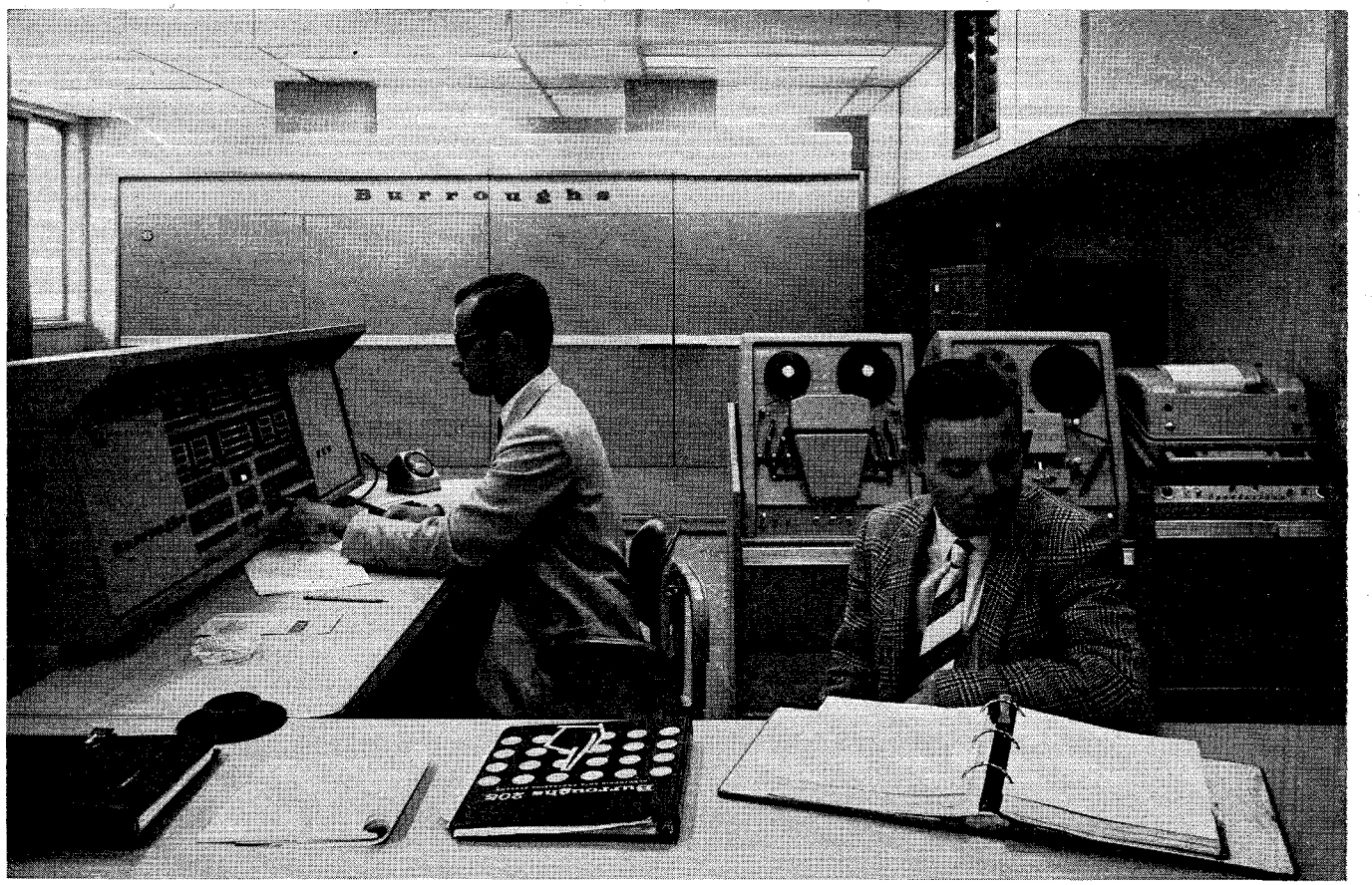
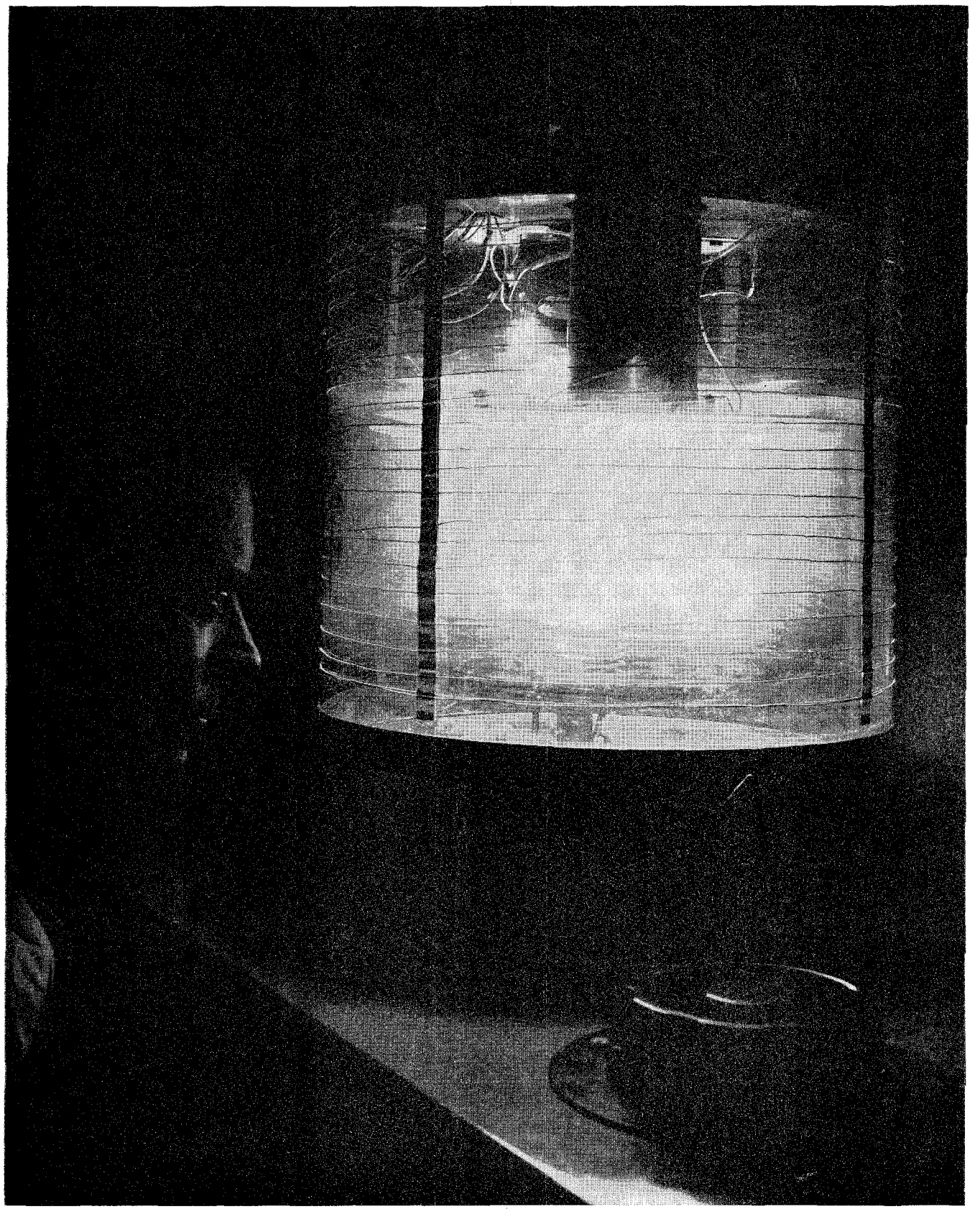


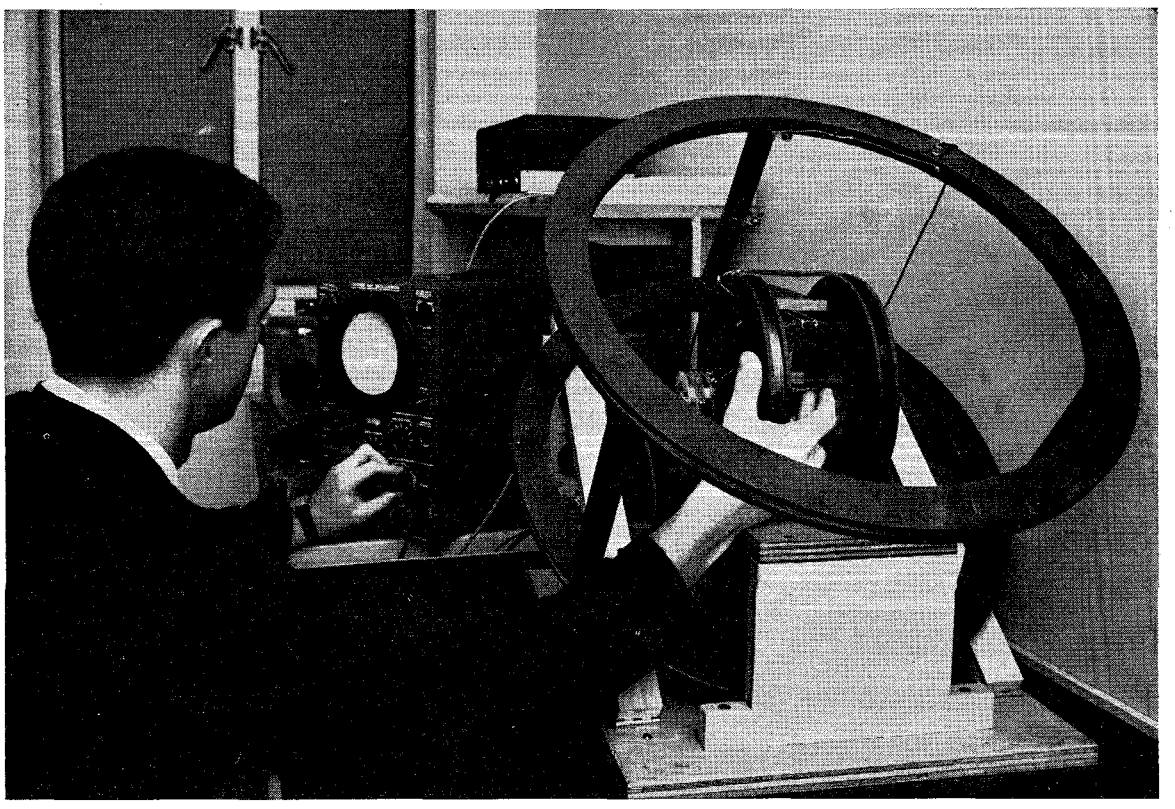
Large scale computers have become essential to modern science and technology. In Caltech's Computing Center, this Burroughs 220 Digital Computer serves as the Institute's computing facility for both general research and instruction in machine computing methods.

ELECTRICAL ENGINEERING

Electrical Engineering, both as a profession and as an educational discipline at the Institute, has changed considerably in the last 15 or 20 years. It used to be confined largely to the generation and distribution of electrical energy and to communications, through the application of the classical physics of electricity and magnetism. Today electrical engineers are concerned with a number of different basic disciplines in the realms of physics and mathematics, and with many different applications. Some of the more important disciplines are plasma physics, solid state physics, stochastic processes, and Boolean algebra. They are being applied to such things as the development and application of new semiconducting devices, microwave tubes, new devices for energy conversion, and to new systems of automatic control, communications, and data processing. The pictures on these pages show some of the current and varied research in electrical engineering at Caltech.

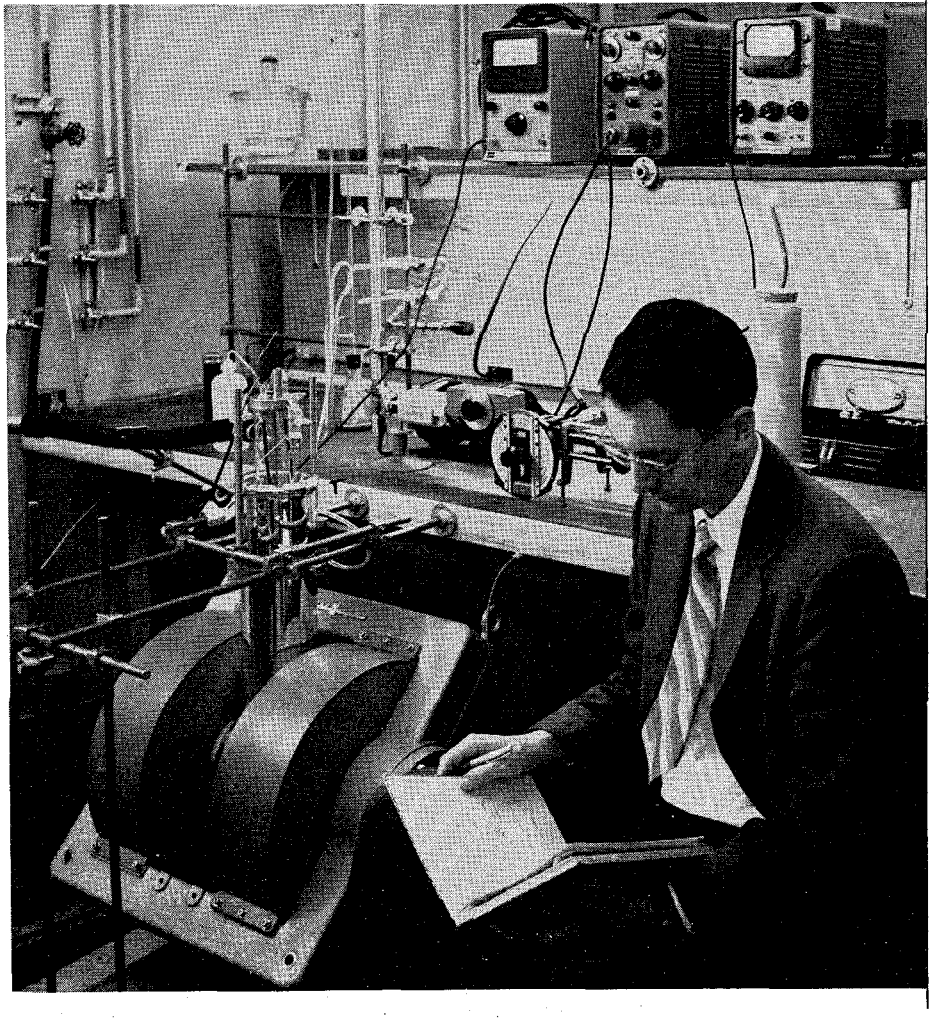


MAKING THIN MAGNETIC FILMS
In Caltech's electrical engineering laboratories, new methods for the fabrication of very thin conducting, insulating, magnetic, or other materials, at controlled thicknesses as small as several hundred angstroms, makes possible new kinds of electronic devices and microcircuits. Here a nickel-iron film about 1,000 angstroms thick is deposited by induction heating evaporation from a crucible.



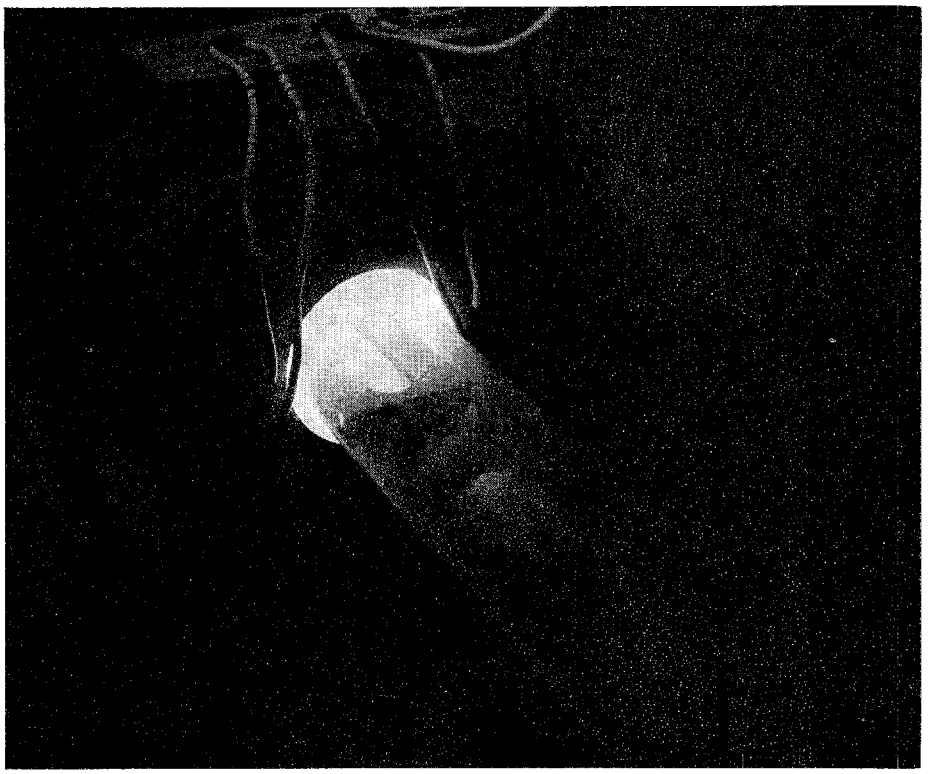
MAGNETIC FILM RESEARCH

Magnetic properties of thin nickel-iron films are investigated with a "B-H Looper." These films can be used either as memory elements, or for switching logic circuits in a computer. They can be switched in only a few thousandths of a microsecond.



LOW TEMPERATURE RESEARCH

This apparatus is used to investigate the interaction of superconductors and electromagnetic fields. Temperatures near absolute zero are necessary for superconductivity, so glass dewars hold liquid helium in which the superconductor is immersed. The equipment on the bench generates microwave fields and measures their interaction with the superconductor. The large electromagnet in which the dewars stand is used to apply a fixed magnetic field in order to investigate its effect.

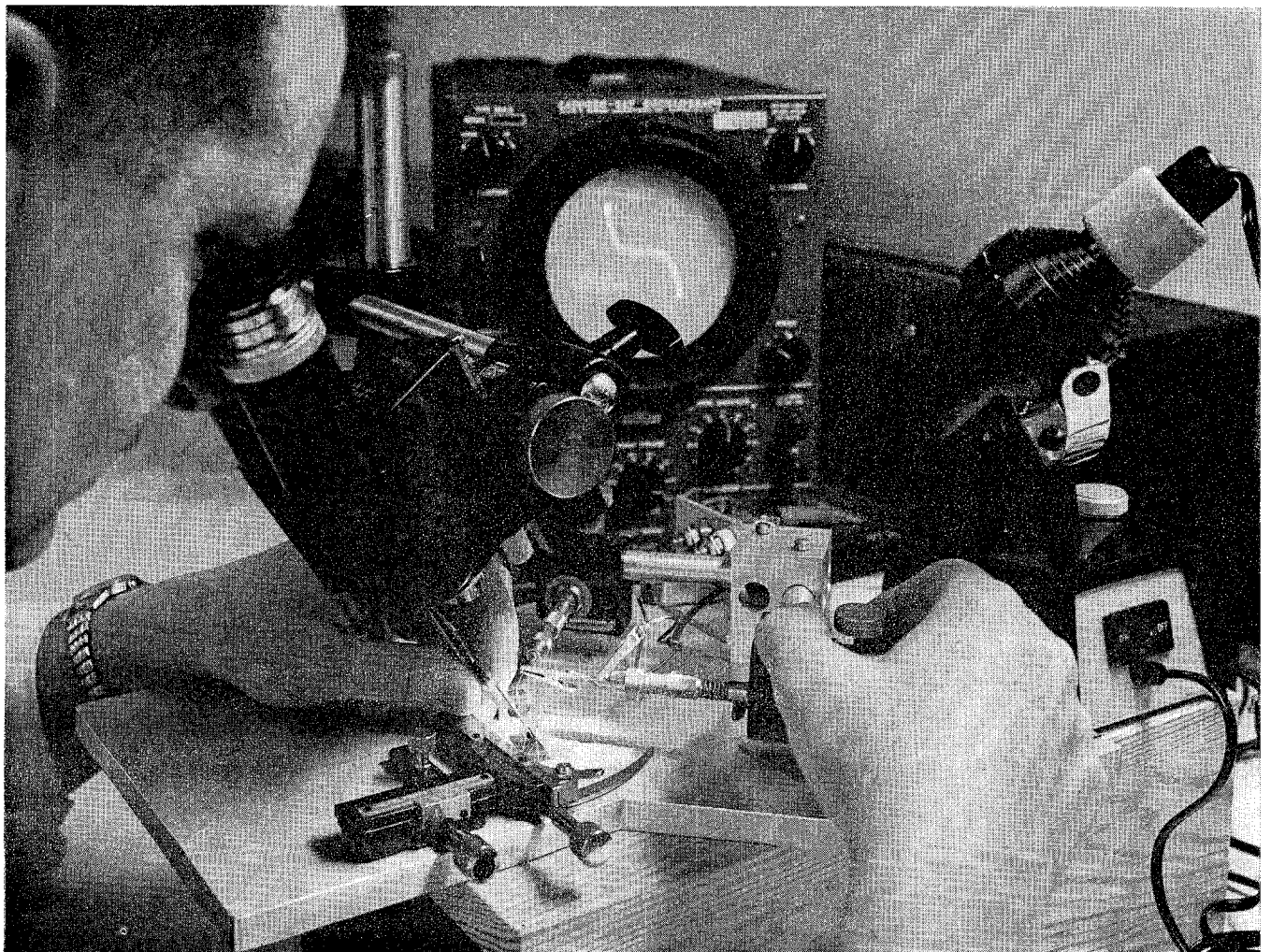


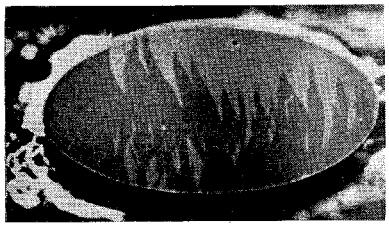
SOLID STATE TECHNOLOGY

"Zone refining" is a technique especially developed to provide the high-purity materials needed in making solid state devices. The material to be purified is placed in an inert environment and repeatedly passed slowly through a furnace. Impurities accumulate in the molten zone, thus gradually increasing the purity of the resolidifying region. Figures like one impurity in 10^{10} are now commonplace.

SOLID STATE DEVICES

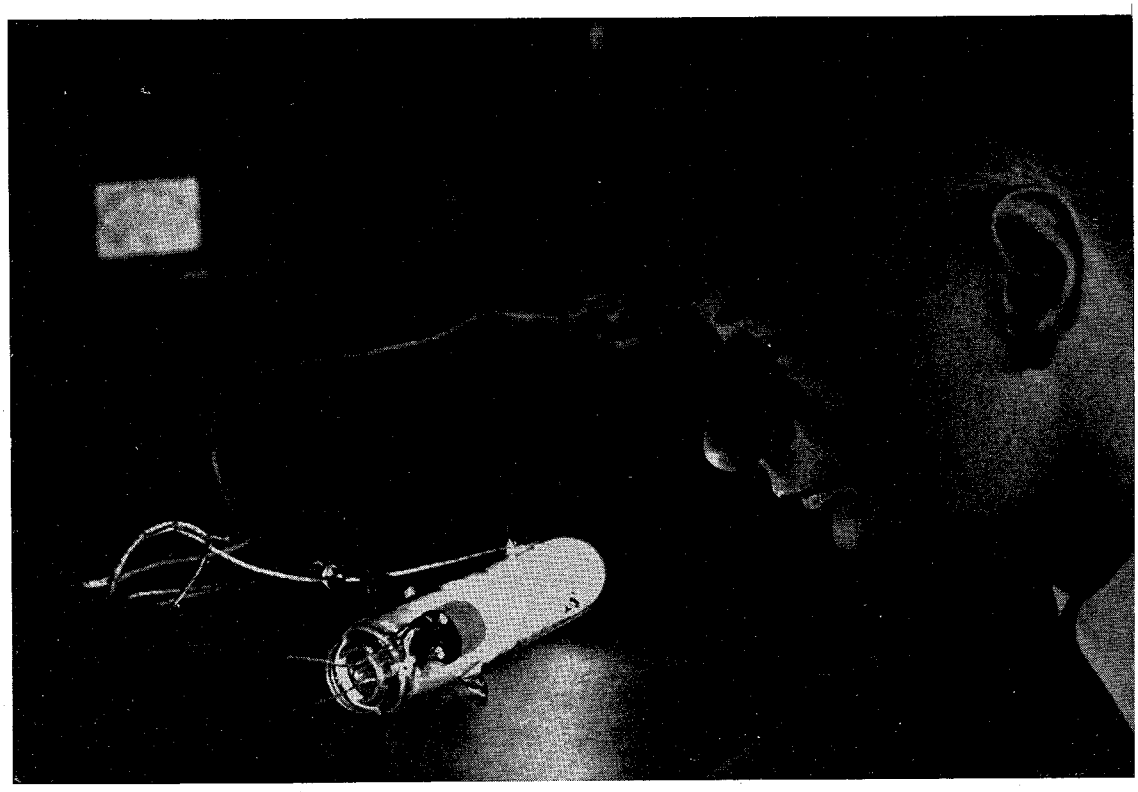
Tunnel emission triodes, which were invented at Caltech, are theoretically capable of very high frequency performance and they may soon be appearing with other thin film components in micro-circuitry. Here, in the Caltech electrical engineering laboratories, a technician makes a connection to a tunnel emission diode with a micro-manipulator probe while the volt-ampere characteristic is displayed on an oscilloscope.





MAGNETIC DOMAINS

Examination of the magnetic structure of nickel-iron material is made possible by using polarized light reflected from the metal surface. This is called the Kerr effect and utilizes differential rotation of the polarized light coming from regions of different magnetization – creating the dark and light portions shown in the film of the structure of nickel-iron at the left.



PLASMA PHYSICS

The interaction of hot plasma with electromagnetic radiation provides an important phenomenon for investigations. Many experimental discharge tubes have been made in Caltech's laboratories to study possible practical application of this interaction.