

DISCUSSION ON "INDUSTRIAL EDUCATION" (COMMITTEE REPORT), BOSTON, MASS., JUNE 27, 1912.

**Henry G. Stott:** The work that we are doing in New York in connection with the companies which I represent, is a very modest one, but one which was forced upon us by very peculiar circumstances. We have men who are trained for switchboard operators in railroad work, who handle a large amount of power, and these men are brought in with practically only a common school education and are taught the ordinary methods of operation of switchboard apparatus, taking care of the apparatus, etc. We found after training up men in this way that they became highly expert, although they had apparently no theoretical knowledge of what they were doing. However, a day of reckoning came to us when something went wrong with the operation or some trifling connection was broken, and these men failed lamentably. After a few experiences of that kind we discovered that no matter how well a man was able to carry on his routine duties, assuming everything was in first-class order, the least disturbance of that routine upset his whole idea. He was only an automaton. He could not think for himself. We thought we were using, perhaps, too poor a class of men. We tried a number of men trained at technical schools but it became very manifest that men who had received technical school education, while they met all the requirements of the case, could not be held there and we could not expect to hold them in work which soon becomes monotonous. We finally came to the conclusion that it would be necessary to establish a class to find out whether a man was an automaton or whether he had been really thinking and reading.

The work started in this way, but we went on with it as we found there was some very good material in the men and it gave us an insight into men's characters which we could not get in any other way. We started in the school by putting in the same kind of apparatus which men had to handle in their every-day work, with all the wiring and apparatus exposed. One of my assistants gave the instruction and began at the beginning of the electrical work, and found that the men took great interest in it.

After trying this out for about a year we found that we were getting inside information in regard to the men's characters, and their way of thinking, which was extremely valuable to us in promoting them. Promotions are now made from the bottom up. We then established the rule that unless a man took this course and passed the examination he could not be promoted. Nothing would be done to interfere with his present position, we announced, but he could not hope for promotion unless he took this course and passed the final examination. This immediately segregated these men into two classes; those who had

no hope of promotion, who were indifferent, and those who were ambitious and wanted to get along. It has thus been the means of telling us which men were best fitted for promotion.

The course is a simple one, a rudimentary course in mechanics and physics, then going on to show how current is generated, etc. We have a good laboratory there, showing how measurements are made, and calculations of various simple problems are made. In other words, a man is being taught to think and reason for himself, not simply to obey rules because he is told to do so. The whole endeavor in the department which I control is to avoid arbitrary rules, to encourage a man to act on his own judgment as far as possible. In this way we have achieved results by this simple course which I don't think we could have reached in any other way. By encouraging these men to take courses more advanced in other institutions, we got a few into college, and I think they will make their mark in life.

It has been the purpose of the company to find out the point of view of the man, whether he was simply there to get his pay at the end of the week, or whether he was ambitious enough to study and devote his time to progress. That has gone through a process of evolution, as I have said, so that it is a fairly good course of instruction now, and any man who leaves us is capable of performing good service in any company.

**J. P. Jackson:** May I ask Mr. Stott where his school gets the men—what the class of men is that he gets?

**Henry G. Stott:** The majority of men that we get have simply been through part of the grammar school; a few through high school, but as a rule with only grammar school education. We started in at one time to get men educated in technical schools, but naturally the monotony of the work, eight hours' work, seven days in a week, with of course a day off now and then, was too great to expect a man to remain there who had spent time in getting a scientific education. They would stay a year or less and then leave us. So that practically all the men whom we put into these positions for operators are those who have had only grammar school educations.

**A. L. Williston:** A great deal has been written or spoken from the public platform regarding the pressing necessity for industrial education, until it seems as though every thoughtful person must understand. And yet, as I work in this field, I find that we have not yet begun to make an impression on most persons of the seriousness of the need for this kind of work. As engineers, we are all interested in efficiency; and we are interested in the conservation of natural resources; and we are interested in all things that tend toward the greater economy in the utilization of all forces. As we commence to study actual conditions in almost all our large industries, we find waste of material, we find loss due to inefficiency in the use of power and machinery; but, gentlemen, as we study the conditions more closely we find that these losses are almost insignificant compared

with the greater human losses in almost all organizations and in all the industries.

These human losses are of two kinds; first, those losses that arise from the mistakes, the errors, the blunders, the waste of time from not knowing what to do, or from not knowing how to do the work in hand in the right way. Such losses, as we all know, are great enough; but a second type of human losses is, I believe, still greater. This includes the waste of human energy that comes from having so often the wrong man in any particular job, having no natural aptitude or taste for it; and the waste that comes from having the great majority of men without any real vision of future possibilities that lie ahead of them, and, therefore, without ambition to do their work with the same spirit of energy and excellence as, when youths, they put into their play. It is the lack of ability to see and understand what is ahead, the lack of vision of the possibilities beyond the present that, more than all else, makes work uninteresting and makes workmen feel that it is not worth their while to do their best or cooperate cheerfully and loyally either with individual employers or with the corporations that are furnishing them the opportunities for work.

If we could only estimate the value to society of having all the young people of the rising generation selected, or sorted in some way, so that the right persons would get into jobs for which they are fitted and for which they have some particular ability and taste; and also could estimate the value of having all of these persons given the spirit that would make them feel that their work was worth putting their hearts into, and could add to this the value of special training that would enable them to do their work with skill instead of with indifference, I think we all would appreciate that, in comparison, all the other efforts that we have been making in the past toward increased efficiency would seem small.

In discussing types of vocational schools and what vocational schools may accomplish, emphasis is too frequently placed upon the curriculum and upon details of methods of instruction. To my mind these are important, but there are at least two other things that are more fundamental and important. First, it is absolutely essential at the beginning to get the right boys to work on. If you are going to train young persons for a given industry, for example, to train them to be machinists or to be switchboard operators, or what not, it is of the utmost importance to select persons not only adapted to this kind of work, but also to select persons who, because of their natural environment, their previous life experience, their home traditions and surroundings, will look forward to the kind of life and future to which the particular vocation will probably lead with enthusiasm, eagerness and interest. The first and all-important problem, therefore, for the vocational school to solve is to get the right fellow into the school at the beginning. This is not easy, in fact it is extremely difficult; and there are very few precedents or guides to

go by. It is possible, however, as there are men who have had experience in selecting from the great mass of untrained people who are coming out of the elementary schools every year, those who will be, with training and experience, well adapted to different lines of work. Every capable factory superintendent employing a large number of young persons and every experienced employment director has some skill in this kind of selection. Men with such experience are needed in vocational schools to advise boys and girls regarding the future possibilities that are open to them, and to select from the applicants for admission those who by natural ability, home environment, etc., are well fitted to succeed in the several lines of work for which the school offers courses of instruction.

The thing of next importance is that during the period when the boys and girls are in vocational schools, they should, in addition to the manual skill that is needed and the elementary technical knowledge that is necessary to enable them effectually to use such skill in their chosen vocation, receive the kind of industrial discipline that will enable them to fit into their life work as efficiently as possible, and also that they should have their ambition stimulated by accurate and intelligent appreciation of the opportunities that will be likely to be open to them later. It is entirely possible to develop in school an atmosphere which will give just as good industrial discipline as any shop. It is possible to select tasks and occupations in the school which will cultivate a right attitude toward work, a spirit of co-operation with one's employer and those other qualities of character which are essential for the best success in after life. And these things are more important, in my judgment, than are the questions of how to teach practical mathematics or elementary applied science, or of how many hours of shop practise of one kind or another to include in the curriculum. Yet, when we get together to discuss matters of industrial education, I find, too often, we spend our time on the latter questions of details regarding the curriculum and too seldom on the correct methods of getting the right boy to work with, or the best ways of developing in him the particular qualities of character and manhood that his chosen vocation requires.

To some persons what I have just said may sound as if I were repeating what has always been the aim of all good schools. This, however, is far from the fact. Until very recently, and with very few exceptions, no schools have made a serious attempt to analyze the different vocations and to find out what particular qualities of character are essential to each, and no schools have seriously endeavored to develop the particular qualities that a chosen calling requires. It is this specialized kind of character-building which is the important function of the vocational school. There is in this country and abroad experience enough to prove beyond a possible doubt that this is not a visionary idea but is entirely practical if we set ourselves seriously to the task.

It is not necessary for me to take time to tell you gentlemen of the American Institute of Electrical Engineers or of the teaching profession—all of you earnest advocates of engineering education and of all the higher types of industrial schools—that mechanical skill is a good thing, or that technical training is a good thing, or that the spirit of open-mindedness, which makes one always eager to search for truth and a better way, is a good thing. To you I have only to suggest that in the field of trade teaching, mechanical skill and elementary technical training adapted to the needs of the boys who may not have even a complete grammar school education, and the spirit of open-mindedness to new methods and new ideas, are as useful, in relative measure, as we ourselves have found them in our own particular field in the higher departments of education.

**Albert L. Rohrer:** Tolstoi was very fond of describing labor as being under four heads, the first being that of muscular labor such as the ordinary laborer does, building roads and carrying the hod; the second class is that of the hand and wrist, done principally in factories; the third is that of the mind as shown by the work of the engineer; and the fourth is the labor of co-operation, that is, of all classes of labor working together, team work, as we are pleased to call it now. Until now both societies have been concerned from time to time in discussing the third class, the work of the engineer, the training of his mind, and the result of his work. Both societies, I say, because one society has discussed the education of the engineer, the man who is to do the thinking, while the other society has discussed his work; but it seems to me that the second class of labor, that of the hand and wrist, is of equal importance, and I am very glad indeed to see it given such an important part in the program. It well deserves and merits the joint session which is being held to consider it.

Now the problem of training the hand and wrist has been attacked from a great many view-points. A great deal of good work is being done. The report of the committee just made indicates to you what has been accomplished, and I believe and agree with Professor Slichter that any man who takes the time to inquire into the topic at all will become enthusiastic. And I think it is the duty of every engineer to get interested in this problem. He can serve his locality and his country to very great advantage by getting interested in the situation and assisting with his good judgment.

Professor Jackson has asked me to describe briefly the work at Bridgeport which was referred to in the report of the committee. I spent a very interesting day there some time ago, and to any of you who are interested I think a few hours, even, spent in inspecting that school will serve to fill you with enthusiasm.

The peculiarity about the Bridgeport school and the school at New Britain is that the two schools were started and are conducted by the state of Connecticut. The state alone is doing

it, and the schools are doing some real constructive work. For instance, the school at Bridgeport, which I inspected, is located in a factory building. That gave me a very good impression at first sight. There is a certain atmosphere that prevails there which you could not possibly get in a school building. Four different branches have been taken up: that of metal working, or machinist; of carpentry and pattern making; of printing, and that of sewing. They have been particularly fortunate, I think, in selecting their teachers. They are all journeymen. They have attacked the problem, you see, from the standpoint of the practical man, and not from the schoolmaster's idea, and I think in some cases where the problem has been attempted by schoolmasters alone that it has not worked out so satisfactorily. These men at Bridgeport are all enthusiastic. They also have two ladies who are in charge of the sewing division and they are really accomplishing things too.

One feature impressed me very favorably in talking with the boys, and inquiring into what they had been doing.

The boy does not usually know what he wants to do. Mr. Williston has referred to that. They are given an opportunity there to try themselves out, which is a very important thing. Several of the boys had tried two or three different trades. One boy thought he wanted to learn the printing trade. He did not work out well at that; he then thought perhaps he might want to be a carpenter. He entered that division for a time, but did not work out very satisfactorily there, and finally he landed in the machine shop, where he is doing very good work indeed.

The work is all practical. They don't do any show pieces which are put in a case or laid on a table. Everything that the boy does is put to practical use. The city of Bridgeport offers some very good opportunities for that work. The business of Bridgeport is very largely the metal trades, and it comprises a large number of small factories. Everything that they do in the way of carpentry and printing and sewing can be carried into any city in this country. The carpentry division took a contract a few months ago for building a \$5,500 house. These boys, fourteen years or over, made their designs and have done all of the work. It seems to me a great inspiration for the boy because he sees that he is accomplishing things, and that is far better than making up forms and things of that sort.

I don't know that we can say that this Connecticut plant is the only solution of the problem, but it seems to me that they are working along the right lines and I was greatly impressed with the character of the work that they are doing. They are doing a great many interesting things. It is practical, every bit of it.

Another feature that I should have mentioned earlier—any boy fourteen years or older can attend that school. I saw one man there of some twenty-five or twenty-six years. And a great many boys go from the sixth grade into the

school and are doing very good work. It is possible that there should be a little closer affiliation between the school and the municipality in which it is located, but I like the spirit they show. They don't ask the boy if he comes from Bridgeport, or where he comes from. A great many boys come there from the farms outside, and they belong there as well as the boy from the city. It is certainly interesting, the way the plant has worked out, and I am very glad to call it to your attention this morning. If any of you can find time to stop off there I am sure you will be very much interested.

**J. P. Jackson:** May I ask Mr. Rohrer whether, in the large number of young men that he employs, he has noticed any distinct differences in the kind of men they are on account of the different kinds of education that they have?

**Albert L. Rohrer:** I don't know that I can answer that question. A great deal depends on the characteristics of the boy, how industrious he is and how anxious he is to get on. We of course prefer boys—I am speaking now of the apprenticeship work—we prefer boys who have been through the eighth grade. But we have found boys who had dropped out before they were fairly started in the seventh grade and they got along just as well. It all depends on the characteristics.

**W. S. Franklin:** I would like to ask whether the school is run the year round, or whether they have a vacation in the summer?

**Albert L. Rohrer:** Fifty-two weeks in the year. And may I say a word more? Mixed up with this, they are doing several other things. They maintain a night school carrying along the same lines so that boys who are working in the city or elsewhere can come into the night school. They also have the continuation idea. A number of the small manufacturers in the city who have apprenticeship boys, but not in sufficient number to maintain a school for them, send their boys a half day each week and they receive instruction in shop work and mechanical work there. You can see that they have a combination there where nothing stands in the way of the boy or man who really wants to improve his condition.

**W. S. Franklin:** I would like to know whether the Bridgeport school attempts to reproduce the shop equipment in detail of the various industries for which they attempt to train the young man; or do they give the more elementary and fundamental phases of all industrial work? I ask that for a very practical reason. A number of us have been discussing in Bethlehem the question of starting a school of this kind, and the problem we are faced with at once is whether it is justifiable to reproduce at a large expense the machinery equipment in the existing shops, or whether we ought not to try to give the boy a beginning in his apprenticeship work so that he can afterward get the more detailed training in actual shops. I want to know simply, does the Bridgeport school have a complete shop equipment in the metal working industries?

**Albert L. Rohrer:** Very complete, including an assortment of lathes, milling machines, and one or two planers. Of course a boy fourteen years old has got to begin with fundamentals. But it is worked out in a very practical way. If they take, for instance, a repair job, a boy is sent to the place where the piece of machinery is located and he makes a pencil sketch. He comes back and makes a drawing of the part. Then a pattern is made and when the casting comes in the boy machines it and he is sent out to put the piece in position.

**Henry H. Norris:** In a recent letter, Mr. Glenn, the superintendent of the Bridgeport Trade School, states that the "day school runs nine hours a day, five days a week, four hours Saturday, fifty-two weeks a year, and that the length of course is 4800 hours, approximately two years, for boys." He also states that the manufacturers' association has allowed two years on commercial apprenticeship for graduate machinists, exactly the time spent in school, so that the boys enter the trade of machinist with full credit for the time spent in this school applied to their period of apprenticeship. I also want to call attention to the "Artisan," a monthly publication of this school, entirely the work of the boys of the school. It gives a delightful picture of the school from the standpoint of the student.

**J. W. L. Hale:** I think it is evident to you that within the last decade the subject of corporation industrial education has become significant. It is a matter generally of the conservation of mental as well as physical resources. As has been well said this morning, when the country's resources become reduced it is necessary to turn more strongly toward development on the mental side. You can cite the example of Germany in this connection. Germany's resources, compared with those of the United States, are poor, but particularly in the mechanical line Germany has endeavored to, and is, conserving mental resources. In the United States, within the last few years, considerable attention has been directed toward the subject of physical conservation, and now we are discussing the question of mental conservation. One agency for mental conservation is the corporation school. The railroad school is one which I want to discuss for a few moments.

The functions of this class of school are given in the Report as follows:

"1. To improve the quality of mechanical skill available in shop work.

"2. To make apprenticeship attractive to intelligent boys.

"3. To make it possible for the right kind of boys to rise from the ranks to positions as foremen and master mechanics."

As far as the speaker's experience goes it seem that the third function is perhaps the most important. In order to make the third possible, the second must be carried out. That is, apprenticeship must be made attractive to intelligent boys. In the case of the Pennsylvania Railroad, which has recently taken



up the question of industrial training in shops, in the present stage of the work, it is impossible to hope to recruit the mechanical force in the shops entirely from apprentices. In Altoona alone there are approximately at the present time 12,000 employees of the railroad. The apprentices number approximately three hundred. Therefore, my former statement, I think, is evident. However, it is highly desirable to develop the three hundred for positions of responsibility in connection with the shop management.

The growth of the railroad school in the last five years has been remarkable. There are at least eight representative roads through the Eastern and Middle States which are giving apprentices well organized courses of instruction—I don't like to say theoretical—but in underlying principles and in shop work as well, and they are getting results. The tables which are shown in the Report, given by permission of the Pennsylvania Railroad officials, are made up from data obtained in the spring of last year. However, they represent conditions at the present time. If we refer to these for a moment it might be well to note that the development thus far along the line of railroad schools has been confined to apprentices in mechanical departments, except in the case of the Union Pacific Railroad which is doing a general educational work by correspondence. They have an evening school at Omaha for apprentices, of the Omaha shops only. They are doing a good work generally, but since the instruction is conducted by correspondence it has some disadvantages which are inherent in that method.

So far as the organization is concerned, the schools giving instruction to apprentices in the mechanical department are managed by the motive power officials. Instruction is given in both shop and school and includes elementary subjects from arithmetic to mechanics, and is presented in a severely practical way. The work of these schools is distinctly different from that of a good many other types of school from the fact that we have to change over the courses of the common school for specific trade purposes. This work opens up a new field in changing over from the general into more practical and definite subjects. The preparation of the boys that we get varies all the way from the sixth or seventh grade grammar to high school graduates.

As has been well said, what we have to do, is to give the boys the proper degree of ambition, enthusiasm and interest. There is only one more point for which I will take your time, and that is to repeat the statement I made first, that we must conserve mental as well as physical energy and give attention to development and increase of efficiency on the educational as well as on the mechanical side. It is necessary to develop the human unit as well as the mechanical unit.

**W. S. Franklin:** I happen to be quite familiar with a recent educational movement in the Pennsylvania Railroad in the telegraph department, which is superintended by

Mr. Johnson, and the work that he is doing illustrates a matter which has been in my mind for a long time and which I had in mind when I asked the question of Mr. Rohrer as to the duplication of existing industrial equipment for educational purposes for schools.

It seems to me, if I may preface what I want to say by a general statement, that one of the greatest problems we have in education at the present time is to make use of industrial and commercial establishments as schools to the extent that they *are* schools, and I think that they are schools to an extent which we scarcely realize. We have been going on for many years, detaching school work from practical work. And I think that one of the most serious faults of our present educational system is its detached character. We place a boy or girl in a seat, at a desk, with a book to study, requiring power of application they have not got and ideas that they have not got to understand. This seems to me to be the most unfortunate thing that can possibly be imagined.

Now, what I want to say is this: if boys of fourteen years and older are able to earn money in industrial establishments by going in there against the law, or on the basis of perjury of their parents, why is it not possible to place them there under the supervision of the public school officer to see that they get a proper variety of work and to see that they work not to exceed a certain maximum number of hours? Why isn't it possible to make use of the industrial value of that youngster at the same time that we are training him?

Now what Mr. Johnson is doing is this: Mr. Johnson's department in the Pennsylvania Railroad is the telegraph system, and his equipment, of course, is spread over the whole United States, pretty nearly; it is a distributed equipment which cannot be made use of for school purposes except it be organized as a part of a correspondence system, and Mr. Johnson is now establishing a correspondence school for all of the employees of this department.

As I said a while ago a number of us in Bethlehem have been discussing this question and the one thing that stares us in the face is this—what is the use of the town of Bethlehem buying a new lathe when there are about a million lathes in that town already? And what is the use of the town of Bethlehem doing a great many other things in useless duplication of existing devices which are already crying out for somebody to use them? We must study to some extent how to make use of existing commercial and industrial establishments as schools to the extent that they are schools.

And just one other thing I want to say: In order to realize my idea, let us devise, let us plan detached schools for babies, so that by the time our youngsters are fourteen years old they can do something that is commercially worth while in an actual establishment, instead of in detached establishments.

I am very glad to know, from what Mr. Rohrer says, that a nine-hour day with six days a week, or nine hours for five days and five hours on Saturday, is the rule in the Bridgeport school; for that means an approach to real discipline which is good to see.

**A. L. Williston:** I am somewhat familiar with the plan of the Fitchburg School. It is an adaptation to high-school conditions of the plan which Dean Snyder has worked out for university conditions in the city of Cincinnati. The boys enter the Fitchburg high school on very much the same terms as any other boys enter other high schools. They spend the first year in the high school giving their whole time to the school work inside the school building. During the second, third and fourth years, however, an arrangement is made with local manufacturers in Fitchburg by means of which the boys spend alternate weeks, one week in school and the next week in some shop in the city.

There is an effort made to distribute the boys around in different shops during the different years of their four years' course, so that each boy will get some experience in wood-working, some experience in foundry-work, and a larger amount of experience in machine shop practise. For some boys the plan is working admirably, especially for those who are fortunate in getting into shops where the conditions are such that they have a chance to work on a variety of tools and to get intelligent answers to questions regarding how this work should be done or how that machine should be operated.

Without doubt, there is in all the shops the endeavor to treat the boys as well as possible; and the school authorities endeavor to carefully supervise them in the commercial shops, so that all is being done in that direction that can be done. But nevertheless, I think this statement is entirely fair: Many of the persons who provide places in their works for these "part-time" boys find it extremely difficult so to organize their shops as to make it possible for each boy to get the variety of work and the change of occupation that he ought to have for his most rapid advancement. The conditions in some of the shops make it necessary for a boy to do things which he already knows how to do, and to continue to do this week after week, wasting a good deal of his time. In other shops the atmosphere is not stimulating either to the boy's intelligence or his ambition, and he does not learn from the workmen around him the spirit of co-operation.

On the whole, however, I think the plan is working well, and I believe that the boys who are taking the part-time course are getting a far better industrial training than they could get with the facilities in Fitchburg in any other way; but I don't think that it is by any means demonstrated that this is for all places the best way. The State Board of Education in Massachusetts recognizes the Fitchburg plan as one of the ways to give industrial education, but it has also encouraged in other cities, in Worcester, New Bedford and elsewhere, the establishment of schools of very

much the type of the Bridgeport school which Mr. Rohrer described, in which the boys are kept all of the time in an atmosphere that is, I believe, just as honestly industrial as is the atmosphere that the apprentice boy finds in the average commercial shop. This enables the school to keep complete control over the situation at all times, and the boy to be transferred from machine to machine, or from department to department, as is necessary for his best advancement.

The course of school instruction in the part-time school at Fitchburg is modified somewhat from the usual high school course in order to make it better fit the needs of these boys who are spending one-half of their time in commercial shops. This modification or adaptation of the school instruction to make it dovetail in with the shop practise and fit the special needs of these boys, is growing, but as yet it has not been developed as far as I believe the authorities in charge of that school feel is desirable. If further information is desired, I shall be glad to answer any questions which you gentlemen may desire to ask.

**W. I. Slichter:** The states of Massachusetts, Maine and Wisconsin provide that this arrangement may be carried out and it is carried out in a number of instances, particularly in Massachusetts. In the report of your committee you will find a definition of the "part-time school" and this statement in the body of the recommendations:

"In the opinion of this committee, the feature of the Massachusetts and Wisconsin laws which causes them to excel those of all other states, is the provision that in order for a vocational school to receive state aid it must receive the state's approval of many of its important features, such as courses, teachers, buildings, methods, time and accounts. This clause is used as an inducement to encourage the local boards to consult with the proper representative of the state board from the beginning of the organization of the school, rather than await the exact period when money is requested of the State. The State board includes an assistant superintendent who has made a special study of the subject of vocational training, and, as members of the board, are private citizens representing the points of view of employers and employees."

**William McClellan:** It was my privilege for several years to be in manual training school work as a teacher, and later to be connected with engineering education in one of our larger institutions. With all due respect to those who favor industrial education, it ought to be recognized that, so far, it has been framed and worked out rather from the standpoint of the corporation than from the standpoint of the individual.

Proof of this has been given this morning. For example, Mr. Stott said that he was forced into it, and yet Mr. Stott has proved that his thought and aim in every respect are philanthropic. The apprentice system has failed and corporations have been driven to take up some other means for getting their industrial workers.

Again, when Mr. Williston spoke this morning of ambition, and the cultivation of it, it occurred to me that the necessary condition to cultivate it and to have it grow and accumulate is that in which there shall be not only an inlet but also an outlet.

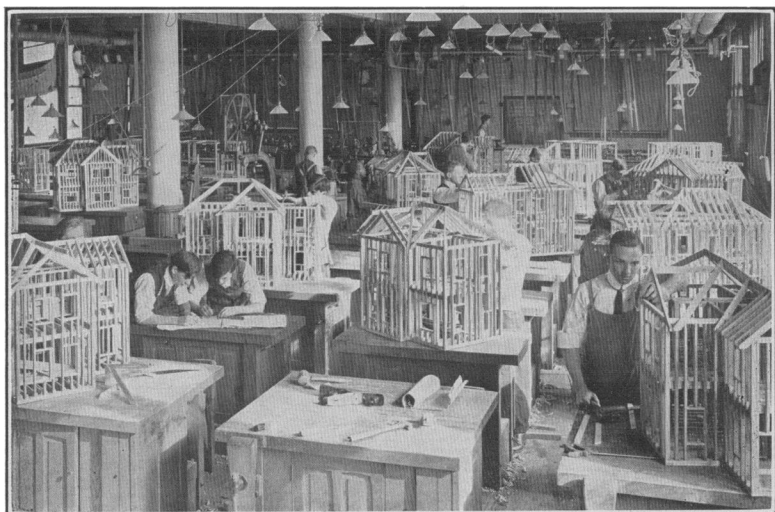
The man whom you expect to be an ambitious man should never find himself or be set in a blind alley. I am impressed in this discussion today with the distinction which is apparently made between the so-called vocational school and the so-called professional school. At the beginning we seem to be dividing men arbitrarily between those who must go into vocations and those who must go into professions. This leads me to think that correlation is really what we must strive for.

Those of you who remember Plato's "Republic" recall that a scheme was laid out by him in which men dropped out along the road. As their mental abilities were discovered by the state, they were arbitrarily side-tracked here and there, and there was a gradation of activities until, at the top, was government in its noblest sense.

I have never framed a definition of the word "professional" as applied to professional schools, but it has seemed to me that the difference between a profession and a vocation is that as you deal more with the human element you get into what we designate "professional work." That is the reason today, I think, that the occupations of the clergyman, the lawyer, and the physician are regarded as professions. We hear so many ask why engineering does not stand with the professions, and I believe that the answer is that we have not yet begun to deal sufficiently with the human element.

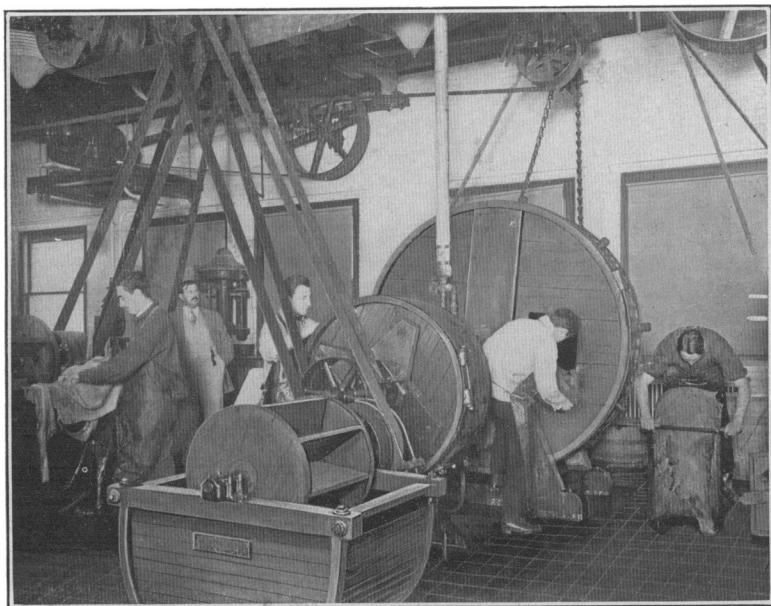
I find, however, in our professional schools, so-called, that we are turning out four or five classes of men. We turn out the mere operative, the man who for all his life must stand at the drawing board, machine, or instrument and this is as far as he can get. Then we have the engineer business man. He is not an engineer in the true sense. Then we have the genuine engineer who really designs and constructs on original lines. And, finally, we have, from the same course of study, a type of man—for which I am really indebted to Professor Bedell for a name—the "industrial physicist" who does not actively get into engineering but who applies science.

Now, gentlemen, these classes are needed and we must arrange for their development. We must start with the boys and correlate all these agencies for education in such a way that men will find themselves by natural selection. We cannot select them at the beginning. We have no business to assume that there is a certain class of vocationalists here and a certain class of professionals there when they are thirteen or fourteen years of age. We must provide means in our system for professional, industrial, vocational and what-not education in proper relation, so that the workers will drop into vocations and professions for which they are particularly adapted.



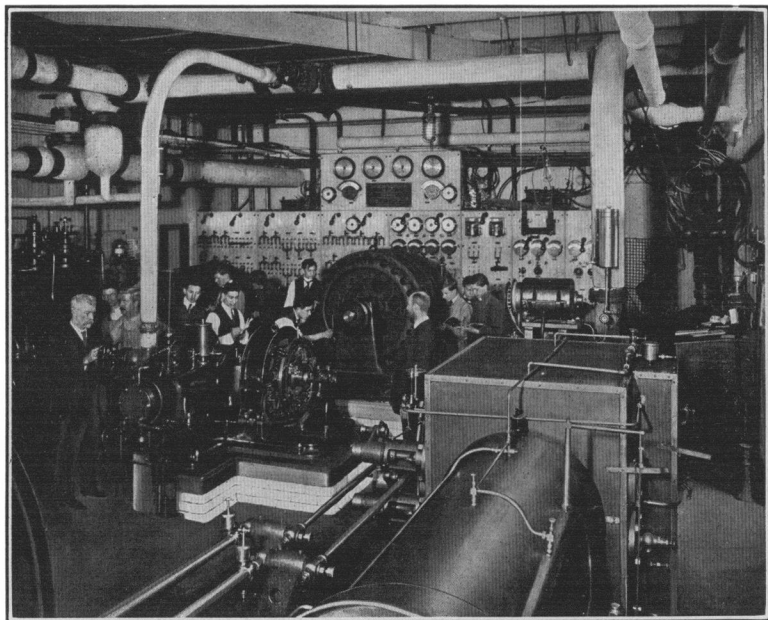
CLASS IN CARPENTRY AT PRATT INSTITUTE

[SHELDON]



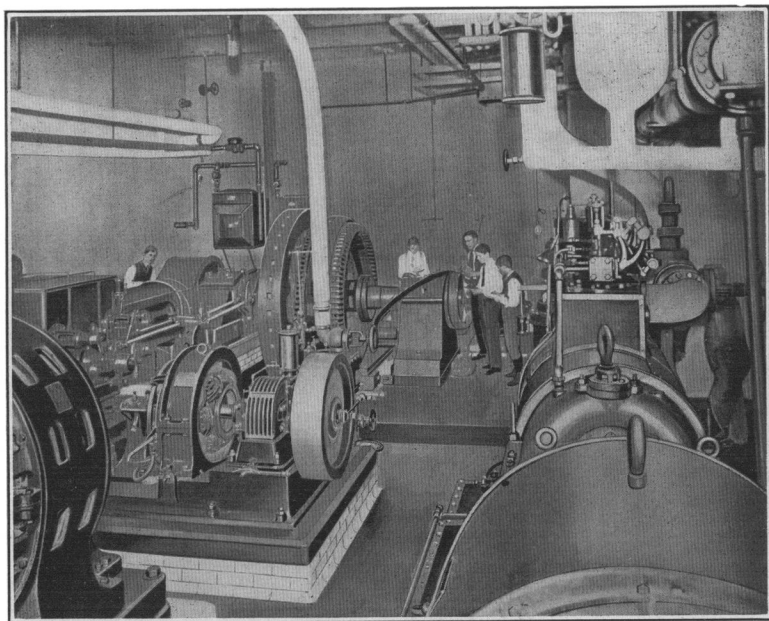
TANNING LEATHER AT PRATT INSTITUTE

[SHELDON]



ENGINE ROOM AT STUYVESANT HIGH SCHOOL

[SHELDON]



ENGINE ROOM AT STUYVESANT HIGH SCHOOL

[SHELDON]

In line with that, let me make one suggestion which I think I have made several times before, and that is, that as an engineer I do wish that, as far as professional and educational interests are concerned, we could get rid of the use of adjectives.

Yesterday President Dunn spoke, I think, of some thirty-four different kinds of engineers and of the fact that when we want to do anything in this country for engineers, we have to get joint committees for pretty nearly every one of the thirty-four organizations. Is it any wonder that we do not make more progress? I wish that the colleges would stop using the adjectives for the mere graduates, or bachelors, and call them graduates in engineering. Later, let them grow into engineers—civil, sanitary, mechanical, electrical, bridge, industrial, and so on.

**Professor Diemer:** Right in line with what the previous speaker has said I would like to call attention to a charting of industrial education along Plato's line, only modernized, by Dean Pearson of the Tuck School of Finance in Dartmouth College. In a little book entitled "Industrial Education" he has outlined a chart in which the central path shows the continuous flow of the common school education, and he recommends there a branching off on one side or another, particularly the establishment of such systems of education in which a child can be branched off at any stage, we will say, after the seventh or eighth grade, and made to receive certain lines of education which will insure his becoming a better citizen in the line in which he is forced to go.

For instance, we have here the continuation school after the seventh and eighth grade, and we advocate that the common school system should include constantly certain principles of fundamental work, we will say, in science or mechanics, simplifying those terms as will best suit, or manual arts, arts and crafts, which are not intended to be in any sense of the word educational, but general culture. Now we should supplement that common school, Dean Pearson says, by certain systems of education on the one side branching off for the men who have more ability with handicraft, and on the other side for those who have ability in accounting and clerical work. So that we branch off on the seventh or eighth year to provide a system of education which will better them in their lives. Then we must provide for trade schools or for industrial schools which will take the place of high schools which are intended as a system flowing into the college. Then he advocates in the college, also, a certain differentiated technical college course. He would have this college course divided, each side containing a predominancy of management, but the one side of a predominancy of the scientific technique and the other of instruction in accounting and financial technique. I simply call attention to that suggestion of Dean Pearson as carrying out a little further the idea of the previous speaker.

**Comfort A. Adams:** I wish to endorse most heartily what Mr. McClellan has said, since it strikes at the very root of the prob-



lem. This problem is not solved when we have provided industrial education for those who, by accident of birth, cannot afford anything else, although that is doubtless a step in the right direction; the problem is not solved when we say to at least 80 per cent of our boys—"You may attain to the position of high grade mechanic but may never gain admission to the professional fields, no matter how much better your native talents may be adapted to professional work."

At the same time, we are forcing through our technical professional schools many young men who are there chiefly because their parents can afford to give them the higher education and not because they are able to profit by it in any marked degree. I am not forgetting the numerous scholarships, evening schools, and other aids to bright boys of slender purse, but I think you will find on closer scrutiny that the beneficiaries of these various aids come in large part from the financial upper 10, or at outside, 20 per cent of the population. Neither am I overlooking the very exceptional men who cannot be kept down by any lack of opportunity; they make their own opportunities. If we were to base our educational system solely on the needs of this exceedingly small group, our problem would disappear.

We thus have a social order in which education beyond the rudiments is so restricted that we are practically wasting a large part of our raw material, in so far as the assorting of the men for the various occupations and professions is based largely upon accident of birth rather than upon real fitness; upon the extent of the parent's pocketbook rather than that of the child's intellect.

The only factor which should control the opportunity for an education is the relative ability to profit by it, and while this may seem a millennial ideal to many, our talk of "equal opportunity" is hypocritical until we have definitely set ourselves the task of realizing that ideal.

We talk much of efficiency in our engineering work, but we are apt to overlook these very vital considerations which affect so tremendously the efficiency of the whole social organism of which we, as individuals, are very small parts.

I realize fully how far such questions reach, and that they involve the consideration of many subjects and problems neither primarily educational nor engineering in their nature, but they are problems which we as citizens must face, and many of which would be vastly simplified by the application of engineering methods.

Therefore, while we are lending our cordial assistance to the promotion of the numerous extensions of our educational system, let us not lose sight of the ideal of "equal opportunity"; let us work towards that ideal, first, as "citizens of no mean country" and second, as members of no mean profession.

**F. C. Caldwell:** I am glad to say that in Ohio we are making a good start along this line of industrial education. Besides the general application of manual training to the

grammar schools, we have manual training high schools in the larger towns and in Columbus, at least, they are also experimenting with the alternate week cooperative plan in connection with manufacturing companies. I agree with Professor Williston that this is something which should be regarded as an experiment. It is certainly a good thing for some cases and always much better than nothing. But that it is better in the case where a man is able to put all his time into his school work is by no means demonstrated.

This educational attitude, which the employers of labor forming the manufacturing companies are coming to adopt toward their employees, is exceedingly promising in one direction which has not been mentioned. When the personal employer was superseded by the corporation with its officers there was a great loss in the personal and friendly relationship with the employee. I suppose a good many here, like myself, have been through the shops and they probably found, unless under unusually favorable conditions, that the employees felt they were simply parts of a big machine, that their personality was of no consequence; that the corporation employed them to do a job and that it was a matter of absolute indifference to the employer whether they stayed or went, whether they advanced or not. That there has often been some justification for this feeling cannot be questioned. It seems to me that what you might call the "educational attitude" of the corporation toward the employee may do something to fill the place of the old friendly relationship between the personal employer and the employee.

One other point that one of the recent speakers brought out ought to be emphasized, and that is, that whatever we do in the way of industrial education for the masses should always have in view the possibility of carrying a man further, of giving him the very best education that any one can have. I do not like the idea that when a man selects the manual training high school or vocational school, he is thereby shunted off from the natural course of advancement into the university. We must find some way by which a man who comes to the vocational school and thereby develops and shows the qualities which will fit him for a position as an engineer should have the opportunity to go right on up to the top.

**M. J. McGowan, Jr:** I would like to ask a question with reference to the relation of the engineering society to the state boards of education in the different states of the United States. Does this society cooperate in every state with the state board of education, to teach particularly the line of electricity? I ask it for this reason. In the state where I come from, New Jersey, the doctors are interested in the advancement of instruction in their line, the agriculturist is the same way, and all the different professions have colleges which teach their particular work. But I have never heard of anybody being interested through the state board of education to take up the technical courses in the schools of the state as to this line. Now having been connected with

the state government, I took great interest in watching the different schools, the different societies and professions which are interested, but at no time in the state of New Jersey have I seen anybody in the electrical line interested to see that the scholar or student should get the preliminary education which would bring him in touch with this particular line or profession. I think this is a very important point and I think this society, in this joint session, should arrange, in all states, committees who would wait on the state boards of education and show them that the electrical field today is one of the greatest and most promising of any profession that has ever been known. In the city from which I come, Newark, New Jersey, I have installed in one school a switchboard apparatus, for technical training in the electrical field. It was the first time it had ever been done in this twentieth century. That is due to lack of encouragement to the state board to show that this particular line needs taking care of. You will notice that all these technical schools are situated nearby the different electrical industries. That shows, in my mind, that those industries are greatly interested in the particular schools for their own convenience, for which I do not blame any man or any corporation. They further their own interests. We must try to eliminate if we possibly can any stated line of study being taught or the following of any particular line of material or peculiar workmanship. Let the teacher be interested generally and go through it all from a to z. Don't lay any stress on any company's manufacture in any school. And I trust that in this way we shall undertake to cooperate with the heads of education in the different states. Go to the governor and ask him if he will appoint some representative from the engineering society or from this joint convention to attend to that matter, and by doing that you will put the responsibility for the teaching of electrical science in the public schools of the different states up to the A. I. E. E. to see that the teaching will be right.

**W. G. Raymond:** The time has almost arrived when we shall have to ask Professor Jackson to close the discussion, but the chair cannot forego this opportunity of relieving his mind of something which, perhaps, you will consider a heresy. You have been discussing principally this morning the details of industrial education, and sometimes it is necessary to plan the details before we plan the general structure, but it is always necessary to provide the means before the general structure can be built. I do not know whether you all realize it, although you all doubtless know, that as far back as 1862, a plan was outlined and provision was made by the Federal Congress for putting us in a position that we are not now in. This committee says that we rank behind European nations in this matter of industrial education, but if it had not been that the funds derived from the act of 1862 have been almost universally misapplied this country would not now be in that position. It makes no difference whether the

colleges of mechanic arts established under that act were separate institutions or combined with state universities, the money has never been used for the development of mechanic arts. I think without exception there has been no school of mechanic arts created in any state under that act which provided distinctly for schools of agriculture and schools of mechanic arts. Dean Jackson will now close.

**J. P. Jackson:** I suppose from the remarks made by Professor Raymond that he is not familiar with the basis of organization of the Land Grant Colleges. The measure passed by Congress in 1862, in regard to the establishment of these useful institutions, is as follows:

“The leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such a manner as the Legislatures of the States may prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life.” This includes everything, I believe, that is being taught by the great bulk of our State and United States supported, or, to use the official title, Land Grant institutions. These institutions have always been alive and vigorous, have been leaders of educational thought along the applications of science, and have proved of prime usefulness to the nation.

**W. G. Raymond:** I agree with you.

**J. P. Jackson:** If that is the case, I need say no more on that subject. I think there is a great deal in what Mr. McGowan said; his plea is similar to that contained in this morning's report by the educational committee. It is a necessary preliminary to have such discussion as we have had among engineers, in order to arouse sufficient interest to do what Mr. McGowan has asked. His plea was made with reference to a specific act. Let me broaden it. If each one of the eleven thousand members of these two societies will use his influence in his local community, to get in touch with the school authorities—get himself appointed to some committee or otherwise place himself where he can be of service—he can, or the eleven thousand members can, do much to raise the efficiency, improve the happiness, and remove the discontent that seems to be growing among the hand laborers of this nation. If the *TRANSACTIONS* containing the discussion of this morning persuade only five hundred of the eleven thousand members scattered out over the country, who are now inactive in educational matters, to engage in the movement under discussion, this meeting will have been well worth while. It will have been the incentive to cause men of intelligence in our industries to become more active in doing what Mr. McGowan suggests; that is, going actively and practically into the machinery of the state to help develop our people in a proper manner. I say to the electrical convention here assembled and to the American Institute as a whole, that I believe there is no other way in which the electrical industries can be so rapidly improved, as by prop-

erly solving this very question, which we are discussing this morning, with reference to producing the greatest efficiency in our young people. There is apparently no specific answer required to any of the other discussions of this morning, as the papers presented were really not under discussion, but rather the general problem.

**Harry Barker** (communicated after adjournment): Professor Williston has pointed out the vital necessity of securing the proper boys for the various vocational school courses and the difficulty that such schools have in selecting from the candidates presented.

It ought not to be necessary for the vocational school instructors to have to step out of their true sphere to do this work. They cannot hope to have the available time or the data and information at hand to make the wisest selections. They need not perform this unwilling function if the cooperation which Mr. McClellan and others have spoken of, is secured with the present public school systems. The organization of vocational guidance based on the boy's manifest aptitude, on his environment and heredity, and based somewhat on a psychological study also, has advanced to such a stage that it is a necessary link between the existing graded schools and vocational courses. The work has risen to its highest development, so far, in vocational bureaus such as found in Boston. Trained and experienced men now find out what work or study the various pupils seem best fitted for and how far they seem capable of progressing; the counselors advise what paths pupils may well follow and what ends they should aspire to, and finally keep track of them for a greater or less number of years, to see that they do not stagnate either from inherent tendency or outside influence.

While this work has been carried out to the greatest extent with bureau organization, there is much of the work within the ability of the grammar and high-school teachers and even such modest beginnings are better than waiting for the organization of a completely equipped bureau. Indeed the largest success will be greatly hastened by an early start. This function, moreover, is one very properly tied in with the work of the local superintendent of schools, acting as the general adviser of other teachers who are striving to make some safe beginnings at vocational guidance, and as the collector of information about local industries and opportunities.

There is not time here to describe the work in detail; it can be studied, however, by those interested. In reaching out for co-operation with state boards and local educational authorities, this is a chance for immediate effort and practical benefits, not to be neglected. Where there is a vocational school, it is a necessity for efficient work; where there are no vocational courses, it is of the greatest possible good in preventing misfits. Once undertaken, it will lead logically to such vocational courses as are best suited to the local situation.

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