

## NEW ROADS TO A TRADE.

MANUFACTURES and commerce require capital; the professions imply a costly education; a trade is easily learned, and demands only enough money to buy a kit of tools. Besides, nearly every successful farmer, manufacturer, railroad officer, and sailing-master has been first a laborer, mechanic, railway hand, or sailor. The trades lead to high places; they are the most secure foundation of wealth. The average income in the United States is estimated to be about six hundred dollars, and on this the majority of our people bring up their families and save money. Any common workman in the trades can earn this; the majority of journeymen earn about twice as much.

Something of this is now recognized, and many young people are asking how they may learn a trade. It is the purpose of the writer to show how and where a young man or woman may learn enough to win a first-rate position in the trades. Two facts make it very difficult to learn a trade: first, the old apprentice system, where the beginner lived with the master and was really a trade-pupil, has completely disappeared, and, second, the division of labor caused by machinery makes it very difficult for the young workman to get a liberal trade education. To compensate for this there have been established, both in America and in Europe, what are called schools of industry. These include schools of design, schools of forestry, mines, and navigation, railroad, dairy, and agricultural schools, schools of mechanics, technical schools, and trade schools. The methods of teaching pursued in these schools vary greatly. They all have one common aim—to enable their pupils to earn a living and become capable workmen, to reduce the number of possible paupers, and to place in the hands of the scholars power to subdue the earth and contribute to the wealth and honor of the nation. Four such schools have recently come under the observation of the writer, and brief accounts of these may serve to show how a trade may be learned.

### THE WORCESTER (MASS.) FREE INSTITUTE.

THE Free Institute, located at Worcester, Massachusetts, is a school of technology. It aims to teach mechanical and civil engineering, physics, and chemistry, and, in addition, drawing, mathematics, and modern languages. In every study there must be actual manual labor in the shop or field. Ten hours a week, and the month that follows the second exam-

ination, must be spent at the bench or in the laboratory. The aim of the school is to make first-class engineers and chemists; but it does more, for in the department of mechanics it seeks to create practical workmen, capable of earning a living as journeymen as soon as they are graduated. This feature of the school is of most interest to us.

Six months before commencing the regular course, the pupil must enter a regular commercial shop and work there, as pupil and apprentice, ten hours a day. Thirty-nine hours a week must be given to this shop-work, ten hours to instruction in drawing, and five to recitation. The instruction in the shop begins with the use and care of the hand-tools used in carpentry. Wood is provided, and, under competent instruction, the pupils are required to make some given form of wood-work. From this making of mere forms they proceed to the union of different parts, and this means construction. They are next given a pattern of some article of wood regularly made and sold in the market. This may be such a thing as a hanging hat-rack for the wall, and each pupil is expected to make a dozen, all exactly alike, and fit for actual use and sale. He at once learns the difference between making an article for the sake of learning how it is made, and manufacturing it. In the drawing-class, he makes a working-pattern of the article he is to manufacture in the shop. He thus learns the language of drawing, and how to make it express practical work, and, at the same time, he learns to work from drawings. The making of a dozen hat-racks teaches the idea of manufacture, and he learns that every one of the dozen must be equally good. He also learns that to insure the ready sale of any manufactured article, the price must be low. He realizes the necessity of economy of time, labor, and materials. He very quickly sees the aim and value of machine tools. He quickly gets to see the essential parts of things, learns to make the parts separately, and to assemble them in the finished whole. If each piece of wood is to receive two saw-cuts, he learns that all these cuts may be made at one time at high speed on a band-saw. If there are six screws to be put in each piece of wood, he learns to arrange the work so as to save time and labor by doing all the screw-driving at once. Next to this manufacturing of simple things comes the construction, from drawings, of more elaborate articles, each employing the use of every hand and machine tool used in a wood-working shop.

At the end of six months he is ready to enter upon his studies. He has at this time learned enough to keep from starving in a clerkship or as a telegraph operator. He knows the labor value of a dollar, and something of the commercial value of education.

All the pupils of the institute, except those studying chemistry and physics, also work in a regular commercial machine-shop attached to the school. No pupil can be graduated unless he has made the working-drawing, and put together and finished a practical working machine, tool, or motor of some kind. Each pupil in every class must work ten hours a week in the machine-shop, and, after the second examination, work a whole month of ten hours a day. They must really work, and not only experiment. They must take their turn at firing the boilers, oiling the engine, and doing everything that may need to be done in the shop.

What are the advantages of such a school as the Worcester Free Institute over the apprentice system? In the first place, in the study of mechanics comes the preliminary six months' daily work in a wood-shop, and under constant instruction. The aim is not solely to make hat-racks or cabinets, but to teach the use of tools and the art of manufacturing. The pupil may get to be a bridge-builder or railroad man, yet there is no position in which he may be placed in after life in which the knowledge of hand-craft he acquires in the apprentice class may not be of use. He may never again lift a tool; yet he knows their use, and is a judge of good work and methods. If, on leaving the school, he has only his hands and his time for capital, he can earn a living. He has a good trade. He can enter a shop knowing far more of the theory and science of the work than his fellows, and yet not wholly unfamiliar with modern tools. There is no danger that he will join the incapables on the road to pauperism or jail.

#### NEW YORK TRADE SCHOOLS.

It is not every young man who can give three years to a course of study in such schools, or even spend six months in an apprentice class. He must earn money the moment he leaves the grammar school. He must, in some fashion, become a workman—stone-cutter, plumber, carriage-maker, painter, or whatever seems best to his liking. He cannot attend any day school, even if it is a free school. For such young men, who really desire to learn and to be educated in their trade, there has been recently opened in New York a series of evening trade schools.

These schools do not aim to be industrial universities, but places where the young workman may attend lectures and drawing-classes at night, and at very low rates. A portion of these schools are under the charge of the New York Trade Schools, the others are controlled by the Metropolitan Museum of Art; and during the short time they have been opened have been attended by a very desirable class of pupils. The classes meet two to three times each week during the winter season, and the terms range from five dollars for five months' instruction, to three dollars a month. For carpenters, masons, and machinists, there are classes in free-hand drawing three evenings a week, for two and a half hours each evening, and the terms are five dollars for five months. For architectural carvers, there is a class in modeling, meeting at the same hours, the terms being one dollar more. In the carriage-building class, drawing with a special view to carriage work is taught three times a week for five months, at a dollar a month. For fresco-painters, instruction is given in the practical work of mixing colors; stenciling, design, and composition are taught three times a week, at three dollars a month. In the class in sanitary engineering, instruction is given by lectures in the art of plumbing, in the application of mathematics to practical work, and in planning and laying out work. Instruction is also given in drawing applied to plumbing, together with practical demonstrations of work and methods. There are also classes in sign-painting and wood-polishing. In addition to these evening classes, which have already been well attended, it is proposed to teach in other schools the science and practice of brick-laying, with lectures and practical demonstrations in brick-work. This school will be open in the day-time, and the charge for tuition will be quite low. These trade schools are designed to benefit those already employed, to help them to do better work, and to raise the standard of workmanship in these trades. Such schools cannot fail to be of value both to the young workman and to his trade. Whatever tends to raise the standard of excellence in any trade, and makes it easy for the workman to earn more money, is a benefit both to the man, the trade, and the public. In this, these trade schools have a wide field of usefulness, and it would be well if they were opened in every large city.

#### THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

THE criticism commonly made in workshops against the education given in technical

schools is that, while the pupils may be first-rate draughtsmen, and well up in the theory of the mechanic arts, they are utterly unable to do any real work in the shop, not being ready to use the most simple tool or perform the most common labor. The young man is a student, and not a workman. He may be theoretically able to take charge of a machine-shop, yet no man will trust him with work, for he would not know whether it were done well or ill. To meet this criticism, the Massachusetts Institute of Technology has opened, in connection with its great school at Boston, a school of mechanic arts. Any one can enter this department who can pass an examination in the common grammar-school studies. The course is for two years, and the plan of study includes instruction in carpentry and joinery, wood-turning, pattern-making, and foundry work in the first year, and iron-forging, vice work, and machine-tool work during the second year. There is also instruction in the regular schools of the Institute, including algebra, mechanical drawing, geometry, physics, and English composition. Four hours a day must be given to study, and three hours every other day must be spent in the shops attached to the Institute.

The system of instruction in this school is entirely different from that followed at the Worcester Free Institute or the Trade Schools in New York. The school-room instruction is not important, as we wish to see only the shop instruction. The pupils are all taught the use of the same tool at the same time. For instance, in wood-turning there are sixteen lathes, and at each is a pupil working from the same pattern and under the same instructor. In the blacksmith work, a number of forges are used at the same time, all the students doing the same piece of iron-work at once. The object is to teach manual skill by classes. The articles must be well made, but it is not essential that they have any commercial value. The thing desired is the knowledge of implements and processes, and a reasonable degree of skill in handling the tools and materials. It is not expected that the pupil shall become a high-class workman, as such a degree of skill could only be obtained at the sacrifice of instruction. The graduates of such a school have a knowledge of the more simple tools used in carpentry, iron-forging, foundry work, machine-shop work, and pattern-making. When they go out to earn their living, they are not wholly at sea regarding the aim and use of the tools they see in shops and foundries. They may not be first-rate journeymen carpenters and machinists, but they are advanced beginners, and have a better general idea of

the theory and practice of their trade than the average workman in it.

#### THE STEVENS INSTITUTE OF TECHNOLOGY.

The Stevens Institute of Technology, at Hoboken, New Jersey, is a school of mechanical engineering. In addition to the usual courses in physics, chemistry, drawing, mathematics, and mechanics, there is also a thorough course in shop work. Every pupil must work in the shop two afternoons a week, and eight hours a day for thirty days in each term. In this school, the aim of the shop instruction is to give the student a great number of exercises in the use of hand and machine tools, that he may obtain as wide as possible a knowledge of methods and materials. It is not intended that he shall be particularly skillful in the use of tools, but that he shall have a liberal education in the trades allied to engineering. It is not intended to make workmen, or to enable the pupils to earn journeymen's wages, or even to give a knowledge of commercial methods. The student is to become an engineer in the broadest sense, and to do so he must know something of every kind of work performed in shops and foundries. To understand this, we may briefly examine the courses of instruction in the shop work. There are no classes, and each student takes up one exercise after the other. As soon as he makes it clear that he understands the tool or process, he goes on at once to the next exercise. Those who are quick of eye and hand advance quickly. The slower pupil simply covers less ground. They have equal knowledge as far as they go.

In carpenter work, there are thirty exercises, progressing from the care of tools to the practical construction of a roof-truss. By following each in turn, the pupil covers the entire range of carpentry work. He sees and performs, at least once, every kind of work performed in commercial carpentry shops. He may not be able to turn out a very nice piece of work, and it may have no commercial value whatever, yet he knows the how and the why, and if in after years he wishes similar work done, the knowledge will be of use to him. In wood-turning there are twenty-seven exercises with a power lathe, beginning with the starting and stopping of the lathe. As each student takes every exercise in turn, and spends no more time over any one than is needed to get a clear knowledge of the work, one lathe answers for the whole class, each in turn performing the exercise for the day.

In machinists' work, there is a course in vice work, in chipping and filing, of eleven exercises, advancing from simple filing to the most elaborate work in finishing iron by hand. In the use of the planer there are ten exercises, on the milling machine eighteen exercises, from the simple setting the machine in order for work, up to intricate problems in the art of gear-cutting. There are sixteen exercises in drilling-press work, and in the use of the metal lathe thirty-six exercises, including all the work done with this tool. All of these exercises in the shop are based on drawings made by the students.

In addition to the foregoing, each class, before its graduation, makes working-drawings, and constructs from them some piece of machinery which implies a knowledge of pattern-making, casting, blacksmith's work, millwright work, and steam-fitting. There are also exercises at the forge, in pattern-making, in molding, and founding, and in all the work required in fitting up a mill, and in erecting steam and gas pipe of all kinds. Each pupil must, either alone or with others, go through these exercises till he shows that he has a clear knowledge of the subject, and that, if he had the practice, he could become a skilled workman in a very short time.

This school has recently greatly increased its facilities for instruction by the erection of a fine machine-shop, which includes a Buckeye high-speed engine, and at least one type of every class of machine-tool used in manufact-

ures. The shop and tools were the gift of Professor Henry Morton, the president of the Institute. This shop certainly gives the Institute great advantages in the practical teaching of the trades connected with mechanical engineering.

These four schools are not all the industrial or technical schools in the United States: there are several others aiming to occupy more or less of the same field; but these show the methods pursued in teaching the trades, and they are the best we have in the country. For the young man who must at once earn money, the Trade Schools in New York offer excellent opportunities to study drawing, which is the universal mechanical language, and to get a better insight into the science of work than can be obtained in the shop. For those wishing to learn the trades in their relation to business, the methods of the Free Institute at Worcester seem best. For the student aiming higher than to be a mere workman, the Massachusetts School and the Stevens Institute offer the best advantages. Each is a university of the trades connected with engineering—the first giving perhaps the most hand skill, the second giving in its school course a wider field of study, with less actual manual skill. The influence of such schools is already great, both upon the standard of excellence in these trades and in raising the dignity of labor. Such schools are the new roads to a trade and a competence.

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### AMONG THE THOUSAND ISLANDS.

THE misty air like amber seems,  
Like melting gold the sky o'erhead.  
Athwart the ivory gate of dreams  
Surely our bark is piloted.

For this is the enchanted realm,  
The fairy-palace reared by sleep;  
Through emerald chambers glides our helm,  
And in our wake flame-opals leap.

I need but lift my heavy eyes  
To South or North, to East or West,  
To see, as at my bidding, rise  
A wave-charmed island's tufted crest.

Here a tall headland draped with fern,  
Pine-crowned and honey-combed with  
caves;

There, just above the river's urn,  
A low, soft nest of grasses waves.

Now narrowing cliffs inclose our prow,  
Fantastic rocks streaked blue and rose;  
The channel eddies swift,—and now  
Broad as a sea the river flows.

Thrilled by the water's long embrace,  
The slender silver reeds are stirred,  
And sway with slow, voluptuous grace,  
Like dancers to a waltz unheard.

There where the crystal floor scarce shines,  
So thick the velvet leaves unfold,  
Superb the lily-queen reclines,  
A miracle of snow and gold.

Here is Miranda's island—look!  
'Twixt tree and cloud still Ariel flies,  
Behind the hill, beyond the brook,  
The whelp of Sycorax yet lies.