

and efficiency engineers receive that figure. \$50,000 would be a better comparative figure as regards the number of men receiving such salaries in the two classes.

The engineering school is a product of the industrial age and is a result of industrial demands. It was born in the inventive era and was a direct result of the desire for men who had fundamental training in science sufficient for them intelligently to use the newly discovered machines, forces, materials and processes. The engineering school grew gradually from a school of pure science to one of applied science because of the insistent demands of industries. The growth and evolution of curriculums were slow processes and lagged far behind industrial demands as regards time.

The era of application and operation gave an impetus to engineering schools that has existed almost to this time. The demands for skilled operators, draftsmen and mechanics were so great that industrial organizations were forced to supply some of the men through apprenticeship systems. The engineering schools were insufficient in number to fill the demand for their products. New engineering schools were founded in great numbers. The field of pure and applied science was sharply divided and defined in this era. The engineering curriculums were changed in order to train students in the use of industrial apparatus in wood and machine shops and in testing laboratories for steam and electric machines. The schools devoted a great amount of time to design and drafting and also taught the fundamentals of engineering as contained in the pure sciences. This was the golden age for engineering schools—their products were in great demand and excited no criticism; the engineering profession was very popular and caused the schools to receive private and state support as well as a great increase in the number of students.

The era from 1900 to date, with the resulting changes in industrial conditions and demands, has greatly changed the working conditions for engineering schools and caused some dissatisfaction with their products. The popularity of engineering as a profession created in the previous era caused a large increase in enrollments for several years and in the number of engineering schools. These conditions existed long after the initial industrial impetus had ceased. The schools still kept in view the training of designers and operators although the demand for such men was decreasing yearly. Engineering schools continued to add large and expensive shops and laboratories to their equipment; some even attempted to manufacture commercial products in order to train students in commercial methods. The apex of this condition as regards engineering schools was reached long after industrial demands had changed. The time lag between school curriculums and industrial conditions is very great and can only be shortened by more intense co-operation between the schools and the industries through faculty associations with industrial pursuits.

The engineering schools awoke to existing conditions in industrial pursuits only a few years ago—the prime source of awakening being a decrease in engineering enrollment. This was explained in part by the growth in popularity of agriculture at this period, but this alone could not be sufficient reason for the decrease in the popularity of engineering as a profession. Upon investigation, the schools found that the industrial conditions and demands had changed. Industry now desired specialist engineers—a man who was not only an electrical engineer but also a specialist in one branch of electrical engineering, such as railways, telephony, illumination, transmission, etc. The engineering problems were

largely problems in economics and no longer those of design or operation. The industrial world also desired executives and business managers and could not obtain a sufficient number. Industry was looking to the engineering schools for their supply and found it unfitted for the existing conditions.

The schools found it advisable to conform to industrial demands as their salvation and life depended upon their products obtaining larger salaries than were being given them. In a haphazard way and at different times the schools began to change their curriculums to conform to the new conditions. In this revision of curriculums, instead of omitting previous courses and replacing them by others of the desired type, they simply added to the existing curriculum specialized courses in engineering, economics, business law and business management and made no attempt to increase the time allotted for an engineering degree. Civil engineering students, for instance, were not only given the previous content of the curriculum but were also given specialized courses in concrete construction, hydraulic engineering, structural engineering, railroad and highway engineering, economics, English, business management and business law. The same conditions held true in electrical and mechanical engineering.

During the elapsed time the knowledge of fundamental laws and their applications had increased and so required more time for their assimilation with the same degree of thoroughness.

What was the result? The schools found they had attempted the impossible; they found that it was impossible to have such curriculums in a four-year course. They found their graduates were not thoroughly trained even in fundamentals; that their reputations were on the wane; that their enrollments were decreasing as a consequence; that criticisms were severe; that radical steps must be taken to avert disaster. The realization of this condition was a slow process and was marked by no organized effort, on the part of the schools, to revise their educational methods and curriculums. Even now a great many schools do not realize that such conditions exist and have taken no steps to analyze the trend of engineering education. The situation is aggravated by the demands of industries for the type of men that cannot be furnished by engineering schools in a four-year course; the industries do not realize the conditions engineering educators face or the problem they have to solve—industry demands results irrespective of conditions. The schools have proven through costly experimentation that the type of men demanded is an impossibility, yet some schools are still trying to supply the demand.

The industrial engineers desire men trained in fundamentals, operation, design and construction and specialized engineers along one line; they desire men trained in economics, business organizations and executive duties. They criticize the schools because they do not furnish such men in a four-year course.

The schools should admit without question that they fail to supply the demand; that they cannot do so under present conditions in a four-year course. It is impossible to train a high-school graduate in four years so that he will possess all the qualifications demanded by industries. The schools should admit these facts and submit their brief to industrial engineers.

Engineering schools are facing a crisis. Industry demands results that are not forthcoming. The lives of engineering schools depend upon their supplying the demands of industry. The problem must be solved and will only be solved by the efforts of engineering educators for