Book Reviews

Chemical Engineering Viewed Historically

A Century of Chemical Engineering. Papers from a symposium, Las Vegas, Aug. 1980. WILLIAM F. FURTER, Ed. Plenum, New York, 1982. viii, 464 pp., illus. $49.50.

At its annual meeting in 1979, the American Chemical Society sponsored a historical symposium marking the 100th anniversary of the first attempts to define chemical engineering as a field apart from industrial chemistry. The 22 lectures from that session were published in 1980 (*History of Chemical Engineering*, W. F. Furter, Ed.; reviewed in *Science* 15 May 1981 by John Servos). A second symposium on the history of chemical engineering was held at the subsequent ACS meeting in 1980. The book under review is a compilation of the 21 lectures delivered then. None of these gives us a sweeping, panoramic history of the field, and none penetrates to the levels of interpretative insight attained in volume 1 by Jean-Claude Guédon, who compared the rapid growth of the discipline in the United States before 1939 with its slower emergence in Western Europe. Nevertheless, many of the lectures in volume 2 make useful contributions to our understanding of various aspects of the history of chemical engineering. They can be loosely grouped into three categories.

The first, on chemical engineering practices in different national settings, reviews the state of the art in five countries: the United States, England, Germany, France, and South Africa. The American experience prior to World War I is analyzed by M. Trescott. She presents us with much new information and aims at relating the internal history of the new discipline to the broad themes of American history in the Progressive Era; but she fails to make her story cohere and to exploit her interpretative glimpses.

More satisfying is M. Appl's essay on the debt German chemical technology owes to Carl Bosch, who, just prior to World War I, approached his assignment of scaling up Haber's ammonia process in a manner consonant with modern chemical engineering practice, in which calculations are made to optimize all technical and economic factors known to affect the potential success of a given process. At the Badische Anilin- und Soda-Fabrik where Bosch worked, and soon after at other German chemical plants, impressive chemical engineering problems, often involving high pressure and catalytic processes, were regularly solved without professionally trained chemical engineers. Before 1945 chemists, mechanical engineers, physicists, metallurgists, and other traditionally trained specialists cooperated to get the job done. Only after World War II was the need felt to generalize the ad hoc experiences gained by these teams so that cumulated engineering know-how could be more efficiently recovered, researched, and taught to a rising generation of specialists in chemical engineering.

The same striving for national self-sufficiency in chemical manufacture that led the German government to promote the growth of chemical technology underlies as well, but more deliberately, the actions of the governments of South Africa and Japan. Prior to World War II South Africa's chemical engineers were mainly drawn from Europe. Their assignments were closely related to the mining and processing of gold, chromium, copper, manganese, uranium, and several other metals. After the war an ever larger fraction of South Africa's rapidly growing body of chemical engineers were trained in one of six state-supported universities. The variety of chemical products they helped to produce grew well beyond prewar limits till by the 1970's the nation had become largely self-sufficient in chemicals and in motor fuels made from domestic coal to compensate for the country's lack of oil. Much is made of the stimulating effect of World War II on the growth of South Africa's chemical industry, but no mention is made of the reasons why the drive toward self-sufficiency has been intensified since then.

The development of chemical engineering in Japan is recounted with clarity by F. Yoshida. This chapter is characteristic of the second category of papers found in this book, those that focus on chemical engineering education. The Japanese academic experience follows rather closely the stages of development discernible in most other nations. Before 1920 chemical engineering was recognized as an increasingly distinctive specialty within the field of industrial chemistry. The era between the world wars saw the creation of separate chemical engineering departments whose teaching and research centered on unit operations. Between 1945 and 1970 there was an explosive growth of the field in terms of numbers of engineers trained, advanced degree programs initiated, the variety of phenomena researched, and the use of sophisticated mathematical modeling.

As for the mix of courses required of undergraduates, it surprised me to read that at the University of Michigan the number of courses prescribed in mathematics, chemistry, and physics has changed little in the last 70 years, and since World War II the number of required chemical engineering courses has remained virtually constant. But modern languages have been dropped in favor of more English, humanities, and social sciences. In Japan, by contrast, command of two foreign languages is mandatory.

For practicing chemical engineers the papers in the third category are likely to prove most interesting. They describe efforts at mastering specific engineering challenges: distillation, diffusion, ultrafiltration, chemical reactors. Additionally there are fascinating descriptions of several manufacturing triumphs such as the invention and characterization of polymer blends, the production of ethylene from natural gas by the Union Carbide Company, the reforming of naphtha to upgrade the quality of gasoline and otherwise generate a large variety of petroleum-based chemicals, and the dehydration of foods. Did you know that freeze-dried coffee is made by methods invented in a crash World War II program for the stabilization of blood plasma and penicillin?

Anyone seriously or casually interested in the history of chemical engineering can benefit from this book. The nonspecialist can enlarge his or her appreciation of the way in which chemical engineers practice their profession and contribute to modern society. Chemical engineers and historians will find papers on important special topics not previously treated from a historical perspective. All these papers are authored by knowledgeable specialists who, with a few exceptions, tell their stories clearly and engagingly.

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