all the prerequisites necessary for the development of the inventive type of engineer, are shunted into undergraduate and graduate courses that are designed to equip them with methods of rigid mathematical analysis rather than to develop their natural talents. Oftentimes these courses take from 5 to 8 years of the most productive part of a student's life. When he has finished them he possesses a keen analytical ability, and a habit of depending upon his mathematical tools to solve all types of problems. He can solve difficult problems and has acquired a habit of presenting the solutions in a most pleasing manner to the instructor or supervisor who gave the problems to him to solve. But does he ever go out and find these problems himself? Perhaps once in awhile, but not often. He is kept too busy with his engineering courses to think of other things. By the end of 5 or 6 years he has become a human comptometer. But what has been done in the meantime in the way of developing his natural talents, his originality? Not much to be sure, and all the time he is growing older. He is approaching middle age and as yet he has not proved to the world that he can support himself." So he gets a job, of the uninventive type that we shall discuss hereafter (¶ 653 ff.). His electrical engineering training has been standardized to fit a standard job, as is easiest for both the college and the employer. And industry is usually minded operatively rather than creatively. If the purpose of enginering education is to train men to solve problems for industry and earn a living, we are doing well. "But if the purpose of engineering education is to develop the individual rather than to remake the man, to develop his talents rather than standardize his thoughts, then certainly engineering colleges are not doing all that they could for the talented student." [616]

[628] We seem to face a hard dilemma. Engineering schools spoil inventors, and yet must spawn a large part of them for tomorrow. About half of their graduates are going into research. A stuffing with facts and scientific rules stifles the imagination, yet is an indispensable kit of tools for an inventor. It is indeed the same dilemma we talked of earlier (¶ 579), the *ambivalence of knowledge*. What are the ways out?

[629] Certainly the teaching of science and the reverence for it cannot be thrown out for inventors, though they might probably be reduced. Even if we overdo science, Professor Kuhn says,[632] its convergent thinking, its elaborate, integrated, unquestioned structure, is essential and basic to education and to the ready, efficient working of an inventor's mind. Lacking it was the old-time "handbook engineer," who could solve only problems for which his handbook supplied method and data. We have spoken (¶ 596) of the importance of exact definitions and the sound, theoretical reasoning of truest science, to break through customary associations. R. L. Meier says that scientists make better inventors than engineers, because they are better trained at thinking algebraically, less hembound by habits. In his own science of physics Kuhn notes how fast the pace of discovery accelerated when the varying mere speculations on the nature of light, in ancient and medieval times, were replaced by Newton's firm corpuscular theory, even though this was later set aside for the wave theory of Huygens, and this in turn by the modern combination of the two. Science's daily task of reconciling facts to a rigid, standard theory