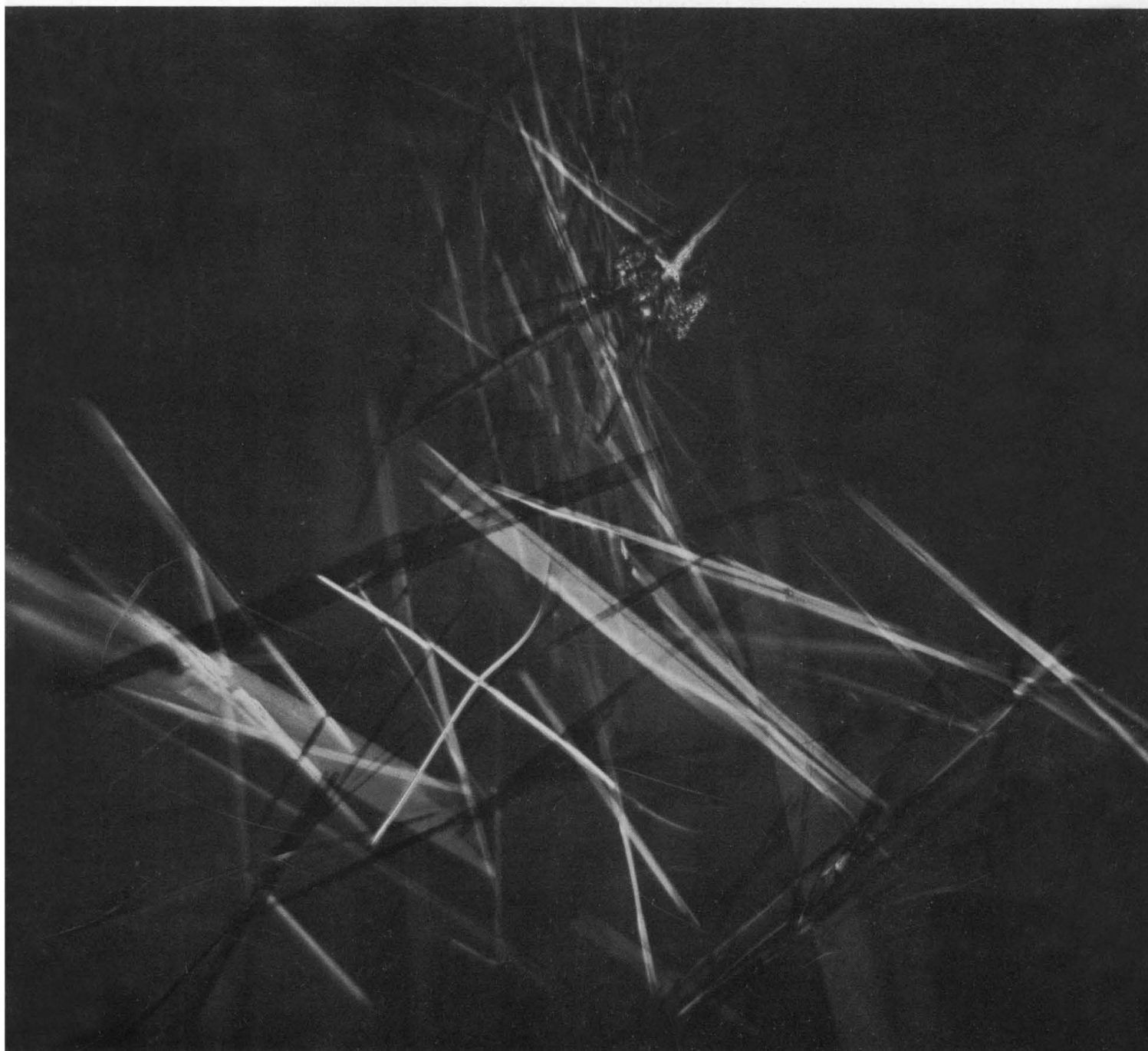


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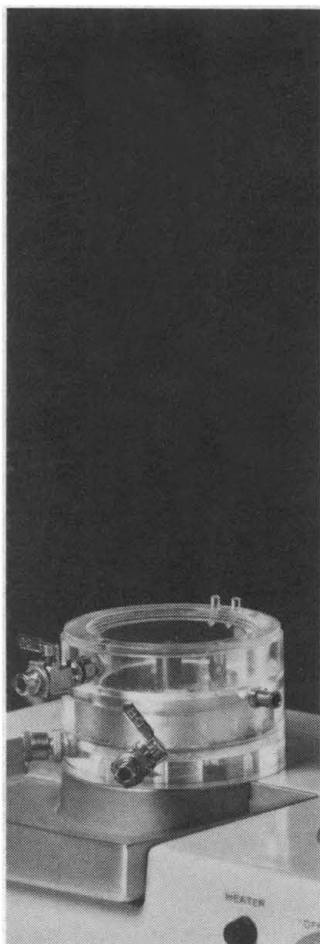
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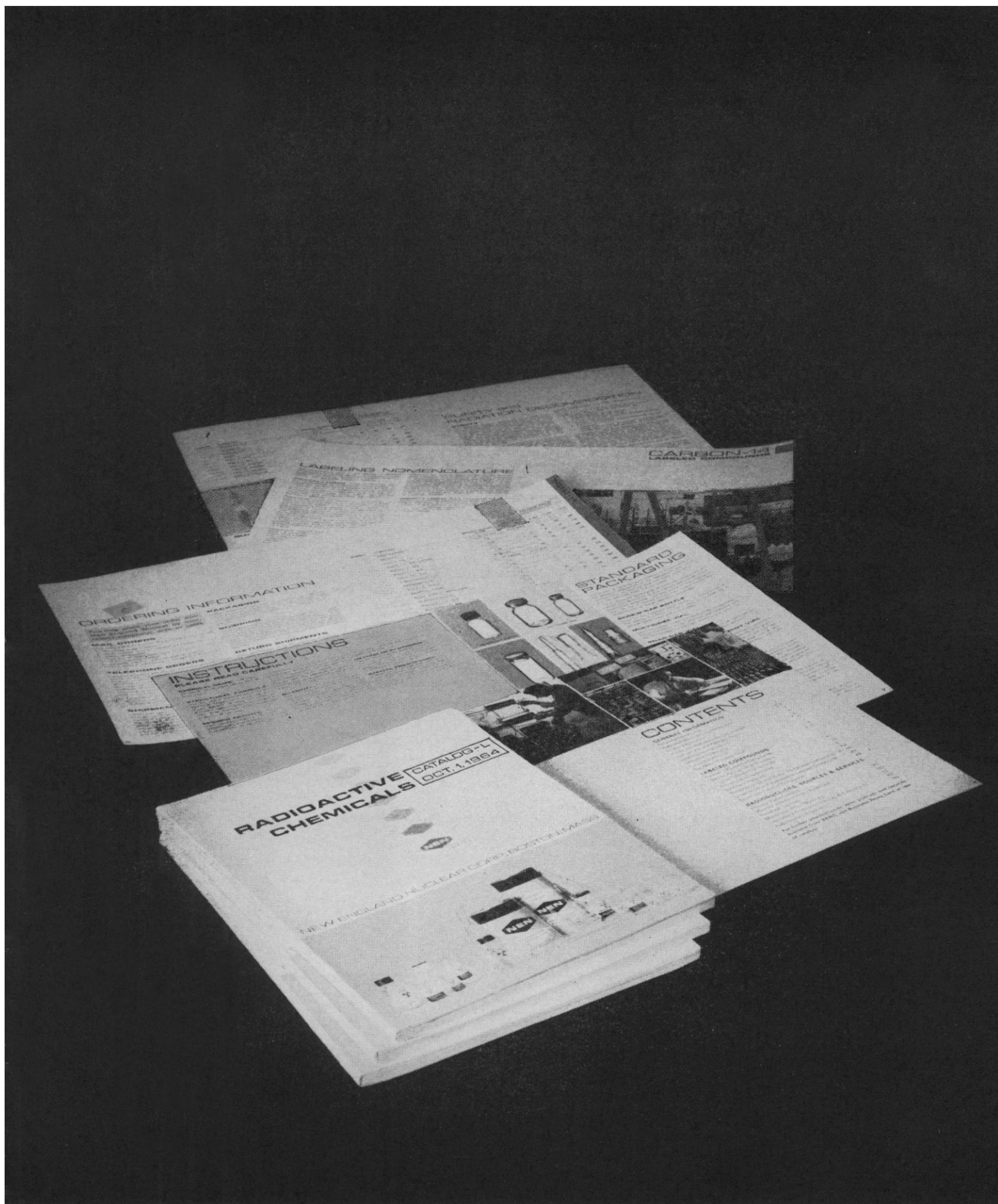
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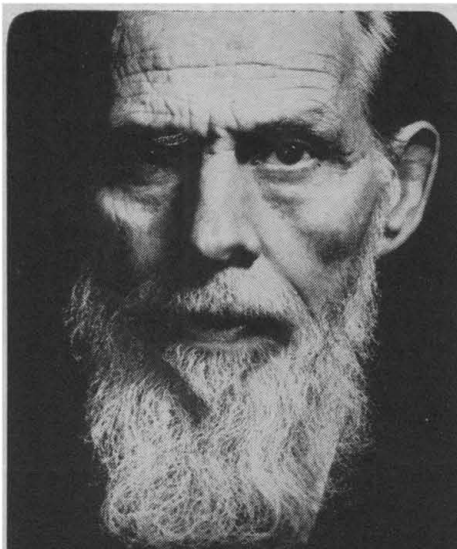
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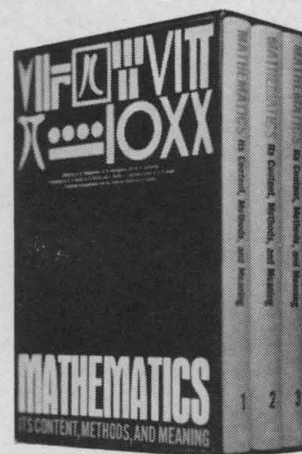
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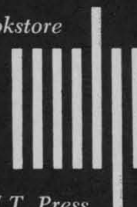
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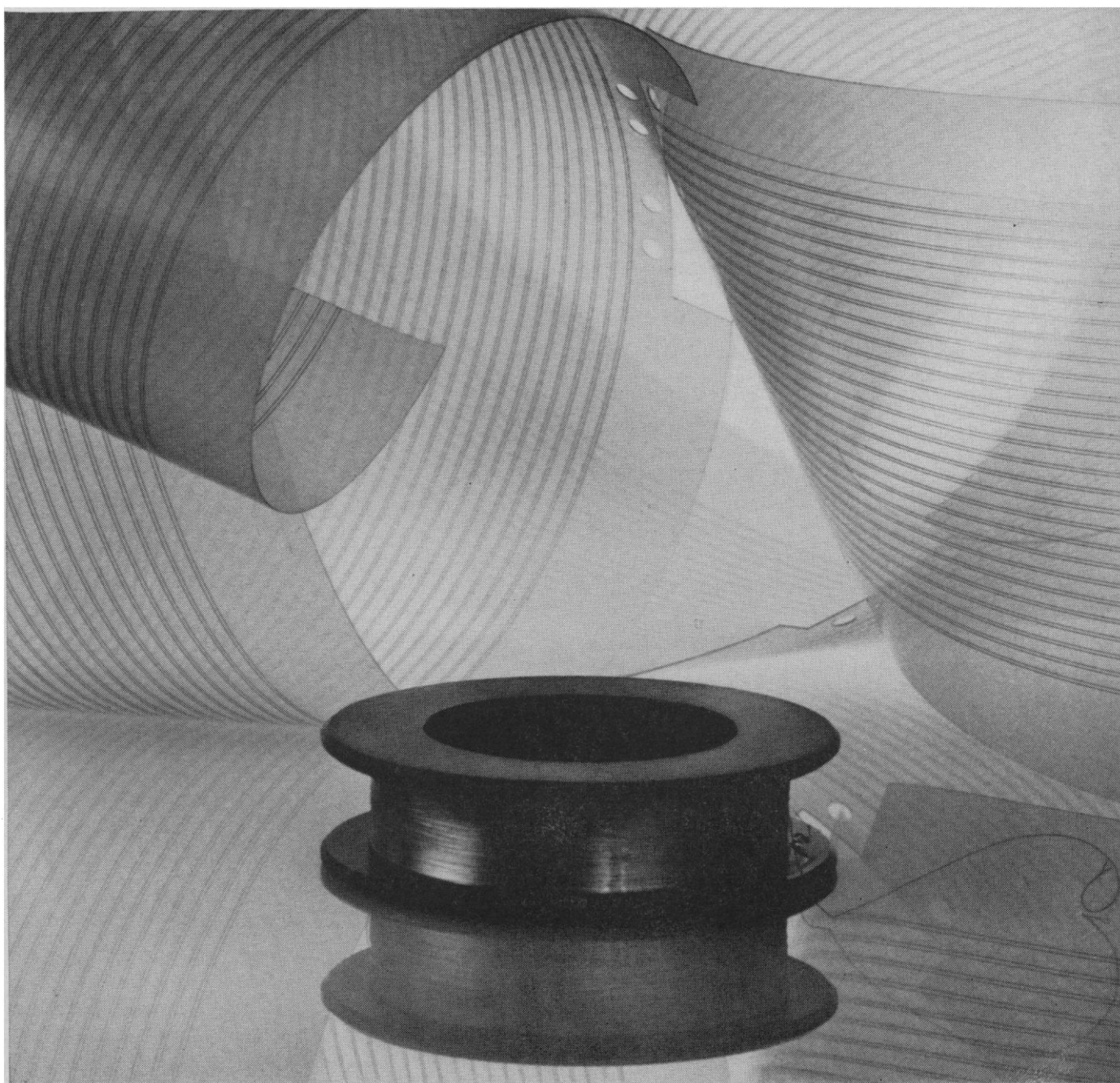
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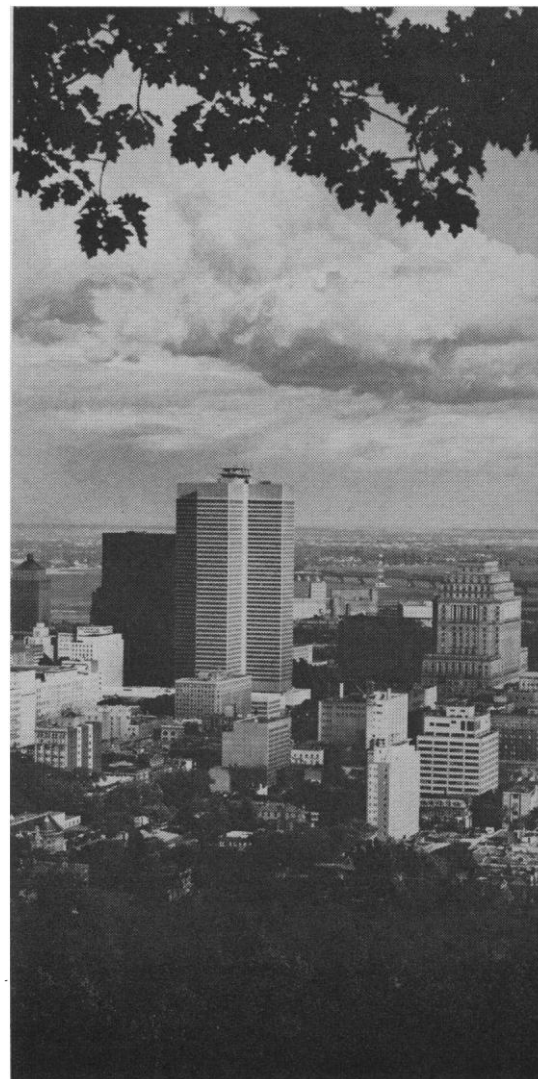
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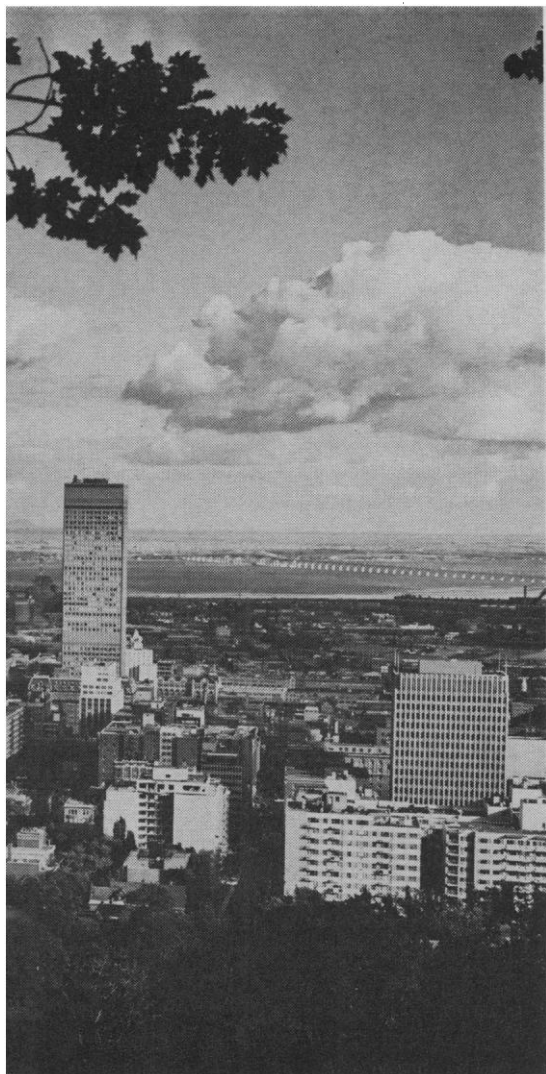
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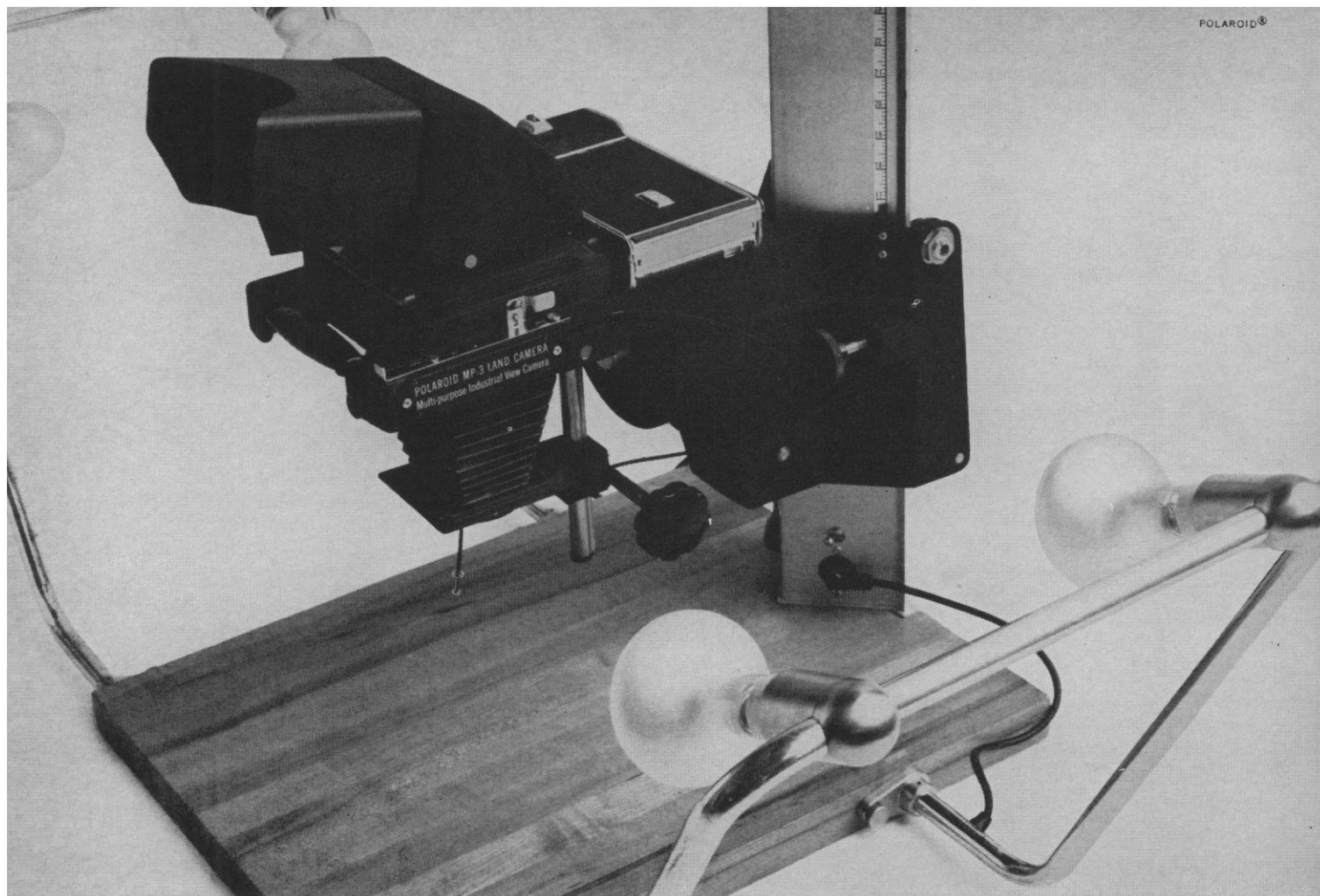
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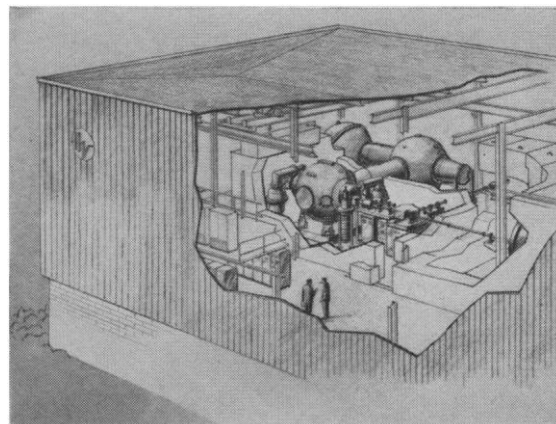
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- (1) To examine basic acceleration processes, ion beam formation and handling, and voltage handling and stabilization in the presence of intense ion beams;
- (2) To develop single-stage tandem injectors and two-stage tandem accelerators capable of proton and negative hydrogen currents in the tens-of-milliampere range;
- (3) To develop high proton current capabilities of 3-stage tandem accelerators;
- (4) To enable tandems to handle all the heavy ions that can be generated;
- (5) To develop neutral-beam tandem injector technology.

## ACCELERATOR AUXILIARIES:

how HVEC research programs broaden the versatility of particle accelerators



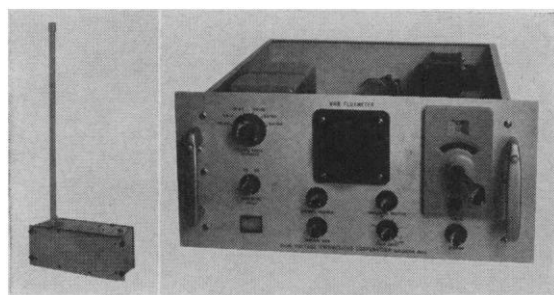
A 3-MV ICT-powered Tandem Accelerator and another higher energy machine to allow complete testing of 3-stage tandem operation will be housed in the new 20,000 square-foot laboratory which will be staffed by 20 research personnel.

## New High-Transmission System

Analyzed proton currents in the order of 10 to 15  $\mu$ A can be achieved over the entire energy range of Model EN and FN Tandem Accelerators equipped with inclined field tubes by the

use of a newly developed high-transmission system. The system is now available from High Voltage and can be installed in the field or delivered with new machines.

## New Single-Probe Fluxmeter

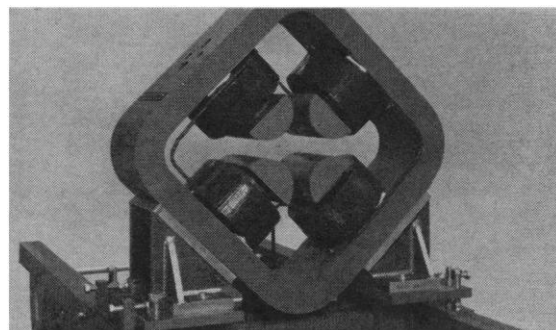


This new NMR fluxmeter allows convenient and accurate determination of magnetic field strengths over a range of 900 gauss to 19 kilogauss. A single probe covers the entire range; there is no need for probe changing and/or shunting. Accuracy is one part in  $10^5$  and signal-to-noise ratio is 20 db, making the unit easily tunable. At magnetic fields exceeding 10 kilogauss, the proton probe is at least one hundred times more sensitive than deuterium or lithium.

## New Magnetic Auxiliaries

A new multiport switching magnet, Model 70-88, is available for use with HVEC Tandem Accelerators. The new switching system will deflect a 77 MeV proton through an angle of 70°.

The new HVEC Quadrupole Lens Model QMD 2.5-360 has been designed for use with the Model 70-88 Switching Magnet beam tube extension. The lens aperture is 2.5 in. and the field at the pole tip center is 2.25 kg/in. Shown at right: new 5-in. aperture Quadrupole Lens Model QMS-5-1100.



*HVEC accelerator auxiliaries are all designed to enhance the versatility and flexibility of HVEC accelerator systems.*

**For detailed information,** please write to Technical Sales, High Voltage Engineering Corporation, Burlington, Massachusetts.



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## The Chinese A-Bomb

The first official Washington comment on the significance of the recent Chinese detonation correctly indicates that new short-term hazards have not greatly increased, but it does not adequately recognize some longer-term problems.

Only a few facts are available to help one in evaluating the significance of the Chinese detonation. The Atomic Energy Commission has stated, "Additional evidence on the Chinese Communist test of October 16 indicates it was a fission device employing  $U^{235}$  . . .," and, "U.S. intelligence has always led us to estimate that the Chinese Communists were constructing both plutonium production reactors and gaseous diffusion isotope separation facilities."

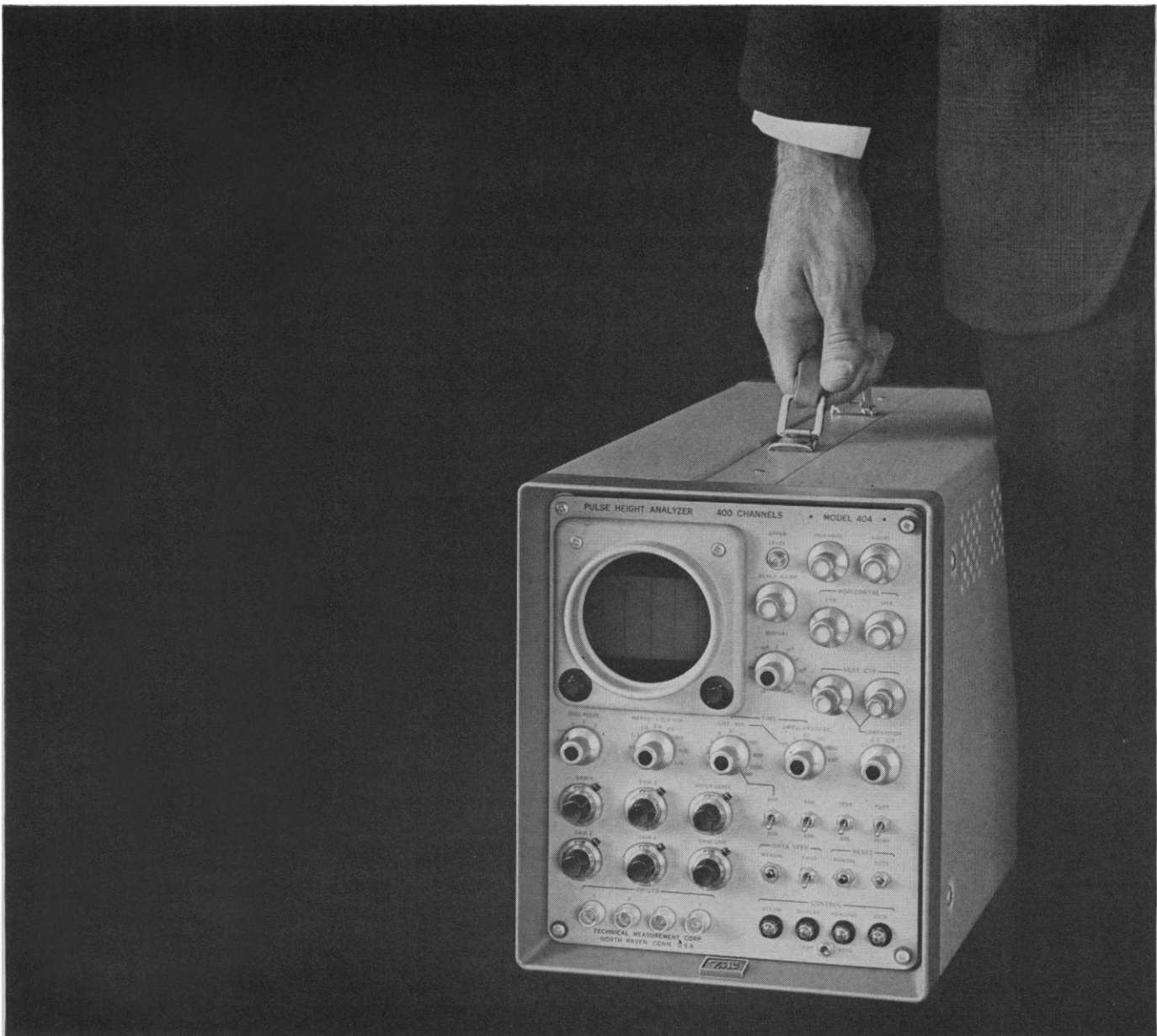
Production of weapons-grade uranium-235 is an impressive technological achievement indicative of considerable industrial capability. Successful construction and operation of a gaseous diffusion plant capable of producing substantial quantities of weapons-grade  $U^{235}$  requires both materiel and skill. Such a plant contains more than a thousand individual units connected in series. Each unit must be constructed with precision—small imperfections can destroy their effectiveness. Moreover, special metallurgical techniques must be available. After the units are assembled their performance must be monitored, controlled, and integrated. This requires a great deal of electronic instrumentation.

A technically incompetent people could not have succeeded in producing weapons-grade  $U^{235}$  without massive help; the French, after 6 years, have not yet announced production of highly enriched uranium. Nevertheless, the new accomplishment was not surprising to many U.S. scientists who have had contact with individuals of Chinese extraction and have known of their first-class aptitude for science and technology.

When a nation builds a successful gaseous diffusion plant it gains great flexibility in nuclear technology. A plant which can produce weapons-grade  $U^{235}$  can be tapped to yield uranium having almost any  $U^{235}$  content. In this country our nuclear power reactors often utilize material containing  $U^{235}$  in the range of 1.5 to 4 percent. The Chinese have the option of producing such uranium. Problems of constructing a reactor are greatly simplified when enriched uranium is available. When ordinary uranium is used, together with graphite, great care must be taken to avoid loss of neutrons either to nuclear poisons or through escape from the reactor to the shielding. With enriched uranium, reactors may be smaller and a wider variety of construction materials can be used. Thus, with enriched uranium, the Chinese have available more options in designing reactors for efficient plutonium production or other purposes than they would otherwise have.

More serious is a greatly enhanced capability of producing tritium, a key constituent of thermonuclear bombs. Tritium is often produced by the reaction of neutrons with lithium-6. Introduction of lithium into an ordinary reactor tends to stop the chain reaction. This tendency can be overcome by introducing enriched uranium. If the Chinese do not now possess quantities of tritium, they can obtain it. In view of the Chinese achievement thus far there is no basis for hoping that they will not achieve a hydrogen bomb—perhaps in the latter part of this decade.

Another member has joined the nuclear club. He already has impressive credentials, and his long-term potentialities should not be underestimated.—PHILIP H. ABELSON



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It is true that the TMC Model 404 is the most portable pulse height analyzer you can own. But it offers a lot more than portability. Built-in CRT, four detector inputs, multiscaling mode, push button data transfer and display overlap are a few examples of the 404's capabilities. It requires a mere 36 watts of power. Analog and digital outputs permit readout on an X-Y plotter, paper tape printer, paper tape punch, IBM typewriter or computer compatible magnetic tape.

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less bench space in more laboratories than any other pulse height analyzer made. And why it was chosen for airborne monitoring of radioactivity . . . or monitoring sea water samples aboard submarines . . . or radioactivity measurements on cattle out on the range . . . or whole body counts in medical research laboratories.

Other TMC Multi-Channel Analyzers include 100, 256, 1024, 4096 and 16,384 Channel Models. One of them is probably right for your application. Contact any TMC office for more information or write Technical Measurement Corporation, 441 Washington Ave., North Haven, Conn., U.S.A. 06473.



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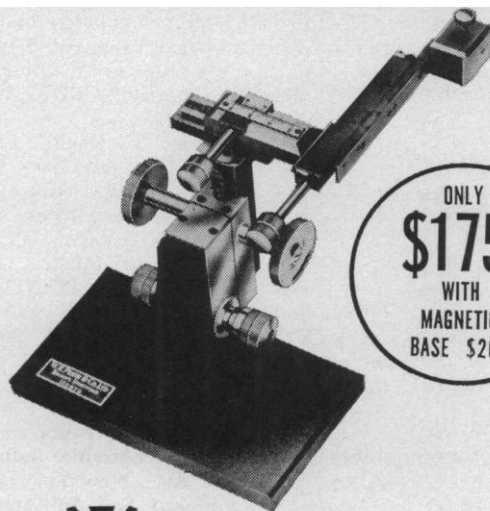
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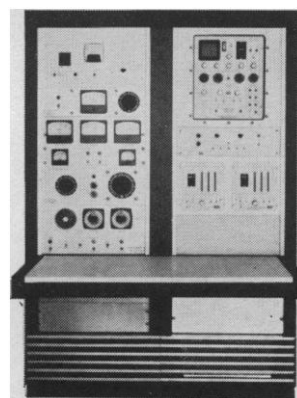
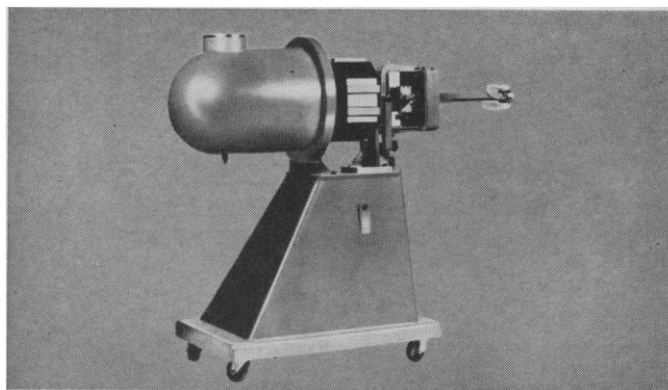
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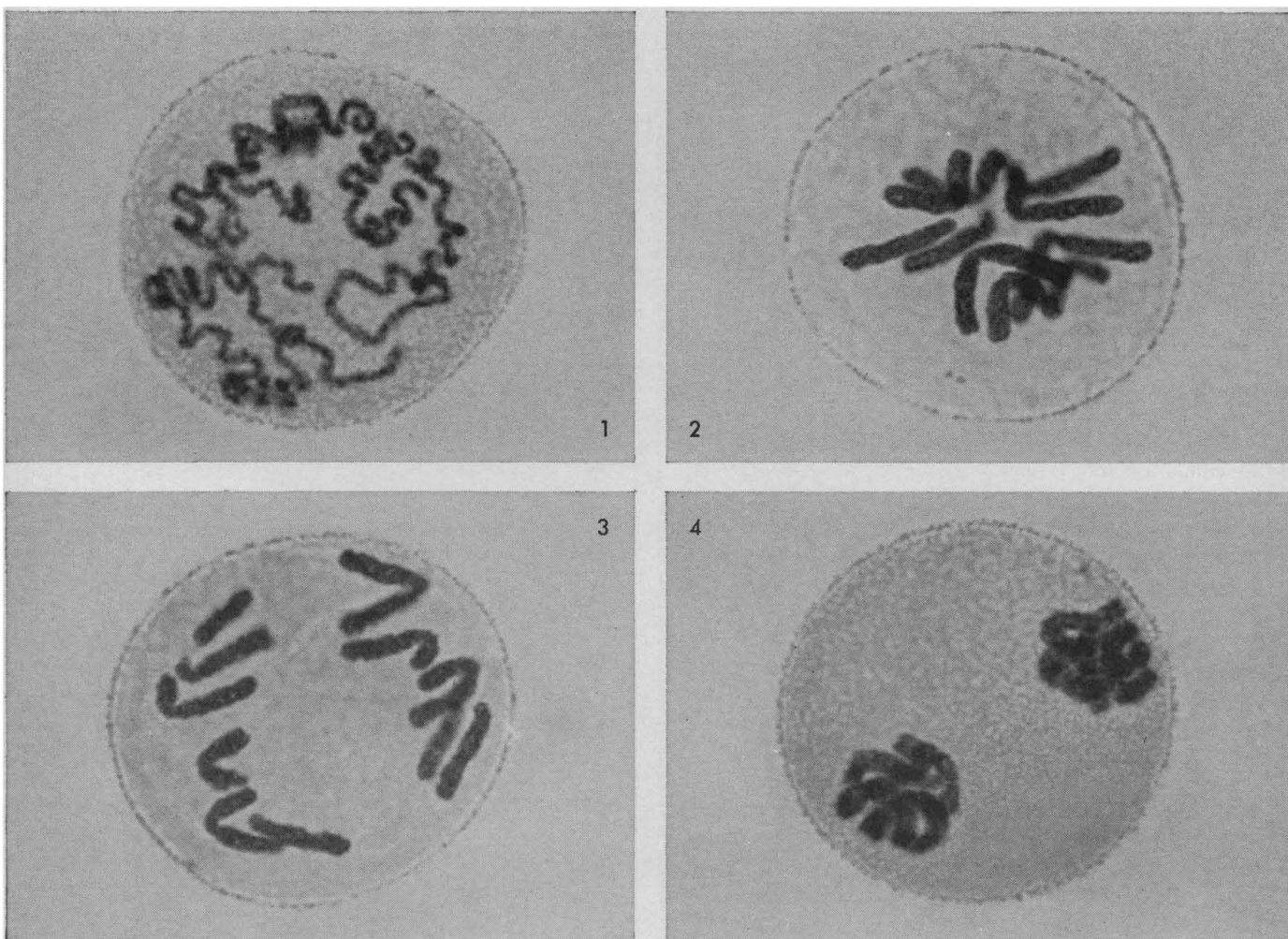
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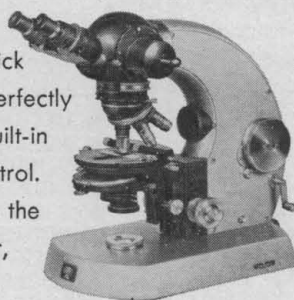


Photomicrographs of mitosis as follows: 1) Prophase, 2) Early Anaphase, 3) Anaphase, 4) Telophase . . . magnification—1600x. Taken by Robert F. Smith.

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## New Products

**Microcell positioner and cell holder** for the Beckman DU Spectrophotometer provides positive positioning and secure locking so that cells may be positioned reproducibly and stably. The carrier mechanism consists of a machined aluminum block, sliding on two precision-ground steel rods. The aluminum frame is interchangeable with that of the standard DU. The cell holder is a separate aluminum block positioned on the top of the carrier with two stainless-steel dowel pins. The cells, themselves, are held between steel posts and spring clips. Set screws adjust the vertical position of the cuvettes. Because both horizontal and vertical cell adjustments are provided, a fixed pin-hole diaphragm is located in the side plate, instead of an adjustable one. The four standard cell positions are provided with solid positive positioning adjustments for each one. The reproducibility of positioning in each of these four stations is claimed to be good to within  $\pm 0.5 \mu$  (standard deviation).—D.J.P. (Microtech Services Co., Dept. S349, 775 Sunshine Drive, Los Altos, Calif.)

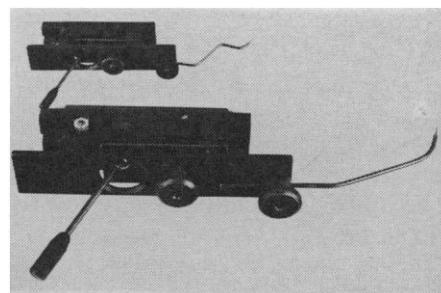
**Miniature valves** and associated accessories allow the assembly of a variety of laboratory systems which are small volume, gastight, and inert. The basic units are a series of three steel-jacketed, Teflon-Kel-F valves weighing less than 1 oz. The first valve is two-way for simple on-off control of straight through flow. Second is a three-way valve with possible porting arrangements allowing flow through any two adjacent ports or through all three at once. The four-way valve can be arranged to allow flow through any two adjacent ports, any three adjacent ports, or any two pairs of adjacent ports. Each of these has a standard port size of 0.076 inch, and the largest valve, the four-port unit, measures only 1-3/16 by 1 by 1-3/16 inches. Standard fittings for these models are male and/or female luer connectors. Two operational fittings, a

male luer fitting with luer lock and a 22-gauge, 2-inch steel needle with 22° joint, can be specified. The ported plugs in these valves are of Teflon; other wetted surfaces are Kel-F. To complete the line is a series of Kel-F connectors consisting of all variations of male, female, and locking luer joints, and 0.076-inch (inside diameter) Teflon tubing supplied with female luer fittings on both ends and available in 1-ft increments up to 100 ft.—D.J.P. (Hamilton Co., Dept. S344, P.O. Box 307, Whittier, Calif. 90608)

**Nitrogen dioxide detector** senses and records concentrations of nitrogen dioxide (nitrogen tetroxide) in the range from 0 to 5000 ppm. This gas is emitted as an unwanted contaminant in the exhaust of automobiles and other internal combustion engines and is now produced commercially for use in industrial processes and in the field of missile propellants. Because nitrogen dioxide at toxic levels can be a hazard to health and safety, a means of continuously monitoring its concentration is often desirable. The model 725-11 nitrogen dioxide recorder is designed to provide both instantaneous readings on a panel meter and permanent, continuous readings on a strip-chart recorder which may be located at a distance from the sensor. The instrument consists of two basic units, the nitrogen dioxide meter, and the strip-chart recorder, connected by a single cable. Determination of the gas concentration takes place within a Brewer-type microcoulomb sensor within the meter unit. The gas sample is continuously drawn through the sensor at a rate of 140 cc/min  $\pm$  1 percent. The basic principle of the sensor in this application is the oxidation-reduction of a modified bromide or iodine-sensing solution to achieve the standard model meter range of approximately 0 to 500 ppm/vol. Reactions within the sensor are electrochemical in nature and take place at the polarized electrodes which are covered by the sensing solution. The

measurement of the electron flow or current through the external circuit is directly proportional to mass per unit time of nitrogen dioxide entering the sensor. A microammeter in series with the electrode-battery circuit provides readings which are translated to nitrogen dioxide concentrations. The strip-chart recorder replaces the microammeter in the circuit when permanent recordings are needed. Connecting the strip-chart recorder has the added advantage of extending the operating range from a low range of 0 to 10 to a range of 0 to 500 ppm/vol or higher, by using appropriate plug-in range resistors. The sensing solution affects directly the operating range of the meter. For example, a potassium iodide solution can be used in the standard model for efficiency at lower concentrations. The operating range is extended upward to 5000 ppm/vol by using a potassium bromide sensing solution in the instrument. The latter range is particularly applicable to auto exhaust studies when catalytic or other oxidation processes are used to convert the nitric oxide exhaust emission to nitrogen dioxide for measurement. The nitrogen dioxide meter can be purchased separately for single range visual concentration readings where permanent records are not required. It weighs 10½ lb and measures 7½ by 11½ by 6 inches deep. The strip-chart recorder weighs 14½ lb with dimensions of 8 by 8½ by 10⅝ inches deep.—D.J.P. (Mast Development Co., Dept. S346, 2212 E. Twelfth St., Davenport, Iowa 52803)

**Micro-manipulators** developed for electrical probing of minute areas of semiconductor crystals utilize a joystick to drive a probe over an area of either 0.032 or 0.062 inches in diameter with a 40-to-1 fixed reduction



ratio. A variable-ratio model covers an area up to 0.1 inch diameter. These manipulators may be of value in biological applications.—R.L.B. (Affiliated Manufacturers, Inc., Dept. S331, Whitehouse, N.J.)