

Engineering is a many-sided profession, in the first place, and is utterly unlike its elder professional brothers in this respect. It enters in some of its many branches into our very life; it means modern progress in the world, and without it civilization would stop. Engineers—not divines, lawyers or doctors—are entitled practically to all the credit for the phenomenal material advance made in the civilized world in the last century, or even in the last half century, that spans an era of development far surpassing in its scientific achievements any equal period in the world's history. It is the engineer—civil, mechanical, hydraulic, sanitary, mining or electrical—that has created our railways and canals, built our steamships and battle-ships, brings wholesome water to our doors, and sets thousands of spindles whirring by water power; drains, builds and paves our cities; improves the homes of rich and poor; turns our metals into finished products, and sets space and time at defiance, and lights our cities and carries their people by the power derived from electrical current. In fact, it is hard to say what an engineer is not, or what he may not be called upon to do.

Under these conditions it is naturally very difficult for either the young man, or his parents, to decide which of the many distinct paths of engineering it is best for him to enter; in which one he would be most likely to succeed. It is just here that the technical school, as now organized, has its real value, as an indicator of the best course to pursue. It is true that some of these schools are intended to train men for special branches of engineering, civil, mechanical, electrical, etc.; but as a rule the earlier courses of these institutions have for their purpose the development of the natural endowments, and do this by a general course of scientific training that is common to all branches of the profession, and essential as a foundation for any special branch. The work-shop, the laboratory and practice in the field now go hand in hand with theoretical teaching, and if the student has any natural inclination toward any special field of applied science, the fact is soon made evident to himself and to his teachers. With the direction once pointed out, it is then easy to find and follow to any end the path in life for which he is best fitted, and in which the student and the man is most likely to succeed. To-day there are schools for the advanced student in any one of the special branches of engineering that he may select, and the amount of knowledge gained before he commences to practice depends purely upon his own mental capacity and power for work.

But, say some young men, all this higher education costs money and we have not got it. Then our honest advice is, seek some other field of work where a technical training is not necessary. There are altogether too many self-taught engineers in the field now in this country, and in every section of the United States evidence can be found of their honestly intended but faulty work. Any young man can enter an engineering corps, learn to drive stakes, pull a chain and run a level or transit in time. By force of circumstances, opportunity or personal influence among the controlling spirits of a corporation, he may finally succeed to a position of some responsibility, and he then usually assumes that he is a full fledged civil engineer. So he is as far as the duties we have first enumerated are concerned, and he may do all of these well. But this is not civil engineering; it is scarcely worthy of being called the A B C of the art. Telford defines engineering as "the art of directing the great sources of power in nature for the use and convenience of man." To realize this definition the engineer must be well trained, he must know what other engineers have done, be mentally equipped so that

he can follow their line of reasoning, profit by their experience, and be enabled to think and to plan for himself. He must know many things and know them well, and to obtain this information the technical school, with its trained and experienced staff of teachers, its laboratories, its work shops and its facilities for experiment and original research is essential.

Engineering is a profession of emergencies; the unexpected thing is always turning up and the engineer must be ready to meet them, and to meet them at once. He is often so situated that the best library of reference obtainable with money is of no avail, for it is inaccessible when wanted and time to consult is lacking. Vast interests or human life may depend upon what work he performs within a few hours, and to perform this work he must first know what to do and how to do it. It may be that he meets a difficulty that is unique in its way, or, if it has happened to other engineers, the methods pursued are unrecorded. But if he is well grounded in the leading principles of his profession, has a broad grasp on the field of engineering knowledge, has gained wisdom by the emergency experience of other engineers, even in other fields, and above all is sure of himself, he will quickly devise some way out of the scrape and gain renown and advancement for himself—though this latter does not always follow in this selfish age.

The timid engineer, who has no capital but the scanty knowledge he has picked up in the intervals of a busy life, may attempt to do something under these circumstances of danger, and he may possess sufficient force of character to put his plans into execution. But he usually does the wrong thing, commences at the wrong end, puts his props in the wrong place and generally bungles. And when he has time to hunt up authorities he appropriates a formula without understanding its limitations or controlling conditions, and builds upon a foundation of mental sand, so to speak, and is professionally a failure. It is true that some one else usually pays for his blunders; but as long as the employers of engineers are short sighted enough to intrust their work to the cheapest man who styles himself an engineer, we certainly cannot say that we are sorry for them. Corporations themselves are to-day mainly responsible for any bad work performed on their properties, for the reason that to-day competent, trained and experienced engineers can always be secured if the employer makes the attempt to seek them out and has the wisdom to pay for the best talent the work in question will demand. In brief, the real engineer of the modern times, to whatever branch of the profession he may belong, is not born an engineer, nor does he grow, as Topsy grew, to be an engineer. He must be made; and, like any other good machine, the finer the original material, the more perfect the workmanship and the more care used in adapting all the parts to the duty to be performed, the more certain and satisfactory will be the results obtained. * * * * *

But while the young engineer should be well educated and well trained, strong of limb, full of energy, brave and just, it is yet proper to say that the possession of all this training, combined with the other qualities, does not necessarily make an engineer. He must add to this years of hard, practical experience and always remember that there is no royal road to success in his profession. Many young men who have carried off the prizes of their college course and have graduated with all honors, forget this and at first feel disappointed because they are barred out from the higher walks in their branch of science. But if the right stuff is in them they soon recover and realize the fact that technical schools do not turn out engineers, but only young men more or less thoroughly equipped for rapidly gaining the practical knowledge that is only ob-