

justified if we are to believe the statements made from time to time by eminent engineers, and I desire to call your attention to a notable address delivered before the American Institute of Electrical Engineers, 1915, by that very prominent educator and engineer, Prof. Geo. F. Swain, of Massachusetts Institute of Technology, from which I quote:—

"Engineers are deficient in clarity of thought as compared with lawyers, and in both clarity of thought and breadth of view as compared with lawyers and business men.

"The best men of the community take up law. Legal training and experience, on the whole, train men better to think straight and reason logically than the engineering training.

"I question whether to-day, and in the past, the training of the engineer has given as much grasp of subjects and breadth of view as has the training of the lawyer and business man. I fear the engineer concerns himself in college and after college too much with the minor technical details of his profession and does not accustom himself to study, does not take interest enough in the broad questions affecting the community in general.

"The fact that engineering is to so large an extent a mathematical subject is one of the main reasons why the engineer is not recognized.

"There is scarcely anything that tends more to narrowness of view than dealing all the time with problems which can be solved only by rigid mathematical process, because the great questions that confront us are not mathematical—the data are shifting, variable, and the human element comes in. Therefore, the man who is accustomed to solve his problems by mathematics and who can only do the solving in that way finds himself at a loss in the practical affairs of life—mathematics do not apply."

I have quoted Prof. Swain at length, because he has given certain reasons for the opinion which the public to so great an extent shares about our profession, but I believe some of the views expressed by Prof. Swain may be seriously questioned.

It is a surprising thing, if true, that the legal training and experience, on the whole, train men better to think straight and reason logically than the engineering training.

The lawyer is dealing with the laws of man, which are constantly being amended, appealed and repealed. Can it be said that there is any particularly straight thinking and logical reasoning behind the laws which are constantly being ground out in the State Legislatures and the National Congress, three-quarters of whose members are lawyers? On the contrary, they are the result of the exigencies of party politics, a servile subserviency to the shifting views of public opinion, and that they are illogical is seen from the fact that so many of them are knocked out as soon as they reach the higher courts.

The engineer, on the other hand, is dealing with the unchanging laws of nature, which can never be faked, and I maintain that of the two men, the engineer should be the straight thinker and most logical reasoner. The lawyer appears to be, simply because he can better express his thought. His training accustoms him to public speaking and setting forth his reasons in argument. He is trained to think standing. The engineer's training affords very little opportunity for speaking. This and

many other of the shortcomings mentioned by Prof. Swain are defects in the education of the engineer.

There seems to be some difference of opinion among the educators of the country as to the way in which engineering education may be improved. There are a large number of men who think a five-year course, and even more, is necessary. There are those who believe less education in engineering detail and more in general cultural studies, and a four-year course, would produce the best results.

I am inclined to the latter view. We are not looking for the colleges to turn out experts and specialists, as the advocates of the longer course think they should do. What we want is young men well grounded in the fundamentals of the profession, and with a liberal education in other branches. They will specialize and become experts in the course of their professional career.

There is no reason why a young graduate from an engineering school should not be able to make as fluent and as logical an address on any subject of general interest as a graduate from a law school. His education is deficient in literature and languages. He is often woefully lacking in the ability to write and spell English correctly, and the colleges are to blame for this. The engineer who will succeed in the profession is one who will regard his college education not as the end of his education, but merely the means to an end, the value of which will be in the forming of correct habits of study. An extensive acquaintance with the best literature in the language, and the ability to speak fluently and write correctly is within the reach of everyone. The "five-foot shelf of books" will furnish the basis of a liberal education, we are told by a great educator, and the young graduate should leisurely study along that line. Good literature and poetry will not only afford him great mental relaxation, but will unconsciously mould his habits of thought and speech.

We realize the inability to make a speech in a land governed by gab is a serious handicap, but with a broader general education on the part of the colleges and a general knowledge of literature acquired by reading after leaving college, the young engineer can train himself to at least hold his own with the lawyer, with whom he is so frequently contrasted to his disadvantage. Referring again to the matter of clear thinking on the part of lawyers: In every lawsuit tried to a conclusion, counsel on one side wins, which, we assume, indicates clear thinking and logical reasoning for that particular lawyer, but at the same time some other lawyer lost, so the lawyers' work breaks "fifty-fifty" all the time. He has the satisfaction, however, of knowing that he is being paid, even while losing, and can console his unfortunate client with the statement that the jury or judge surely erred, and that there may be a reversal for him if he continues the case through the long line of courts to the bitter and expensive end.

Now, what can we do to improve the conditions in the profession? We can look to the colleges for some improvement in the graduate, and we, the practising members of the profession, can undoubtedly improve the conditions of employment. The engineers have been misled by the fallacious doctrine that engineering consists in the art of investing a dollar so that it will earn the most interest, and with the equally fallacious idea that low costs means efficiency. The engineer should be concerned less about the cost than the character of his work. He has been often anxious to complete his work

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