revered by the 20th-century news media nor the Olympian genius the self-appointed guardians of his image made him out to be.

Unfortunately, the portrait that does emerge is not a complete one. Conot does not piece together a satisfying picture of the most prolific inventor in history. The mastery of detail that he displays in dealing with the data from Edison archives deserts him when he leaves those sources. Conot is clearly not at home with the technology that is at the heart of understanding Edison's work. The efforts to master technical details result in explanations that are sometimes laborious, sometimes incomplete, and sometimes just plain wrong. A botched attempt to show how Joule's law is applied to parallel circuits (p. 132) and a misunderstanding of the light ratings of incandescent bulbs (p. 141) are signals to the reader that Conot is not to be trusted on technical matters. This is no trivial fault in an account of a life as thoroughly immersed in technology as Edison's was.

Even Conot's use of the material in the Edison archives is not above suspicion, as one already well-publicized example will illustrate. Supporters of Joseph Swan's claims to have preceded Edison in the invention of the incandescent light have seized on Conot to back their arguments (as reported in *Science* 6 April 1979, p. 32). But does the evidence really support such claims? The *Scientific American* article in which Edison read of Swan's experiments reports not the success of the Englishman's lamp but rather its utter failure. The laboratory notebook in which Edison refers to the Swan report is not dated immediately before Edison's successful experiments with carbon in October 1879 (as Conot implies and *Science*'s reporter appears to have assumed) but was probably written several months earlier, in July (when the article appeared). There is simply no evidence—certainly none cited by Conot—that suggests that Swan's results had a direct influence on the course of Edison's experiments.

Nor is Conot able to describe fully the social and economic milieu in which Edison worked and of which he was such an important part. The judgmental tone with which Conot attempts to describe the "real" Edison would be more persuasive if he could make clear the historical standards against which he is measuring Edison's conduct. These standards do not emerge, however, so we are left largely with a sense of cynicism rather than dispassion.

What Conot has given us, therefore, is a provocative insight into the character of a unique man, backed by the most complete and probably the most reliable descriptions of Edison's work ever offered. *A Streak of Luck* is not the final word on Thomas Edison, but it is an important corrective for the adulatory treatments of the past. Even more important, however, it can also be a guide to how much there is yet to know and understand, even after a hundred years.

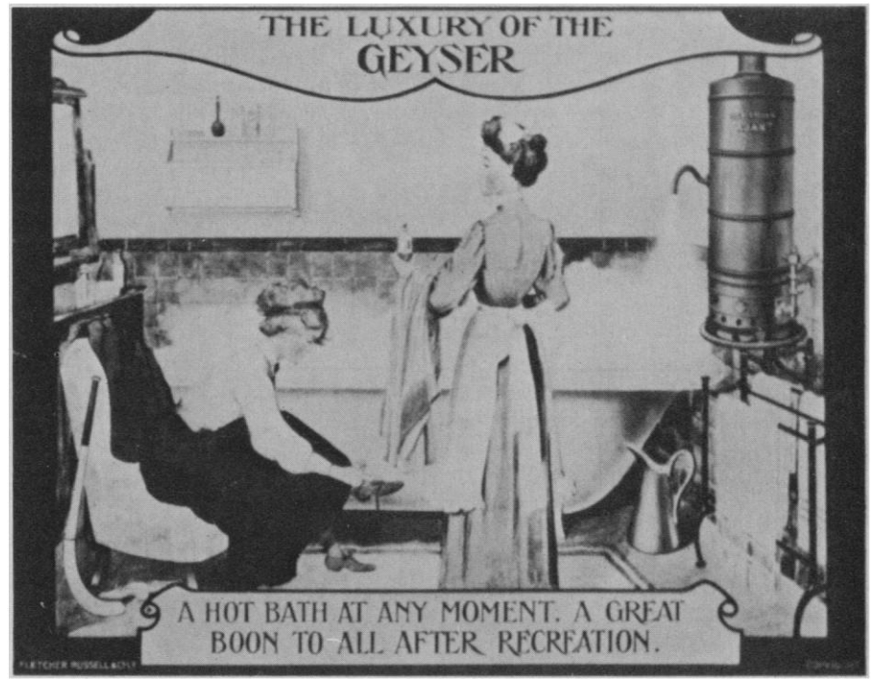
ROBERT FRIEDEL
National Museum of History and Technology, Smithsonian Institution, Washington, D.C. 20560

Singer's Work Continued

A History of Technology. Vols. 6 and 7. TREVOR I. WILLIAMS, Ed. Clarendon (Oxford University Press), New York, 1978. Vol. 6, The Twentieth Century, *c*. 1900 to *c*. 1950, part 1. xxvi pp. + pp. 1-690, illus. $39.50. Vol. 7, The Twentieth Century, *c*. 1900 to *c*. 1950, part 2. xx pp. + pp. 691-1530, illus. $47.50. The two volumes, $82.

As a field of systematic professional study, the history of technology is relatively new. About 20 years ago a professional society was organized and a journal, *Technology and Culture*, was started. Since then a small number of journals have informed the scholarship of a small but growing group of specialists. Growing largely from the fields of history of science, economic and business history, and engineering, the field often continues to bear the marks of its birth.

As in the history of science and business history, the early work in the history of technology was largely descriptive chronologies of inventions and developments, often whiggishly emphasizing contemporary interests, definitions, and trends. Nearly 30 years ago Charles Singer, a historian of science, medicine, and technology, conceived of an encyclopedic survey of the history of technology from antiquity to 1900: *A History of Technology*. Between 1954 and 1958 the five volumes of the survey appeared under the editorship of Singer and three associates, with the articles written by specialists in each of the various kinds of technology. Singer chose the terminating date of 1900 believing that it was impossible to present the modern period in nontechnical language, that the amount of space required would be excessive, and that it would be difficult to select the significant events. Although Singer thought that science and technology needed to be integrated into cultural history, he argued that a precondition for this was the detailed ex-



"A geyser by Fletcher Russell and Co., 1914. The gas-fired instantaneous water heater in polished copper has been a serviceable and popular method of heating bath water ever since Maughan invented it (and the title 'geyser') in 1868. This illustration from a contemporary catalogue is a social document, with its unruffled long-skirted girl, just back from hockey, being attended by her maid." [From G. B. L. Wilson, "Domestic technology," in *A History of Technology*, vol. 7, part 2]

ploration of the technological component.

Now, more than 20 years after the publication of the last volume of this monumental work, one of Singer's associate editors, Trevor I. Williams, has undertaken the "completion" of the set with two volumes for the period 1900 to 1950. Williams believes that the passage of time has diffused the original objections to extending the series. With the intention of placing more emphasis on the economic, social, and political factors and adding chapters on management and unions, he has otherwise sought for these volumes to be "an extension of their predecessors."

Though the time that has elapsed since the publication of the volumes to 1900 has provided opportunity to make more judicious selection of topics and materials, the continuation in the basic format of the earlier volumes reminds us of how different a field the history of technology is today from that of the middle 1950's. Seven essays on the historical setting, the sources of innovation, and the economics of technological development have been added, but despite Williams's request that his contributors place their work in a historical setting most of the remaining 51 chapters, which cover subjects ranging from sources of power to food technology, simply chronicle technical developments. There are few analytical discussions of the role of technology in its social or cultural setting or of the shaping influence of society on technology. Where discussion of social context occurs, economic forces predominate.

In a certain sense these two volumes are an expanded equivalent of the second volume of the Kranzberg-Pursell textbook, *Technology in Western Civilization* (Oxford University Press, 1967). In this case the contributors are predominantly British rather than American. The result is an account that places undue emphasis on British developments—in some cases, such as atomic energy and weapons, requiring that the time frame be expanded well beyond 1950 in order to make the British case. Moreover, continental developments are slighted.

The organization by areas of technology has led to the usual redundancies, such as those between the treatments of atomic power and atomic weapons or of electricity and electric generation and distribution. The latter two chapters are separated by 30 chapters and are in different volumes. The chapter on communications ignores telephone technology after 1910; surprisingly little mention is made of the submarine, even in the chapter on ships; military technology in general is slighted; rubber technology is ignored; and styling and design in the automobile industry are underplayed. Much of the discussion of space technology is out of place in the designated time period. The chapters on management and architecture are among the more notable as good summaries.

As Williams notes, one of the basic problems for a work of this kind is obtaining qualified authors for 20th-century topics. It would have helped to draw upon a more international group of scholars. Yet the problem of true integration would have remained, given the Singer format. Such integration will not come through encyclopedic surveys but through scholarly monographs such as those of Bruce Sinclair, Merritt Roe Smith, Thomas Parke Hughes, Edwin T. Layton, and Hugh Aitken. The continuance of such analytic studies is required for any future survey of the history of technology that is to be truly historical and integrated.

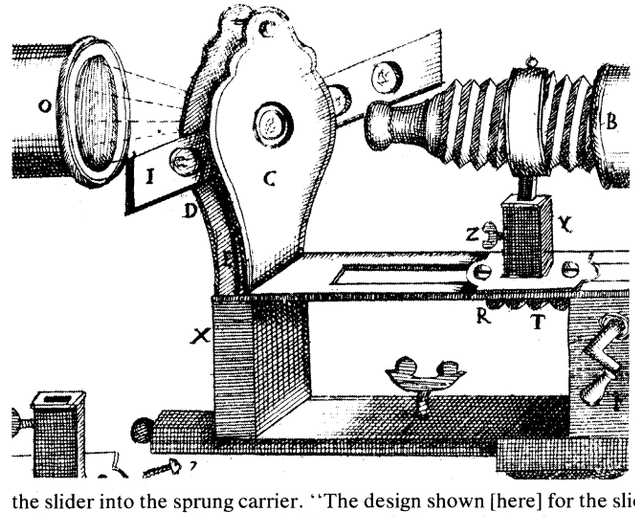
Williams, like Singer, has undertaken a Herculean task. The work provides a comprehensive survey of Anglo-American product and production technologies in the first half of the 20th century. I shall certainly make use of these volumes. The problems of sufficient space for meaningful discussions, appropriate contributors for the articles, integrated discussion of technologies that cut across industrial or disciplinary boundaries, and a true international perspective are most difficult to solve, especially in the Singer format. Williams has made a notable effort. And despite a misnumbering and incorrect ordering of pp. 1056–58, Oxford University Press has produced once again handsome, well-illustrated volumes with good indexes.

REESE V. JENKINS
Thomas A. Edison Papers,
Rutgers University,
New Brunswick, New Jersey 08903

Slides and Microtomes

A History of Microtechnique. BRIAN BRACEGIRDLE. Cornell University Press, Ithaca, N.Y., 1978. xvi, 360 pp., illus. $47.50.

The microscope has been the subject of some excellent publications by historians and practitioners, but the techniques associated with its use have had less attention. Brian Bracegirdle's account of the development of some of these techniques introduces a new high level of instrumentation scholarship by combining the historian's practice of interpreting published and ephemeral sources and the technician's facility in examining and using instruments to determine their functions and capabilities. Inspired by Edwin Clarke, who has demonstrated the value of recreating and duplicating classic experiments and observations for the study of the history of medicine and its technology, Bracegirdle set up a project in which he reviewed 40,000 microscope slides and scrutinized over 3500 of them in order to understand the development of microscopial preparations over a span of 150 years (1760–1910). He inspected original 18th- and 19th-century slides with the microscopes under which they were originally viewed.



The first illustration of a "slider," from F. Bonanni's *Observationes circa viventia, quae in rebus non viventibus reperiuntur* (Rome, 1691). The earliest sliders were made of ivory or hardwood and had several apertures. Each aperture contained a pair of mica disks, between which objects for viewing were placed. The disks were retained against a shoulder by a brass circlip. This illustration shows the chamfered end that facilitated insertion of the slider into the sprung carrier. "The design shown [here] for the slider was to be the norm for well over a century." [From *A History of Microtechnique*]