Atom Smashers—50 Years

Take some time out from future shock to experience a little past shock. Particle accelerators are only half a century old, but their past is already history.

BY DIETRICK E. THOMSEN

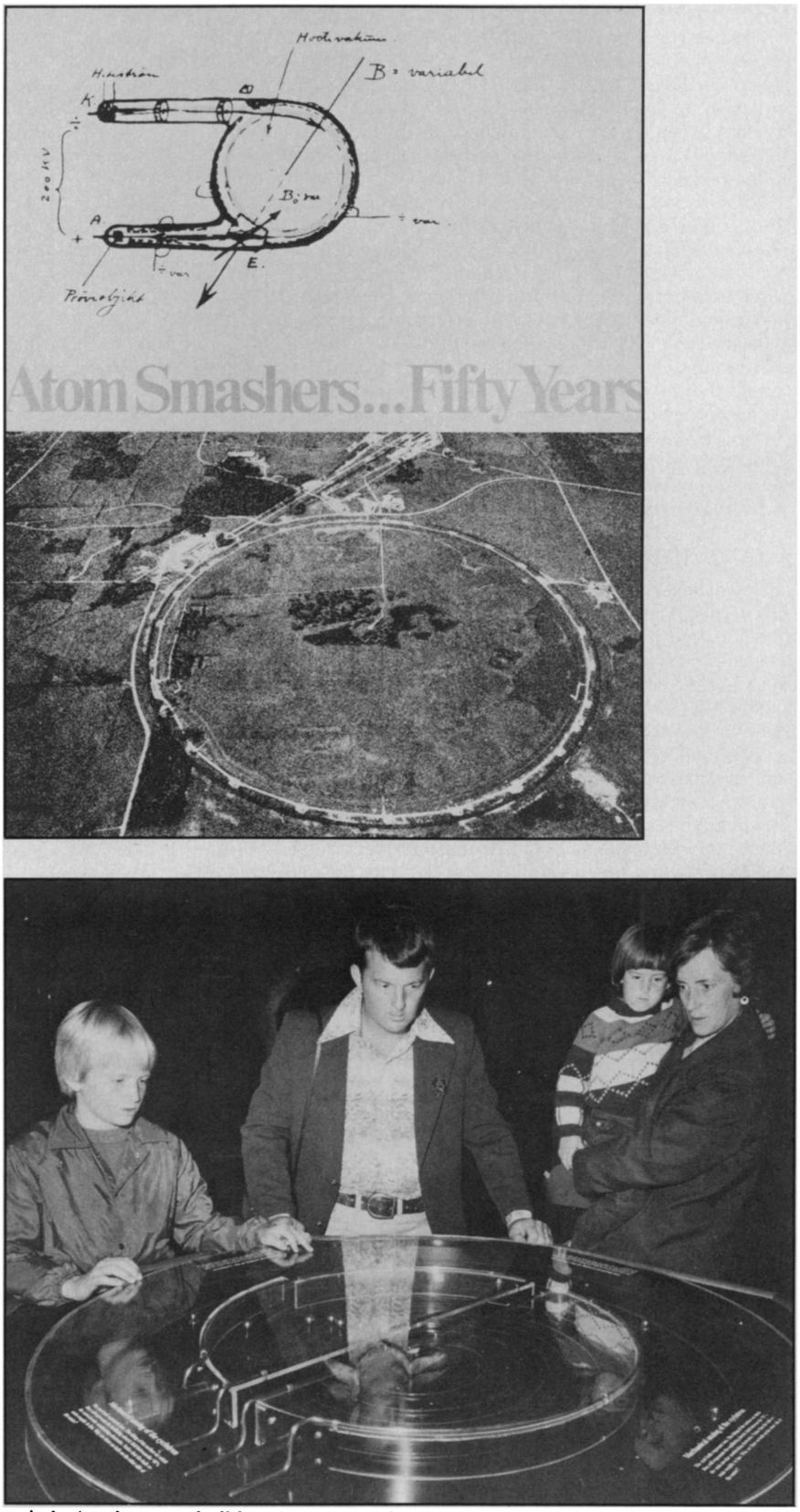
It starts with cutout portraits of Marie Curie and several of her contemporaries. It ends with Samuel C. C. Ting's Nobel diploma. The Smithsonian Institution calls it Atom Smashers — Fifty Years. It's an exhibit that opened at the National Museum of History and Technology on December 2.

Fifty years represents the time that has elapsed since Ernest O. Lawrence and Robert J. Van de Graaff began working on their ideas for particle accelerators. It is something of a shock to recall how small Lawrence's first cyclotron really was. At the other end of the scale, a visitor to the exhibit can enter a representation of the synchrotron tunnel at Fermilab. Lawrence's first cyclotron would sit comfortably on a kitchen table; Fermilab's synchrotron is more than 8 kilometers around. The difference in scale is seldom so graphically displayed in two corners of a single room.

The exhibit actually begins with a prologue: the equipment used for nuclear physics by Madame Curie, Lord Rutherford and others in the days before accelerators. In those days the glassblower's art was essential to nuclear physics.

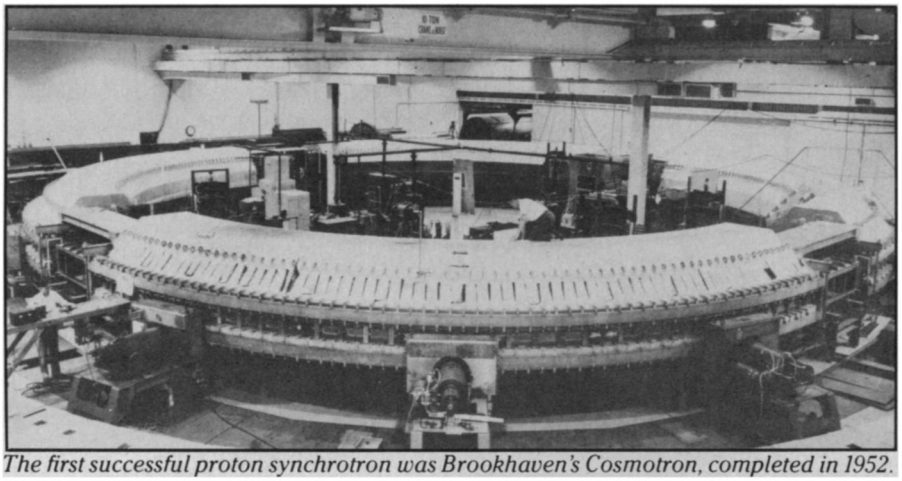
Much of the history of particle accelerators took place in the United States, so the subject is especially fitting for a national museum. At Berkeley in the early 1930s Lawrence and his collaborators began the development of circular accelerators that culminates today in Fermilab and the CERN Super Proton Synchrotron. At the same time, Van de Graaff, who worked at Princeton and at MIT, invented one of the first designs for a linear accelerator. (Strangely, Cockcroft and Walton seem to have been overlooked.) The apogee of linear accelerators today is the two-mile electron linac at Stanford, and it seems fitting that that university should have it, since much of the technology that makes large linear accelerators possible was developed there.

Indeed, the exhibit underlines the large contribution to accelerator history made by just two universities, Stanford and Berkeley. Europeans will object, but as far as the United States is concerned, a lot of particle physics equipment could bear an "invented in California" stamp. Many of the seminal ideas were developed in the envi-

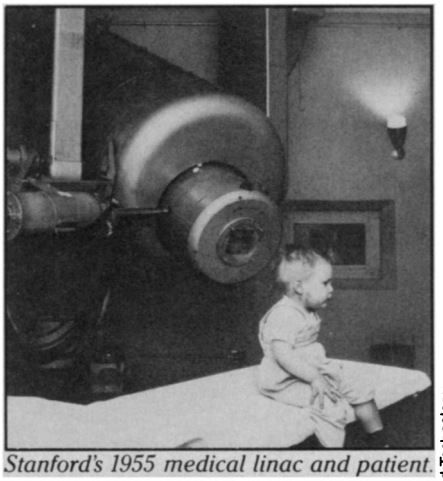


A device that uses ball bearings to simulate particles shows how a cyclotron works.

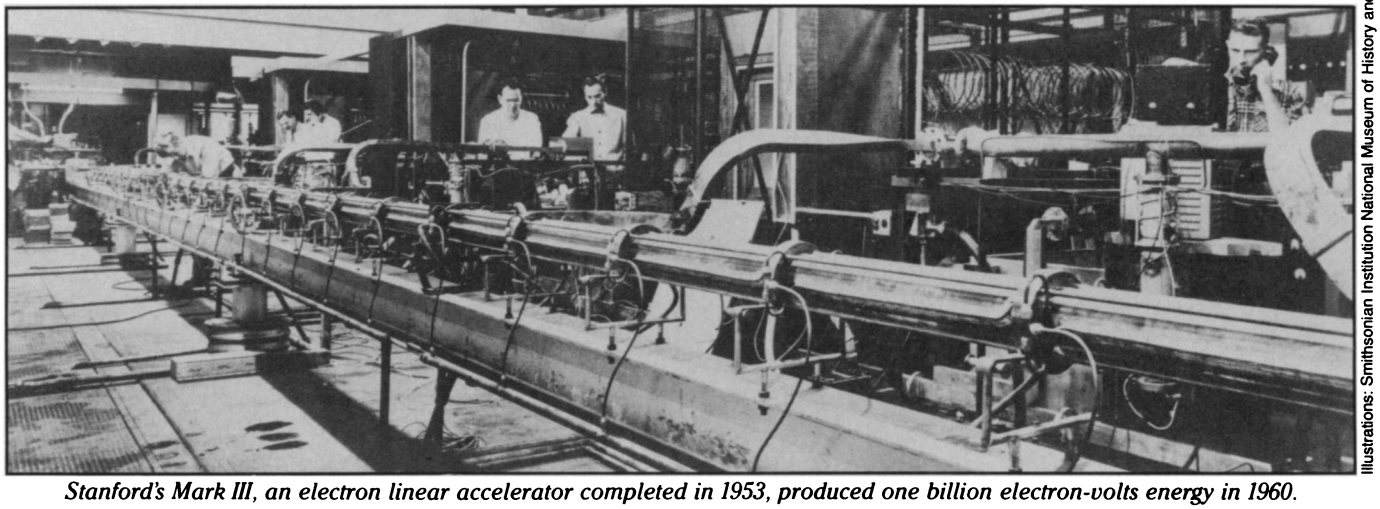
1939: Donald W. Kerst constructed the first betatron. Today: Museum visitors enter a section of Fermilab's synchrotron tunnel.



The first successful proton synchrotron was Brookhaven's Cosmotron, completed in 1952.



Stanford's 1955 medical linac and patient.



Stanford's Mark III, an electron linear accelerator completed in 1953, produced one billion electron-volts energy in 1960.

Illustrations: Smithsonian Institution National Museum of History and Technology

rons of the same city that gave us flower children and topless bars. I wonder if there's a connection.

Those who remember the history and those who want to learn it will find the famous names displayed here: Lawrence and Van de Graaff, Kerst (who developed the betatron), the Varian brothers, Hansen and Alvarez (contributions to linear accelerators), Macmillan and Veksler (who both came up with the idea that led to the synchrotron and made possible the modern development of circular accelerators). Particle detectors from the days of Geiger and Müller to Glaser (he invented the bubble chamber) and beyond are represented.

The last part of the exhibit deals with storage rings and colliding beams, a chapter of history that was largely written in Europe. It begins with the first storage ring, which was built at the Frascati laboratory near Rome, and concludes with one of the beam collision sections from the Intersecting Storage Rings at Geneva, now the world's largest storage ring installation. That leads up to Ting's Nobel diploma (he shared the 1976 prize with Burton Richter), which was given for a discovery that was made with both a synchrotron and a storage ring.

It is a bit breathtaking to be reminded that all this development took place within the span of less than the actuarial mean life expectancy of one person. Those who remember the history can give themselves a test at the start of the exhibit. There is a slide show that flashes pictures of historically important accelerators. Try to name them all without reference to the captions. Those who want to learn the history will find the captions extensive and explanatory. There are also working exhibits that the visitor can manipulate, which demonstrate some of the basic principles of accelerator physics. □