

even if your standard structure should fail for some extraordinary reason, you could defend yourself in that you had followed accepted principles. The engineers who run our factories, railroads, etc., are very apt to be hostile to invention, because it is the great foe of (immediate and personal) efficiency, by disrupting routines achieved, while its benefits likely inure to some other department. As engineering president J. R. Van Pelt says, and Rossman.⁶²⁸

[625] What is an engineering course like? It is almost all mathematics, which is not to be questioned, and principles of physical science and engineering, which are taught as unquestionable, and the solving of problems by means of these, problems which have only one right answer. It is analysis and "convergent thinking", the very opposite of *finding* problems, *asking* questions, getting around the laws of science, and synthesizing "divergent" answers, alternative solutions, which sum up the business of an inventor. Kettering said ⁶²⁹ that in school you must never fail, but "an inventor fails all the time and it is a triumph if he succeeds once;" while fear of failure ruins him. The specially competent Rossman ⁶²⁸ says the engineers' training gives them an exaggerated regard for precedent and supposed laws, and "By the time the student graduates any originality which he might have had has been completely stifled and suppressed." He quotes Samuel W. Rushmore, an engineer and distinguished inventor, as saying that engineers are rarely inventive by habit or disposition, and "I further believe that the colleges are largely to blame in their insistence upon rigid, soul-killing worship of precedent, and their cramming of immature minds with such a mass of simple data that imaginative power and all initiative are destroyed." And he quotes Admiral Fiske that the engineer and the inventor are two quite different men; it is very desirable when they can be united under one skin, or at least cooperate. Kettering ⁶²⁹ said the pneumatic tire is one of the greatest inventions, but "It isn't mentioned in any textbook in any engineering school. The reason, they say, is that we have no formulas for it. You have to study the low-pressure steam boilers because we have the formulas, but they don't make those any more."

[626] Another man said ⁶³⁰ "From grade school upward, native curiosity, individual initiative, and inherent inventiveness are discouraged. In terms of basic improvements in the individual's creative and inventive capacity, most college courses are prefabricated, predigested and preposterous." Simpson writes ⁶³¹ more moderately, "Unfortunately, engineering education does not always prove a beneficial atmosphere for the development of such personal qualities (as an inventor requires). Engineering students get little opportunity to express their own ideas. Few engineering teachers encourage their students to initiate solutions instead of following the teacher or textbook. It does not help a student's personality and initiative if he spends his time being stuffed with facts." Two GE men wrote earlier, ⁶¹⁴ "Whatever stimulus has been given to this creative ability in undergraduate days has come uniformly through student-professor relationship. * * * Whatever ingenuity a man may possess is often so deeply buried under a 4-year layer of erudition that it takes years for it to reappear, if it ever does."

[627] Professor Conrad of Yale wrote ⁶¹⁶ "Under present systems many undergraduate students of electrical engineering, who possess