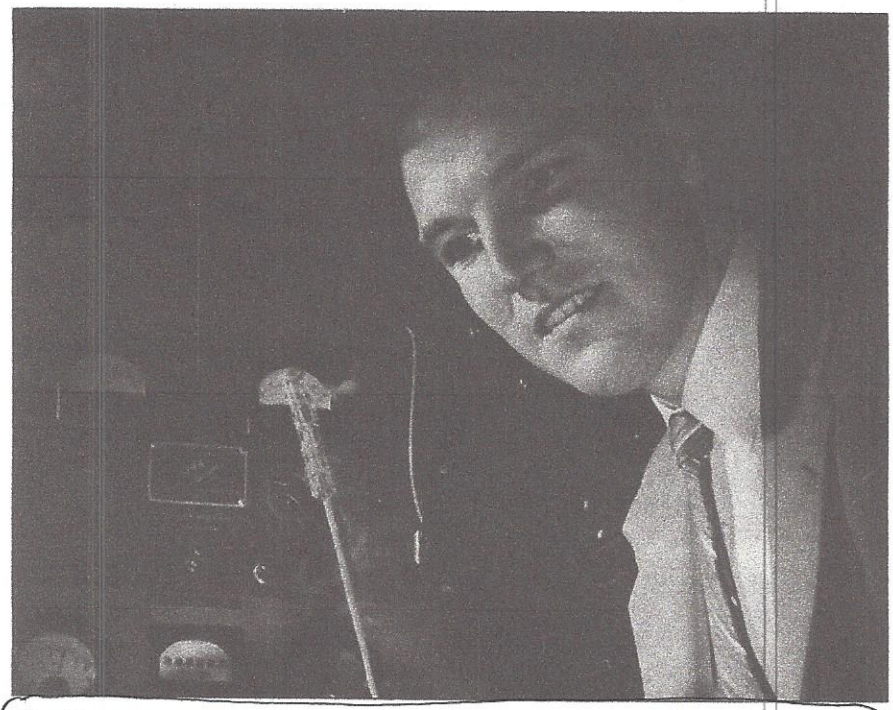
BACK TO THE FUTURE:
Professor Dudley A. Buck (1927-1959)



"Dudley Buck was one of the most imaginative persons to do research in RLE. His work on computer elements and photolithography was years ahead of the times . . ."

—MIT President Emeritus Jerome B. Wiesner

"The day is rapidly drawing near when digital computers will no longer be made by assembling thousands of individually manufactured parts into plug-in assemblies and then completing their interconnection with back-panel wiring. An alternative to this method is one in which an entire computer or a large part of a computer is made in a single process. Vacuum deposition of electrodes onto blocks of pure silicon or germanium and the subsequent diffusion of the electrode material into the block to form junctions is a most promising method. The successful development of this method would allow large numbers of transistors and all their interconnecting wiring to be made in one operation. Vacuum deposition of magnetic materials and conductors to form coincident-current magnetic-core memory planes is a second promising method that will allow an entire memory to be made in one operation. The vacuum deposition of superconductive switching and memory circuits is a third method that will make possible the printing of an entire computer. The authors feel sure that the most significant milestone in computer component technology will be the announcement by one or more firms, in perhaps 2 years, that all of the technical problems of building a printed system have been solved, and that one of their engineers with his vacuum system can make a digital computer in an hour. . . ."

"An Approach to Microminiature Printed Systems" by Dudley A. Buck and Kenneth R. Shoulders, *Proceedings of the Eastern Joint Computer Conference.*

In December 1958, Dudley Buck presented the above paper outlining a scheme to form a thin film upon which would be placed a resist by electron-beam polymerization of siloxane vapors. Then, a selective removal process would be carried out by means of a gaseous etchant that would leave the desired superconductor as an element in cryotron fabrication. From the time of this paper until his death, Dudley Buck worked on various aspects of vapor deposition of refractory metals as good superconductive films, in the first step of a lithographic technique.

Born in San Francisco in 1927, Dudley A. Buck received his B.S. degree in electrical engineering at the University of Washington in 1948, and spent two years as a communications officer with the U.S. Navy. He entered MIT in 1950, and served as a research assistant on the Servomechanisms Laboratory's Project Whirlwind while working towards his master's degree, which he received in 1952. He served as an Instructor in the Department of Electrical Engineering until 1958, when he received his Sc.D. and was appointed Assistant Professor. He was also associated with both RLE and Lincoln Laboratory.

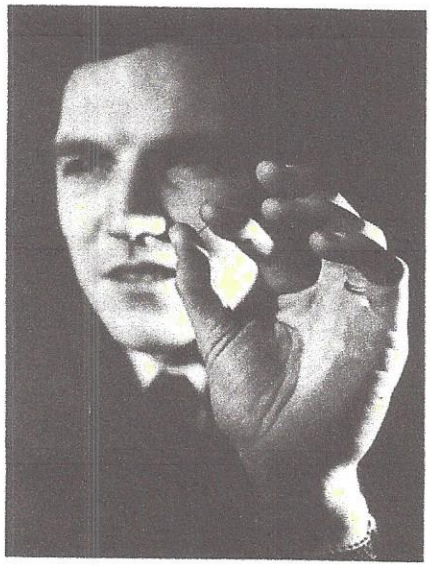
During his nine years at MIT, Professor Buck made outstanding contributions to the field of low-temperature physics. He was most recognized for the development of the cryotron, a superconductive, magnetically controlled gating device that was hailed as a revolutionary component for miniaturizing the room-sized computers of the '50s. A technical paper, "The Cryotron—A Superconductive Computer Compound," was recognized with the Browder J. Thompson Memorial Prize of the Institute of Radio Engineers in 1957, an award that was made to a scientist under 30 years of age who presented the year's most outstanding paper. Dudley Buck also won an honorable mention in Eta Kappa Nu's selection of the Outstanding Young Electrical Engineer of 1958. During his last two years, he sought to carry miniaturization even further by attempting to make cross-film cryotrons with dimensions only a few millionths of an inch.

While his professional accomplishments were many and varied, his loyalty to MIT and the thoroughness of his teaching were equally outstanding. In addition to his research, he represented the MIT Admissions Office on high school visits, and exhibited what one colleague called "a contagious quality of optimism, enthusiasm, and just plain joy about each man's work." Because of his strong convictions about the importance of education, and his deep interest in youth, he was elected chairman of the Wilmington School Committee. He was also a former scoutmaster and a lay speaker in the Wil-

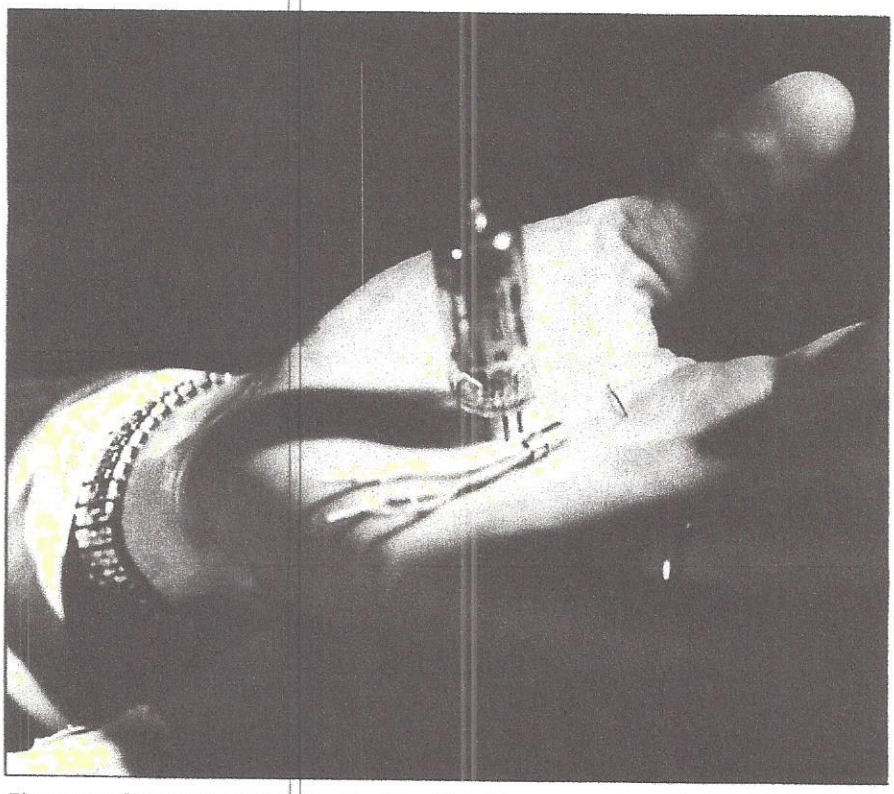
mington Methodist Church.

Dudley Buck's dedication and creativity were sources of admiration to his students and colleagues. Before his untimely death in 1959, he possessed all the attributes of greatness and had already achieved much in a short time.

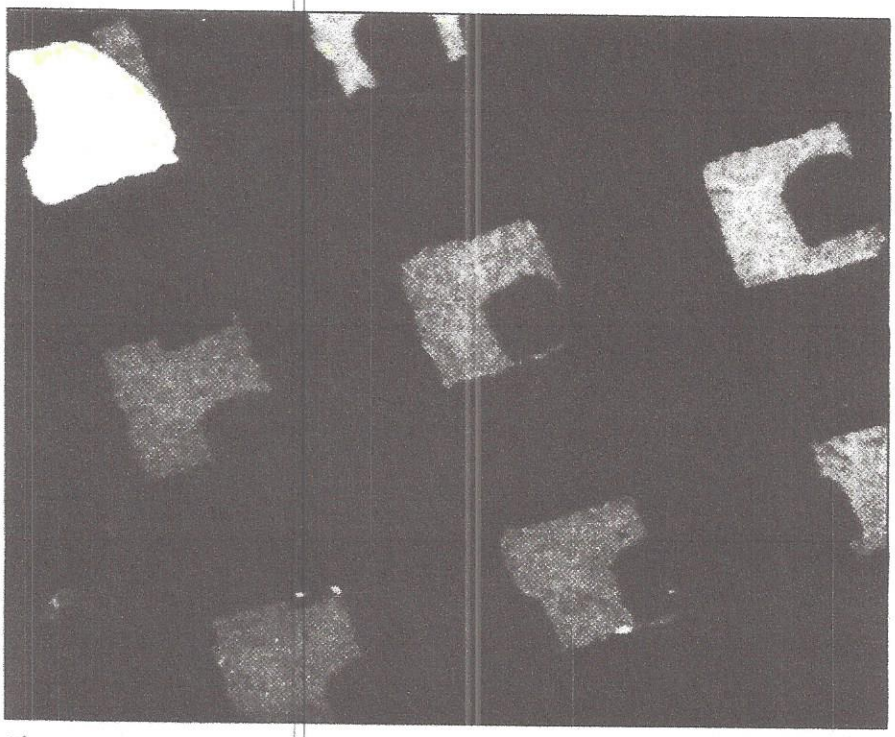
Above the vapors of liquid helium, Dudley Buck compares a fragile, bulky vacuum tube with his cryotron. (Photo Gjon Mili)



The cryotron was man's first practical use of superconductivity—the ability of some metals to conduct current with no resistance at extremely low temperatures (below −420 degrees Fahrenheit). In the hand of its inventor, is the incredibly small cryotron (100 will fit into a thimble). Its operation was based on the effects of magnetic fields on superconductivity at liquid helium temperatures.



First came the vacuum tube, then the transistor. The cryotron was destined to spark another revolution in electronics.



Electron micrograph of a molybdenum film etched into 0.001-inch squares shows Dudley Buck's proposed process to produce etched wiring on a 0.1-micron scale involving the selective removal of a thin film. It differed from conventional systems of the day since the process was carried out in a vacuum system, and electrons or ions replaced light as a means to control the deposition of the resist.

(Photos courtesy of MIT Historical Collections)