees as a type of promotion training.

(1) *A Brief Course for Foremen.*—The first type is spoken of as an extension course as it is provided to improve men already thus employed. It seems to find its utility as an aid in the introduction of a change in supervisory policy where the foreman is thought of as a leader and not a driver. It also offers an opportunity to present the company's policy in employee control and for a general discussion of all the responsibilities of the foremen. This latter element seemed particularly pertinent when the functionalizing of the foremen's duties was being introduced into the plant.

In one plant the plan was to hold the foremen's meetings for the purpose once or twice a week for about an hour and a half each time through ten or fifteen weeks. In another plant the plan was to hold the meetings daily through a shorter period of three or four weeks.

(2) *An Extended Course for Foremen.*—In one plant the program should probably be thought of as an educational program for foremen. It starts with a discussion of company policy as does the first plan but is intended to proceed through several years covering such topics as labor psychology, economics, etc. As it was found in but one plant its more general introduction will probably depend on its success there.

(3) *Training for Promotion to Foremanship.*—In

metal working plants a frequent justification for apprenticeship is that it provides a source of superior workmen from which foremen and other supervisors and even executives may be recruited. Of course it is true that training received by a young man before he is twenty may probably only remotely function when perhaps after he reaches thirty he is selected for a foreman's position. It does, however, provide a period of testing for superior individuals and those who survive stand out as individuals worthy of notice by the company's management. Also their varied experience has given them a wider adaptability so that they are selected for more varied duties than the ordinary employee who can be relied upon for but one machine. Their varied employment may have led to an increased interest in the whole manufacturing process of the company which may reflect in the apprentice graduate's continuing his education by reading his trade's journals and the like, in short in his growing in all that pertains to his type of work. Also the special interest taken in him may enlist a greater loyalty on his part to the company than that shown by the ordinary employees. At any rate all connected with apprentice instruction emphasize this element of training for foremanship as a justification which it is believed has some basis.

Of course the fact that apprentice graduates frequently make good foremen does not obviate the desirability of additional training for their duties in that field should they be selected for the purpose, for it should be recognized that but little in the training of apprentices has direct bearing on the responsibilities of a foreman save only perhaps that of training the

workmen of the department concerned in their respective duties.

A somewhat similar method of training future foremen is found in the " flying squadrons " of one company which the manager asserts has been remarkably successful for recruiting a supervisory force. As the men concerned here are usually older the training in a large number of cases may just antedate the time of their promotion and it would be wholly possible to provide definite instruction for that very purpose. In fact most of the instruction given for two hours a week throughout three years seems to be particularly suited to this very purpose. It is claimed to have been successful at any rate in 98 per cent of the cases where the subject has actually completed the course.

**School Substitutes in Special Training Fields.**—In public vocational education as developed thus far there is little provision for special training in the various fields of semi-skilled specialties outlined in this chapter though here are found the largest number of workers in all manufacturing industry. The only exceptions are probably to be found in the fact that graduates of the machine departments of the vocational schools can probably usually start as lathe hands, drill press operators or in the other machinists' specialties. Also in the cities where evening extension instruction in the school shops is provided such provision may function in a highly useful way as assistance in upgrading.

It is possible that provision for foreman training will shortly be made as it is evident that little equipment is needed though a highly capable instructor with much manufacturing experience is absolutely essential

to insure marked success. Probably the great difficulty will be found in attracting the right men to take such a course as, if it is a public provision, it must be voluntary and limited to foremen and such competent workmen as are capable of handling a more responsible position than that of their present employment.

The difficulties to be met with in the general utilization of a vestibule school as training for all types of specialty production apply with equal force if we consider the provision of public training schools in these occupations. There are also other difficulties such as efficient business administration and the assurance that those trained will find immediate employment. Also there is to be expected the opposition of labor organizations who may be apprehensive that the training of young workers for their occupations will multiply the number of workers in their field until employment will be less regular and wages reduced. The logical means for meeting this opposition is to confine training to those actually engaged for vacant positions. Training for upgrading purposes is so clearly in the interest of the workers concerned and of the general public in providing for more economical production by more efficient workers that it should undoubtedly more generally be aided by public financial aid.

## CHAPTER XIV

## TECHNICAL AND GENERAL INSTRUCTION FOR EMPLOYEE IMPROVEMENT

THERE are several forms of more general education upon which corporations frequently embark which are worthy of some attention. Among these are: (1) English and civic instruction; (2) Health and accident prevention instruction; (3) Evening schools.

(2) **English and Civic Instruction.**—During and since the World War there has been an extensive propaganda throughout the United States for Americanization of aliens. This ordinarily assumes the two forms when employed labor is under consideration of the teaching of English and suitable instruction for and assistance in securing American citizenship. The attention which has been given to this work of course arose through the apprehension that there was much anti-American propaganda being spread by the foreign language press of the country and the belief with some justification that a non-English speaking workman was more susceptible to Bolshevistic agitation than one who can communicate in our vernacular. It is also generally recognized that a laborer who can speak English is on that account more valuable than one who cannot. Directions can be given with greater assurance that they will be carried out. There is not

the trouble of appealing to an interpreter. Danger warnings and other posted orders can be understood. In short it is considered good business on the part of many corporations to teach their alien workmen English.

The case for civic instruction and the encouragement in securing citizen papers is not so clear. The reasoning here is that a man who starts on the road toward citizenship has acquired a stake in the country and on that account works more contentedly. He is probably less influenced by radical and in particular anticapitalistic agitation which is frequently associated with strikes and sabotage.

It should be said to the credit of several corporations that they had previous to the war organized well-planned schemes for teaching English and for aiding their employees to secure citizenship. This movement had also been greatly aided by the Young Men's Christian Association. The work particularly through the past year has been much extended both by the corporations' own educational departments and by the assistance of the philanthropic association just mentioned and other similar societies.

Methods are usually very simple. Volunteer teachers are usually secured who are given a short course of instruction. Classes are then organized wherever a blackboard can conveniently be set up in the plant with benches opposite it. Classes ordinarily meet just after the day shift or just previous to the night shift twice a week. Usually the company pays the volunteer teachers a small salary for the time required. On the whole the classes meet with more favor during the winter when there are less outside distractions.

Various means have been suggested to bring into the classes all for whom they are intended for there are ordinarily many who do not avail themselves of the opportunity. Of course it is possible to secure the coöperation of the company and have all non-English workmen discharged but that creates bad feeling and often loses the service of an otherwise satisfactory workman and may simply drive the men to classes where they give but half-hearted attention. One proposal has been to encourage the learning of English by giving a small bonus to those who in addition to being satisfactory workmen regularly attend the classes and gain a knowledge of English. This is based on the general opinion that a laborer speaking English is on that account a more valuable man. Thus if 46 cents an hour was the prevailing rate for unskilled labor in a given region an additional 2 cents an hour might be given either for knowing English or for regular attendance to acquire it. This would mean about $50 a year above the basic rate, which it is believed would be only a fair recognition of a difference in earning power. Another method frequently found is to make attendance at class compulsory and to pay for class attendance. If classes are held two hours a week, this would amount to about the same increase in pay. When classes are voluntary a small fee is frequently charged of a dollar a two or month. This places a value upon the classes to those who take them which is said to make the attendance more regular but probably greatly reduces the enrollment.

In one class a more thoroughgoing course is provided of three hours per night three nights a week.

This appeals to the younger more ambitious men who wish to get ahead. These classes are of course voluntary and the expense is borne in part by the students' fees, the deficit being supplied by the company.

One of the problems of this type of instruction is that of obtaining suitable teachers. It is the general opinion that the ordinary public school teacher is unsatisfactory particularly for the beginning classes unless she is taught a new type of teaching. Ordinarily she brings to the work elementary school methods and text books and for the night school is already exhausted by her regular day work. Probably the best men in the plant are the best source for teachers particularly the educated younger men who are given a short initial training for the work. Frequently among the recent immigrants are found several with good educations in their native lands or desirably in this country who speak good English and who can be enlisted for the purpose. They should, however, be carefully scrutinized as to their American loyalty and general social viewpoint as there are of course many among these immigrant *intellectuals* with the most radical opinions. In some plants properly trained women seem to be very successful.

The dramatic direct method seems to be the preferred starting course. It utilizes the everyday life of the men as its source, does not attempt too much in each lesson, and by repetition fixes the correct pronunciation of the new words in the men's minds. This is followed by reading lessons drawn from the mill life in which the problems of pay, lessons in thrift, health, avoiding accidents, and various types of company welfare activities are introduced. It is probable that

these men welcome genuine assistance in this way coupled with English instruction where it would be passed up with suspicion by native Americans.

This instruction has been organized usually by the company's educational department who get it up first as mimeographed sheets and later have it printed. For the advanced courses standard texts with lessons drawn from American history, government, and geography are used. The new geography of Europe has been a matter of great interest. Lantern slides as an element in the courses have added much to the popularity of the classes and are a point of departure for the discussion which in the advanced classes may be carried on.

In some plants the problem is with foreign women and is solved by similar methods only that the teaching force is made up of educated women and there is an introduction of instruction in homemaking as many of the women are already married or contemplating such a step.

It should be said that English classes can work more closely in conjunction with company welfare activities than can the definite vocational instruction discussed in earlier chapters. Thus there is coöperation in, advice and assistance toward homeowning, with visiting nurses, and in legal aid where such is provided. Often working with entertainment and recreation departments particularly in the way of musical clubs and athletic teams has been very successful.

*The Negro in Northern Industry.*—The influx of the southern negroes into the unskilled labor field of the North has brought into many plants somewhat the

same problems as has the foreigners in others. Illiteracy replaces lack of speaking knowledge of English as the problem of education. There is frequently the same incapacity to handle their own housing and legal problems and to secure innocent amusement. There is usually the same or greater ignorance relative to hygienic conditions and probably greater danger of race feuds. Fortunately there are educated negroes who can be secured to handle various types of educational and welfare work. Much excellent organizing work in this field has been done by the Young Men's Christian Association.

**Health and Accident Prevention Instruction.**—It is doubtless true that American industry is constantly improving as regards healthfulness of working conditions. This includes proper lighting, sanitation, good air, optimum adjustment of temperature, where possible, provision of sitting facilities (particularly for women), pressure withdrawal of noxious gases and dust, etc. Many companies also provide cafeterias where the best food is provided at moderate cost for midday lunches and even for all meals.

This better provision for the health and comfort of employees should be ascribed to two causes—supervision and inspection by state commissions and the intelligent realization on the part of the corporation management that it pays to have contented healthy labor. It is believed that a better grade of labor is recruited at the same rate of pay, more is accomplished with the same machinery, with fewer accidents and with a reduced turnover. Workmen's compensation laws and the same enlightened attitude has also worked toward the installation of safety guards and the

provision of emergency hospitals with adequate medical and first aid personnel.

This study has, however, been concerned with the provision for instruction in this field. Thus we find one company provides a lecture on health and accident prevention for all new employees. If even a part of the employees can be induced by this means to be more careful it is worth while as *"in a large steel plant the accident records revealed that men employed less than thirty days were injured six times as frequently as those employed longer, and that those employed less than six months were injured four times as frequently as the remainder." Also it has been demonstrated †" in the industries doing the most efficient safety work, two-thirds has been accomplished through organization and education, as against one-third accomplished by means of mechanical safeguards or equipment."

Much more than by the formal lecture has, however, been accomplished by definite explicit instruction in hazards to be avoided in each particular job. A very great responsibility falls on the foreman as regards instructing both his new and old men suggesting an important element in foreman training.

In many plants the work heads up to a safety engineer (or inspector). He is assisted in initiating and disseminating improved safety policies by a central safety committee. Much has been accomplished in securing the coöperation of workmen by safety committees formed among the men in each department

* "Industrial Accident sand Their Prevention," p. 21. Bulletin 47, Federal Board for Vocational Education.

† Ibid., p. 8.

who make inspections and monthly (or in some cases weekly) reports of possible improvements. Much education in the field is carried out by bulletin board exhibits, graphically depicting accidents recently occurring. Rules for health promotion during working hours and for accident prevention are frequently formulated after consultations with central and workmen's safety committees, and printed for general distribution and in particular to new employees. They may also serve as English lessons to immigrant employees.

(3) **Evening Schools.**—Some companies find it worth while to provide their own evening schools in addition to public night schools and extension departments of universities and technical or commercial institutes. Their policy is usually based on the fact that through their technical staff they can provide instruction more suited to the particular needs of their employees than other educational extension facilities at a more convenient hour and place, just after work or during the noon hour in the plant. Again the plant may be the center of the community life, particularly when it is the sole industry of the locality.

The instruction is ordinarily of a trade extension nature, i.e., drafting, mechanics, etc., for the men, typewriting, and comptometry for the women employees.

Sometimes it offers assistance in trade conversion, that is provision for shifting to a more congenial or better suited employment such as providing training for salesmanship to clerks.

Occasionally there is more thought of general community welfare as when a course in "hygiene and health" as a training for practical nursing is provided.

This may be a provision for the wives of company employees.

At the best all this instruction should be considered as assistance toward efficiency in a new or present occupation rather than basic vocational education. It may indeed be highly useful but the perusal of the studies in definite industrial training would lead one to believe that such instruction should hold but a subordinate place in a corporation's educational program.

# CHAPTER XV

## CONCLUSIONS

**The Corporation as a Vocational Education Unit.**—The fundamental conclusion resulting from these studies of the educational and training programs of various American corporations is that the larger corporation may profitably be considered the unit for the vocational training of its employees in their specific occupations. In limited fields for the skilled trades which may desirably be entered upon leaving elementary school this takes the form of apprenticeship. For such employments as presuppose either an extended or specialized technical training this period of practical experience is less extended but quite as desirably under direction. In the far larger field of semiskilled specialties definite vocational training is quite as essential but in most cases for a brief period several days, weeks, or months only. There is also the definite upgrading or promotion training for specialized occupations usually peculiar to the particular products of the company concerned. Further, there is a more general training for the supervisory force of a corporation. This may take the form of part-time instruction or conferences of those at present employed in this capacity or of an organized practical experience through a period of time as a promotion program to prepare for such positions.

**Size of a Plant to Warrant its Organizing as an Educational Unit with a Distinct Education and Training Department.**—Later experience may warrant much smaller plants organizing educational departments. This investigation has, however, found plants which employed a working force of not over 3,000 people, operating successful educational programs. It seems to be a rough experimental ratio that not more than 10 per cent of the total working force of a company will be under various types of training—initial intensive training, upgrading, supervisory training, or evening extension (either provided by the company or by external educational institutions). This is based on the ratio of immature and inexperienced workers to adults and trained employees which a plant will ordinarily have in its employ. Preparation for rapid expansion or the initiation of a training program in a plant with an outstandingly low production record might justify placing temporarily a much larger force under training. On the other hand, a plant with low labor turnover with an even satisfactory production and efficient supervisory force may find it necessary to provide training facilities for a much smaller ratio of employees.

Where only one or two types of training and education seem desirable a much smaller company may feel warranted in providing its own facilities for the purpose. Thus, a company with only twenty apprentices may arrange a progressive schedule of transfers for variety of experience and a class for supplementary instruction in drawing and related mathematics. Such a company might organize conferences for instruction of its foremen. It might provide a scheme

of intensive training in one or more of its specialties where production was unsatisfactory or turnover seemed unnecessarily large. It would probably rely on the public facilities for evening extension facilities. If such were not provided it might initiate such provision either through its engineering or employment departments. Such various provisions as above outlined have been found in companies with not over 800 employees.

Experience in the publishing field seems to warrant the opinion that these smaller plants can coöperate in maintaining a school for the supplementary instruction of all their apprentices. It is a reasonable presumption that, in order to assure that such a school will be efficiently maintained in the interest of the boys concerned, it should be supported at public expense.

The policy of maintaining part-time industrial schools to provide this instruction is of course an extension of this plan to other industries. Only in one state, that of Wisconsin, however, is this plan based on a regular indenture with the official machinery for promoting such a provision, and for recording accomplishments. It is a recommendation based on this study that such machinery should be set up in every industrial state.

It should be reiterated that the provision of supplementary instruction does not solve the problem of industrial education, but that directed experience at all the operations incident to the trade for which preparation is being made is of equal or greater importance than supplementary instruction. The Wisconsin plan undertakes to supervise this provision by

requirement that a schedule of processes to be worked shall be made a part of the contract of apprenticeship.

**Organization of Training and Education Department.**—To assure satisfactory education and training within an industrial plant, a suitable organization is of course as essential as for any other function subordinate to production such as employment, safety, sales or auditing.

This necessitates a training department with a chief competent to handle all the responsibilities of such a department. He may be styled a manager, superintendent or director depending on the corresponding designations of coördinate departments in the plant concerned.

The plan of organization used by the Emergency Fleet Corporation is shown in Fig. 4. In some plants the preferred arrangement is to make the training and education department subordinate to the employment manager. If training is to be of the vestibule school variety this may work satisfactorily if we may presume that the employment chief is capable of directing the work. The disadvantages of vestibule schools have, however, already been pointed out suggesting the advisability of tying up the training to the production departments.

Probably the most satisfactory arrangement is a department of education and training independent of both employment and production heading up to the vice president in charge of industrial relations. Cooperation of the other departments should then be arranged for through a consultation committee in which the policies of the training and education department are formulated.

It is believed that the following description of the Director of Training in the Shipbuilding Corporation is equally applicable in other industries:

"The director of a training department is an important factor in effecting the success of training in a shipyard. Experience has

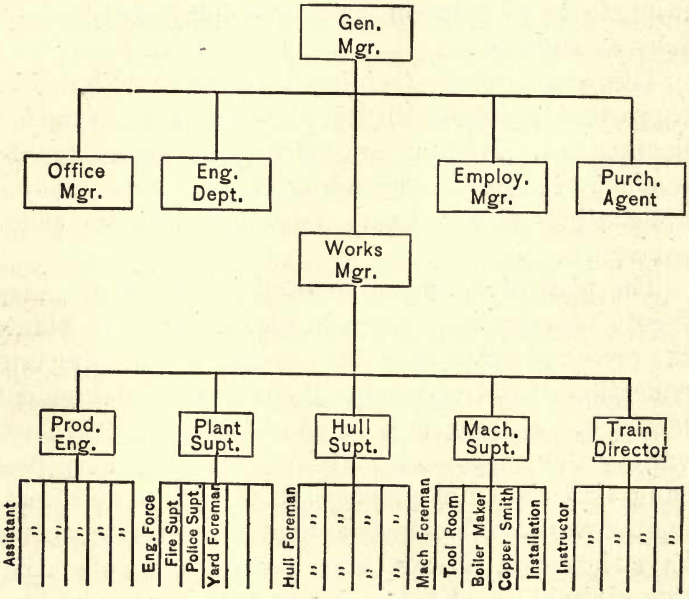


FIG. 4.—Organization Chart Showing Relation of Training Department to Other Departments in the Emergency Fleet Shipyards, from "The Training of Shipyard Workers," p. 53.

shown that he may not be an experienced shipyard man. He may not necessarily have had experience in industrial training. In the first place, he must be a good executive, a leader of men; he must appreciate the principles governing effective training; he must understand the shipyard organization; he must be coöperative with all departments, he should be a man big enough to head up to

the general manager and work on a par with the various superintendents and head foremen." *

When there are several important departments in the program the practice seems to be to provide a supervisor of each. Especially is this true of apprenticeship. In this case he is usually the head of the apprenticeship school and of the shop training department if provided, and is given supervisory charge of transfers of apprentices in their shop work. One plant has also several training supervisors to oversee the training being provided in each of the major departments of the plant.

One very essential element of their duties is the organizing of the instruction in the specialties under their charge on the basis of a teaching analysis which it should be stated will ordinarily be quite different from the job analysis of the employment department. The latter are intended to be logically complete; the former psychological, i.e., in good teaching order.

Another of their responsibilities will be the teaching of good training method to the instructors under them. This will be equally essential if the practice of the department is that of employing the job foremen as instructors. Upon the effectiveness of this teaching depends the success of a training program.

Probably the director will frequently arrange conferences to impress the instructors with the importance of this teaching and will check up its satisfactoriness. Of course if department supervisors are not employed the responsibility will fall upon him which will be the case in the smaller plants.

* "The Training of Shipyard Workers," p. 52.

**The Extension of the Training Idea.**—These studies have shown that training and education are accepted responsibilities in a large number of plants. There are equally important plants where it is not practiced. How can it be made universal?

It is conceivable that it might be made mandatory. We now have state industrial commissions which limit the hours and types of work at which minors and women may be employed. It might be possible by law to require that every factory shall maintain a training department for initiating into its work the raw recruits as did France during the war.*

If, however, such an imperialistic policy for peace times proved unpopular with the manufacturers, it would be very easy for them to render it nugatory or so to manipulate it that it became equally unpopular with the workers whose votes would quickly abolish the system. Probably, in any case, trade unionism would be hostile.

The democratic approach is to allow any new system to prove its case in competition with the old order. If a manufacturer by introducing a more effective training program can build up a superior working force his resulting prosperity will quickly force his competitors to adopt similar methods.

It is sometimes said that no manager can afford to effectively train his workers as competitors make it a practice to immediately " steal " the trained men by inducements of better pay. It must be the reverse side of the shield of good training to make the conditions of employment of the plant in which it is

* Bulletin No. 3. Training and Dilution Service, U. S. Dept. of Labor.

practiced so attractive that they will prefer to remain with the company which has first won their loyalty. In other words, training and education are but one element in building up satisfactory industrial relations.

It is, however, true that much good promotive work can be done by national and state vocational education departments. Such phases of their educational machinery as lend themselves to coöperation with the manufacture may be utilized. This, of course, applies in particular to supplementary instruction which can be made much more effective by constant consultation with the production departments of the employers of their pupils to assure that it really ties up to the work in the plant.

As regards apprenticeship, the case is clearest. It is possible to establish a bureau for promoting apprenticeship and for keeping accurate records of progress. This should be a state institution and probably in the vocational education department since it is through that arm of its service that it must reach each locality and plant for its educational work.

**An Analysis of the Incidence of the Cost of Training and Education.**—The following are in varying degrees affected by presence or lack of effective vocational education:

(1) The Worker
(2) His Employer
(3) The Industry of which the employing concern is a part
(4) The Group of Workers to which the worker belongs occupationally
(5) The State as representative of the consuming public, but also as interested in the Worker

> as one of its members or as responsible for his education if still a minor, and as directly interested in the prosperity of the Employer upon which its own depends.

It can be said that inadequate training falls most heavily on the *Worker* as low production must be reflected by low wages. It is folly to presume that workers' organizations can force up wages unless proportionate production actually takes place. Also, self-sustained training, including apprenticeship, is paid for by the worker concerned. The cost of it is by the economic law of wages assessed back on him in competition with the full producing worker.

The *Employer* is equally benefited by good training. Only two sources are open to him through which he can recruit his working force—training or inducing skilled workers to leave other employers for his service. Experience is demonstrating that the former works ultimately to his advantage and in the long run is cheaper.

It should also be recognized that the larger the reservoir of skilled workers becomes in a given industry the less possibility is there of unreasonable demands being enforced by strikes and threats of cessation of work.

In the long run good training benefits the *Group of Workers* concerned. Only by maintaining a high grade of workmanship with the resulting high production can a group of workers maintain a satisfactory wage scale. If training is defeated by the workers it means that their type of work degenerates until it reaches a par with unskilled work which entails that it will be invaded by the horde of unskilled laborers.

The *State* benefits by good training as whatever makes production larger makes it easier for all to purchase. It also increases the number of its skilled workers, lessening the number of its casual irresponsible workers. Moreover, increasing production is reflected in improved revenues from taxation which of course accrues to the benefit of the general public in better schools, roads, and all that we have come to expect shall be provided by the commonwealth.

## SELECTED BIBLIOGRAPHY

### General References on Training and Education in the Industry

National Association of Corporation Schools, Annual Reports, Vol. I to *date*. New York.
(This is the main authoritative source for all types of corporation training.)

BEATTY, A. J.: A Comparative Study of Corporation Schools as to their Organization, Administration, and Methods of Instruction. Urbana, Ill. 1917.

Corporation and Continuation School. National Education Association Yearbook, 1916, pp. 415–420.

Industrial Education Survey of New York City. 1918.

Minneapolis Survey for Vocational Education. U. S. Bureau of Labor Statistics. Whole No. 199. 1916.

Vocational Education Survey of Richmond, Virginia. U. S. Bureau of Labor Statistics. Whole No. 162. 1916.

SNEDDEN, D.: Vocational Education. New York. 1920.

BABSON, R. W.: The Future of the Working Class. Economic Facts for Employers and Wage Earners.

COMMON, J. R. Industrial Goodwill. New York. 1919.

Possibilities of Paper Box Making; Report N. Y. State Department of Labor. 1915.

COLVIN, F. H.: Labor Turnover, Loyalty, and Output. New York. 1919.

KELLY, R. W.: Employment Management and Industrial Training. Federal Board for Vocational Education. Bul. 48. 1919.

AYRES, L. P.: Constant and Variable Occupations and their Bearing on Problems of Vocational Education.

LITCHFIELD, P. W.: Some Wingfoot Clan Editorials. Goodyear Tire and Rubber Company, pp. 22, 77, 87. 1919.

### Special Training

ALLEN, C. R.: The Instructor, the Man and the Job. New York. 1919.

The Training of Shipyard Workers, U. S. Shipping Board. Philadelphia. 1919.

Industrial Reconstruction Problems. Report of the Proceedings of the National Conference of the Society of Industrial Engineers. 1919.

Descriptions of Occupations. U. S. Dept. of Labor. 1918.

Trade Specification and Index. U. S. Army. 1918.

VALENTINE and GREGG: Outline of Job Analysis. N. Y. 1918.

LEE, F. S.: The Human Machine and Industrial Efficiency. N. Y. 1918.

EMERSON, H.: Twelve Principles of Efficiency.

GANTT, H. L.: Industrial Leadership. New Haven. 1916.

——— Work, Wages, and Profits.

TAYLOR, F. W.: The Principles of Scientific Management. N. Y. 1911.

National Association of Manufacturers, Annual Reports of Committee of Industrial Education, Years 1918, 1919.

U. S. Training Service. Washington. 1919.
Bul. 1. How to Start a Training Department.
Bul. 5. Training Labor for Peace Time
Bul. 6. Labor Turnover and Industrial Training.
Bul. 12. How Training Departments have Bettered Production.
Bul. 13. Industrial Training in Representative Industries.
Bul. 14. Training in Industrial Plants.
Bul. 15. Training in the Paper Box Industry.

LINK, H. C.: Employment Psychology, Chaps. XX, XXI. N. Y. 1919.

SPENCE, J. C.: Shop Industrial Training. Civic Education Review.

Foreman Training Courses. Federal Board for Vocational Education. Bul. 36. 1919.

The Foreman. U. S. Training Service. Bul. 26. 1919.

LITCHFIELD, P. W.: "Our Flying Squadron" Factory, Mch. 1, 1920.

### Apprenticeship, General

Outline of Instructions in Related Subjects for the Machinist's Trade. Federal Board for Voc. Ed. Bul. 52. 1919.

ADAMS and SUMNER: Labor Problems. Chap. XI

BEMIS: The Relation of Labor Organizations to the American Boy and to Trade Instruction. Annals of the American Academy of Political and Social Science. Vol. V., pp. 209–241.

BRAY: Boy Labor and Apprenticeship.

CARLETON: Education and Industrial Evolution. Chaps. XXI, XII, XV.

EATON, J. S.: Education for Efficiency in Railroad Service. U. S. Bureau of Education. Bul. 10. 1909.

FLEMING, A. P. M. and PEARCE, J. G.: The Principles of Apprentice Training. New York. 1916.

PLATET, H.: La Crise de l'Apprentissage dans la Ganterie; ses Causes, quelques Moyens d'y remedier. 1915.

RÉVILLE, M.: Enseignement Technique et Apprentissage. Encyc. Parlementaire des Sciences Politiques et Sociales.

ALFASSA, M.: La Recrutement et la Formation Necessaires de nos Apprentis. Correspondant (Nouvelle serie) tome 226, pp. 659–678. Paris. 1916.

JULLY, A.: Les Répercussions des Methodes Modernes de Travail sur l'Utilization et la Formation du Personnel Ouvrier. Apprentissage et Préapprentissage. Tome 128. Paris. 1917.

United Typothetae of America. Com. on Apprentices. Report. 1913.

A Rational Apprentice System. *American Engineering and Railroad Journal.* Vol. 81, pp. 201–210, 253–259, 333–337, 373–387, 413–423. New York. 1907.

Apprenticeship and Skilled Employment Association. Annual Reports. 1907–18.

ASHWORTH, J. H.: Helper and American Trade Unions. Baltimore, 1915.

The Apprenticeship System. Mass. Bur. Statistical Labor. 1906.

ALEXANDER, M. W.: Conference Board on Training of Apprentices. Nos. 1 and 2. 1916–1917.

THOMAS, F. W.: Training Men for the Mechanical Department on the Santa Fé. Western Railway Club. Vol. 29, pp. 185–214.

—— The Training of Young Men for Positions of Responsibility. N. Y. Railway Club. Vol. 26, pp. 4584–4617.

—— The Apprentice Systems of the Santa Fé R.R. System. National Education Association of the U. S. Journal, pp. 175–184. 1914.

C. R. DOOLEY: Final Report Committee on Education and Special Training. War Department. 1919.

### Apprenticeship, History

SCOTT, J. F.: Historical Essays on Apprenticeship and Vocational Education. Ann Arbor, Mich.

UNWIN, G.: The Guilds and Companies of London. 1910.

DUNLOP, O. J. and DENHAM, R. D.: English Apprenticeship and Child Labor. London. 1912.

KRAMER, S.: English Craft Guilds and Their Government. Columbia University Press. New York. 1905.

LAMBERT, J. M.: Two Thousand Years of Guild Life. Hull, England.

WRIGHT, C. D.: The Apprenticeship System in Relation to Industrial Education. U. S. Bureau of Education, Bul. 6. 1908.

Trade Guilds of Europe, U. S. Consular Report, 1885.

WESTERMAN, W. L.: Apprenticeship Contracts and the Apprentice System in Roman Egypt. *Journal Classical Philology*, Vol. IX, pp. 295–315.

SEYBOLT, R. F.: Apprenticeship and Apprentice Education in Colonial New England and New York. Teachers College Contributions to Education, No. 85. 1917.

### Training in the Industry for Technical and Executive Positions

GOWIN, E. B.: Developing Executive Ability. New York. 1920

GALLOWAY, L.: Office Management, its Principles and Practice. New York. 1918.

SCHNEIDER, H.: Coöperative System of Technical Education. *Engineering Magazine*, Vol. XXXIV, p. 354.

—— Coöperative Course in Cincinnati, ibid., Vol. XXXV, p.929. Sept., 1908.

BERG, E. J.: Coöperation between Engineering Colleges and Industries. *Engineering Education, 10:214–15*, Feb., 1920.

### Public Industrial Education

Vocational Secondary Education. Bul. 21, U. S. Bureau of Education. 1916.

Bibliography on Industrial Education. Bul. 22, U. S. Bureau of Education. 1913. Bul. 33, 1915. Bul. 37, 1916.

National Education Association Proceedings. pp. 710–777. 1910.

U. S. House of Representatives Report, 181. 1916.

Industrial Education, Cyclopedia of Education. Vol. III, pp. 425–444. 1914.

National Society for Promotion of Industrial Education. Bibliography on Industrial Education. Bul. 2.

National Society for Vocational Education. All bulletins.
(This is the American organization of all interested in public industrial education.)

University of the State of New York. Bibliography on Industrial Education. 1914.

Federal Board for Vocational Education. 3d Annual Report, 1919.
*Also* Buls. 3, 4, 7, 8, 9, 11, 17, 18, 19, 30.
(This is the authoritative source for contemporaneous literature on Vocational Education.)

GLYNN, F. L.: Some Trade Schools in Europe. U. S. Bureau of Education. Bul. 23. 1914.

DEAN, A. D.: The Worker and the State. 1910.

BONSER, F. G.: Education for Life Work in Non-professional Occupations. American Academy of Political and Social Science.

HEDGES, A. C.: Wage Worth of School Training. Teachers College, Columbia University Contributions to Education. No. 76.

LUTZ, R. R.: Wage Earning and Education. Cleveland Education Survey. Vol. 25.

PROSSER, C. A.: Facilities for Industrial Education. *Vocational Education*, Jan., 1913. pp. 189–203.

—— Meaning of Industrial Education. *Vocational Education*, May, 1913. pp. 401–409.

SNEDDEN, D.: Debatable Issues in Vocational Education. *Vocational Education*, Sept., 1912.

—— Problems of Vocational Education.

**Public Industrial Education, Part-Time and Continuation Schools**

ARMSTRONG, J. W. S.: Trade Continuation Schools of Germany. London. 1913.

BEST, R. H. and OGDEN, C. K.: Problem of the Continuation School. London. 1914

OBERG, H.: Gründung, Enrichtung, und Verwaltung von obligatorischen gewerblichen Fortbildungschulen.

Part-time Vocational Education. National Education Association Proceedings, 1919. pp. 272–276.

KERSCHENSTEINER, G.: The Schools and the Nation. London. 1914.

—— Three Lectures on Vocational Training. Chicago. 1911.

SADLER, M. E.: Continuation Schools in England and Elsewhere.

Boston Continuation Schools, Circular of Information and Courses of Study. No. 4. 1919.

# INDEX

# VITA

JOHN VAN LIEW MORRIS.

Born at Lodi, N. Y., July 14, 1886.

Graduated from Ovid High School, 1903,
and Palmer Institute, 1904.

Attended Hamilton College, 1905–1907;
Harvard College, 1907–1909;
Harvard Graduate School, Sept., 1909–Jan., 1911;
Cornell University, Summer, 1911;
Teachers College, Columbia University,
Summers, 1914, 1915, 1916.
Academic years, 1916–1917, 1919–1920;
University of Paris, March–July, 1919.

Degrees: A.B. Harvard, 1909; A.M. Columbia, 1917.

Teacher in Rural School, 1904–1905.

Instructor in Mathematics and Physics, Simmons College, 1909–1910.

Principal, Shawinigan Technical Institute, Shawinigan Falls, Quebec, Jan., 1911–June, 1916.

Soldier, U. S. Army, Sept., 1917–July, 1919.

Instructor, N. Y. State School for Trade Teachers, Jan.–April, 1920.

Publications:

"Why Teachers' Colleges," *School and Society*, Vol. X, p. 522.

"Colleges for Teachers," *School and Society*, Vol. XI, p. 412.

"Separateness of Vocational Education in Manufacture," *Educational Administration and Supervision*, Vol. VI, p. 220.