The respondent side effects of operant schedules are often such as to interact with the positively rewarded instrumental behavior. Since these elicited reactions are in many cases primitive, phylogenetically and neurally, parsimony requires that they be considered before more complex discriminations are invoked by way of explanation.

MICHAEL F. HALASZ
Research Laboratories in Neuropsychiatry, Veterans Administration Hospital, Pittsburgh, Pennsylvania

It is quite possible that the force variations during fixed-ratio responding are mediated by emotional responses, as Halasz suggests. However, in the study reported, the systematic changes in force were generally enhanced through repeated exposure to the reinforcement schedules, contrary to what one might expect if emotional habituation played a significant role. Moreover, the cycles that showed high and low forces typically had a period of less than 30 seconds. Twenty-five daily variations in force with cycles of this relatively high frequency do not appear to reflect the more integrative changes in tonus that would be produced as a concomitant of emotional response.

A discriminative basis for the increase in the force of response after nonreinforcement has been proposed by Notterman and Block [*J. Exptl. Anal. Behavior* **4**, 289 (1960)]. They suggest that the organism *learns* to respond "harder" when reinforcement does not occur. This direction of change is learned in an environment in which an increase in vigor frequently produces reinforcement after other behavior has been inefficacious.

Nature provides relatively few situations in which "softer" is an effective direction of behavioral change. It is possible that within the evolutionary process there has been selection for an increase in vigor of response and the phenomenon has become a basic property of the operant. This pattern may frequently be correlated with a more general pattern of emotional response of the sort Halasz has noted. However, the force changes may well be functionally independent of the emotional pattern.

DONALD E. MINTZ
Department of Psychology, Princeton University, Princeton, New Jersey

New Products

A neutron monitor, the 9120 spherical Dosimeter, which provides a close approximation of total human body dosage, is designed for monitoring personnel areas in reactor or accelerator facilities, or around any type of neutron source. It is sensitive to all neutrons within the energy range of thermal to 15 Mev. Dose rate or cumulative dose is obtained in a single, immediate reading. The measurement is omnidirectional. The instrument consists of a $Li^6I(Eu)$ scintillation detector surrounded by a 12-inch sphere of polyethylene, a transistorized preamplifier, mobile stand, and decade scaler. The detector assembly is also equipped with hardware for wall or ceiling installation. The advantages of the instrument result from its detector-moderator geometry which provides a response approximating that of the human body. Deviation is less than the uncertainty of the neutron flux equivalent of amrem. Readings are independent of the energy distribution of the incident neutrons. Since all neutrons from thermal to 15 Mev are detected, no knowledge of the energy spectrum is required. Multiple readings, graphical interpretations, or instrument geometry considerations are unnecessary. Unlike other neutron monitors, such as films, proportional detectors, tissue equivalent detectors, or fission threshold detectors, the 9120 spherical Dosimeter has no gaps in its energy response. The intermediate energy range from epicadmium to 100 kev is also efficiency detected. The sensitivity of the unit is approximately 3000 counts/mrem. Readings may be made from 0.1 to 1000 mrem/hr. Models with a range up to 10,000 mrem/hr are also available on request. Background count is approximately 2 count/min. The instrument is insensitive to gammas.—R.L.B. (Texas Nuclear Corp., 359 E. Howard Ave., Des Plaines, Ill.)

Circle 1 on Readers' Service card

X-ray-tube driver is a variable pulse width and slope hard tube modulator equipped with a −75-kv output transformer to drive an x-ray tube. The modulator is capable of producing pulse shapes with variable rise times and pulse widths as follows: peak voltage, 0 to 15 kv negative; peak current, 25 amp; pulse width, 2 to 5 μsec; rise time 0.5 to 5 μsec; pulse repetition rate, 180 ±10 percent per second; pulse rises quickly to a predetermined pedestal from 50 to 100 percent of peak, and then slopes up to the full voltage. The modulator can be externally triggered. Output of the pulse transformer is 75 kv peak voltage and 5 amp peak current. The transformer is oil impregnated and its bifilar winding is rated for 4 amp r.m.s.—J.S. (Sperry Gyroscope Co., Great Neck, N.Y.)

Circle 2 on Readers' Service card

Peristaltic pumps are designed to transfer liquids and semi-liquids by means of peristaltic action on plastic or rubber tubing. Tubing is inserted into two tube-holding channels, one on either side of the pumping mechanism. Thus the pumps can be used for multiple as well as single-tube operation, making it possible to multiply the capacity of the pumps or to feed multiple circuits simultaneously. Since the action on one side of the mechanism is 180° out of phase with the other, it is possible to accomplish virtually pulse-free pumping by using two tubes in parallel. All motion is at right angles to the tubing, eliminating the tendency for the tubing to creep. A pair of screw-driven compression plates is used to occlude the tubing and to adjust for various diameters. Maximum tube capacity is two ½ by ⅜ inch plastic tubes, one on each side. The pumps will accommodate as many smaller tubes as circumstances permit. The design of the pumps is such that flow rate is directly proportional to speed over a wide range of pressure. Model 600-1200, designed for low-volume, high-accuracy work, features a synchronous reversible motor and accurate gearbox with 12 gearshift positions. In operation, any speed over a 5000-to-1 range can be selected simply by turning the gearbox knob. Average reproducibility is 0.1 percent. Flow rates are obtained from 0.0042 to 228 ml/min. Output pressure is in excess of 200 mm-Hg. Tests indicate negligible hemolysis. Model 500-1200, designed for high-flow rates, is driven by a heavy-duty, high-speed, variable-speed motor which is controlled by a solid-state speed control producing rates over a 50-to-1 range with a given size tube. Feedback circuit assures excellent reproducibility. Tests indicate negligible hemolysis. Flow rates are obtained from 1.4 to 760 ml./min. Output pressure is in excess of 700 mm-Hg.—R.L.B. (Harvard Apparatus Co., Inc., Dover, Mass.)

Circle 3 on Readers' Service card

Portable salinometer (model 621) uses magnetic induction to sense the ratio of conductivity of a sample of seawater under test to the conductivity of standard seawater. Any temperature difference between the sample and the standard is compensated by a double-bridge circuit using platinum resistance thermometers immersed in the samples. The compensator is said to eliminate the need for controlling the temperature of the sample. Range of conductivity ratio is 0 to 1.5, corresponding to salinities of 0 to 53 percent. The volume of sample required by the measurement is 50 ml. Accuracy of measurement is said to be ±0.003 percent. Temperature compensation range is 0 to 40°C.—J.S. (Hytech Div. of Bissett-Berman Corp., G Street Pier, San Diego, Calif.)

Circle 4 on Readers' Service card

Magnetic tape delay system (model 102-DR) provides a time lag of 0.3 to 10 sec. The system comprises a tape delay transport mechanism and two data converters. Time delay is accomplished

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The material in this section is prepared by the following contributing writers:

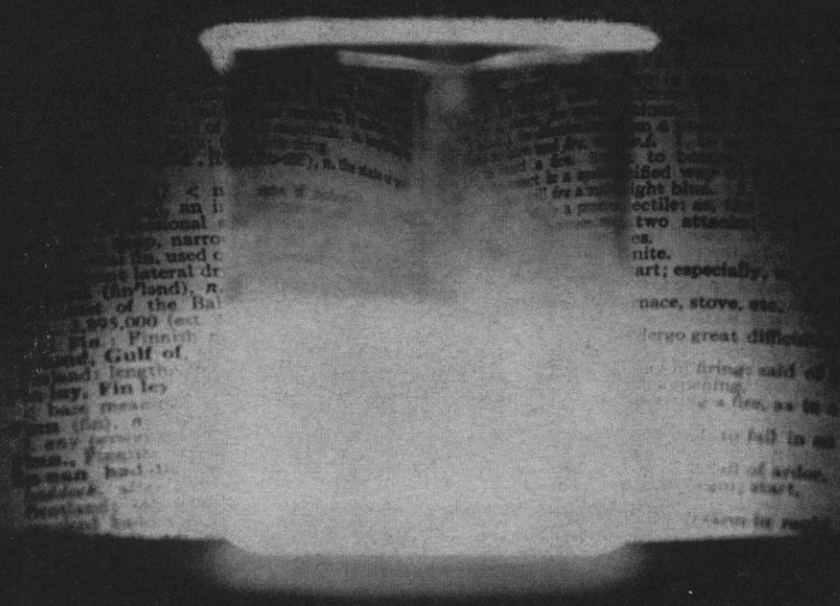
Robert L. Bowman (R.L.B.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writers assume responsibility for the accuracy of the information. A Readers' Service card for use in mailing inquiries concerning the items listed is included on page 979. Circle the department number of the items in which you are interested on this card.

Erratum. The sensitivity and accuracy of the Mettler ultramicro balance described in New Products [18 Jan. 1963, item 5, p. 254] are measured in micrograms rather than milligrams.

FOR ATP MICROASSAY—DEHYDRATED FIREFLY TAILS—The most sensitive method* for assaying the minute levels of ATP found in biological systems. Use Schwarz' ATN, crystalline disodium adenosine 5'-triphosphate, to standardize your assay SCHWARZ BIORESEARCH is the primary manufacturer of phosphorylated adenosine compounds including isotopically labeled forms FIREFLY KIT TO DEMONSTRATE BIOLUMINESCENCE—Provides enough dehydrated firefly tails and ATP for 10 dramatic—and convenient—demonstrations.



The light for the photo was provided solely by firefly tails.

*For your copy of the latest revised procedure for assay of ATP and for further information on these and other nucleic acid derivatives write to Dept. HB:

SCHWARZ BIORESEARCH, INC. Mount Vernon, New York · BIOCHEMICALS. RADIOCHEMICALS. PHARMACEUTICALS. for research, for medicine, for industry.

by establishing a loop between record and reproduce heads of the tape system. The length of the tape loop is adjusted by positioning a slider that carries an idling spool. The slider moves on the track of a fixed scale that is calibrated in seconds and tenths of a second over the operating range. The system is said to have a linearity of 0.2 percent of full scale and a frequency response of 0 to 400 cy/sec at 7.5 in./sec and 0 to 100 cy/sec at the lowest tape speed of 1⅞ in./sec. Minimum signal-to-noise ratio is 30 db at full scale input. A noise compensator provides an additional 10 db improvement in the signal-to-noise ratio when the system is used for analog data recording.—J.S. (Mnemotron Corp., Pearl River, N.Y.)

Circle 5 on Readers' Service card

Thermoelectric microscope cold stage consists of a cooler in a 3 by 3 by 1½-inch-high epoxy housing and a compact controller. Cooling is provided by thermoelectric elements which transfer heat from the sample to a tiny integral heat exchanger. With 15°C tap water in the heat exchanger, the instrument will work down to −60°C. Hotter or colder liquids will shift the working range accordingly. Temperature is sensed by a small bead thermistor fixed directly to the sample holder. The resistance of the thermistor is measured with a model RC-16B2P General Purpose AC Wheatstone Bridge. Audible null indication through earphones allows continuous, uninterrupted observation of the sample during the entire determination. The temperature is read to better than 1°C from a chart of thermistor resistance versus temperature. Alternatively, a direct-reading electronic thermometer may be used. A simple calibration procedure, involving standards of known freezing point, can increase the accuracy of either instrument. In operation, a few milligrams of sample is placed under a cover glass on a 6- by 18-mm glass slide and inserted in the instrument. Alternatively, several different samples may be accommodated simultaneously in small drawn capillaries. With liquid flowing through the heat exchanger, the thermoelectric cooler is energized and the sample temperature controlled by adjusting a knob. Generally a liquid sample will be cooled until freezing begins. If the cooling rate has not been excessive, the moderate amount of supercooling attained will allow observation of the crystal front as it moves across the field of view. Proper manip-

ulation of the knob will allow the progression of this front to be slowed, halted or even reversed. Melting may be controlled as easily. The freezing and melting rates may be adjusted to a small fraction of a degree per minute. —R.L.B. (Industrial Instruments, Inc., 89 Commerce Rd., Cedar Grove, Essex County, N.J.)

Circle 6 on Readers' Service card

Image plane digitizer provides a means for digitizing x and y coordinates by locating the position of a crosshair reticle projected on the image plane of a magnified film view. The unit can be used with systems employing back or overhead projection. Hard copy may be read directly. The digitizer is encased in a frame containing a 2-ft-square viewing area. Both x and y cursors may be hand manipulated to approximate the desired point locations, after which the reticle may be precisely set with individual vernier knobs having reduction ratios of 15 to 1. Mechanical stops prevent damage at the extremities of travel. An auxiliary data processor control console provides digital output compatible with commercially available tape and card punches. Provisions are made for external foot-pedal control of data-record functions.—J.S. (Itek Corp., 10 Maguire Rd., Lexington, Mass.)

Circle 7 on Readers' Service card

Ultra-micro mull holder enables the analyst to easily position micro samples for infrared analysis and to obtain good qualitative spectra without the need of expensive beam-condensing optics. The holder mechanically positions the sample very close to the focus of the spectrophotometer beam. Although the beam is physically attenuated, sufficient energy is transmitted through the 1-by-4-mm aperture to provide good analysis of micro samples. The small, single-block Ultra-Micro Cavity Cells are ideal for this method of sample mounting and offer a low-cost method of obtaining spectra of samples as small as 0.2 μl. With the Micro Mull Plates, a quantity of material can be analyzed in the form of a mull. A spring-loaded pressure plate holds both cavity cells and mull plates reproducibly in the beam. By merely depressing the pressure plate, a cell may be inserted or removed from the holder. The unit is satin nickel finished throughout to provide a chemically resistant surface. The Ultra-Micro Mull Holder can be used in all Perkin-Elmer and Beckman infrared spectrophotometers. It mounts directly into the

Perkin-Elmer Models 21, 221, and 421, transmitting about 30 percent of energy. An additional holder, the CH-15, is required for mounting the Ultra-Micro Mull Holder in the PE Infracord and the Beckman Models IR-4, 5, 7, 8, and 9. About 20 percent of the beam is transmitted through the holder when mounted in these instruments. The CIC BA-1 Variable Beam Attenuator will compensate nicely for losses in energy. The Ultra-Micro Cavity Cells and Micro Mull Plates are available in NaCl, KBR, CaF_2, BaF_2, and CsBr transmitting materials.—R.L.B. (Connecticut Instrument Co., Wilton, Conn.)

Circle 8 on Readers' Service card

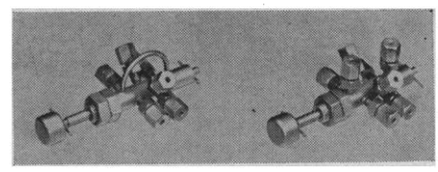
Four-channel mobile recorder provides a compact configuration of four channels of standard Offner recorders. Designed to permit use in operating room or laboratory, the unit offers a heretofore unavailable cabinet arrangement which fills frequent requirements for a four-channel unit (normally available only in an eight-channel cabinet). The all-transistorized Offner amplifiers provide a maximum sensitivity of 1 μv per millimeter, a frequency response in excess of 150 cy/sec, and drift of less than 1 μv/hr. Physiological parameters such as EEG, EKG, EMG (integrated), temperature, blood pressure, and so forth, are easily recorded. Modular design provides quick change of measured function. Sixteen-speed drive (1 mm/min to 250 mm/sec) is provided. Folded chart paper is used with self-contained take-up tray. A handrail completely surrounding the machine is designed to absorb impacts.—R.L.B. (Invengineering, Inc., P.O. Box 360, Belmar, N.J.)

Circle 9 on Reader's Service card

Teflon needle has a Kel-F hub that fits standard hypodermic syringes to permit the handling of highly corrosive or sensitive materials. The tubing of the needles is available in sizes approximating the standard needle sizes of 8 gauge through 22 gauge, in lengths from 1 inch to 100 feet.—R.L.B. (Hamilton Co., Inc., P.O. Box 307, Whittier, Calif.)

Circle 10 on Readers' Service card

Multi-port instrument switch valves are precision O-ring valves for analytical instruments and other control applications where many ports are required. These valves are ideal for gas chromatograph column switching, precision volume gas sampling, pneumatic



signal switching, multi-stream switching, and other switching applications requiring low dead volumes. They are available with six and eight ports and will operate at temperatures over 100°C. A maximum operating temperature of 160°C is possible for short periods of time. Valve bodies and stems are stainless steel, O-rings are Viton A or Buna-N, and connections are ⅛-inch outside diameter Swagelok tubing fittings. The O-rings can be easily replaced or inspected by removing a cotter pin, then removing the stem containing the O-rings from the valve. Electropneumatic or motor actuators for these valves are also available.—R.L.B. (Loenco, Inc., 2092 N. Lincoln Ave., Altadena, Calif.)

Circle 11 on Readers' Service card

Flame spectrometer uses the Rowland principle that if a spherical concave grating is placed on a circle whose radius is one-half that of the grating, and if a slit is placed on the circle opposite the grating, spectral images of the slit will be found in focus on the circle symmetrically arranged on either side of the slit. Thus, if photomultiplier detectors are placed around the circle at the appropriate location, characteristic wavelengths of the emitting elements may be detected and the elements identified. By taking advantage of the symmetry, analytical detection may be made on one side of the circle and background detection on the other. Then the background channels may be connected to the differential inputs of the analytical channels so as to electrically subtract out the background interference. Each detector has a separate photomultiplier, amplifier, and adjustable regulated high voltage power supply which allows adjustment of each of the photomultiplier sensitivities. Each channel has a differential input cathode follower which matches the photomultiplier tube to an indicating meter. Any number of detectors up to 66 may be installed to allow many simultaneous determinations. Light sources or flame can be used and the slits can be fixed or adjustable. This spectrometer uses a concave grating with 981.8 lines per millimeter. Its 0.75-m Rowland circle has a range of 3000 to 9000 Å, with

dispersion of 12.98 Å/mm at 3000 Å and 6.36 Å/mm at 9000 Å. With 0.6-mm wide slits, it measures less than 1.0 ppm magnesium, 0.01 ppm calcium, and 0.01 ppm sodium.—R.L.B. (Technicon Instruments Corp., Research Park, Chauncey, N.Y.)

Circle 12 on Readers' Service card

Micromanometer differential for gage pressure measurements is available in two models with ranges of 0 to 10 and 0 to 20 inches of water, respectively. Accuracy of the direct-reading instrument is said to be better than +0.1 mm of water. The cup and stem, made of nickel-plated copper alloy, provide surface areas in the ratio 9 to 1. They are filled with distilled water to which a wetting agent has been added in an amount small enough so that the effect on the specific gravity of the water is negligible. A glass float in the stem carries a glass scale graduated in millimeters. The scale is projected on a screen magnified 20 times. Maximum static pressure is 15 lb/in.^{2} Special models for higher pressure can be supplied.—J.S. (Instrumentenfabriek Van Essen N. V., Delft, Netherlands)

Circle 13 on Readers' Service card

Organ-scanning phantom is a liquid-filled shell which duplicates the abdominal contours of a man from diaphragm to upper pelvis. The phantom may be used in AP, PA, lateral, and upright positions. A liver, kidneys, sleen, stomach, and pancreas may be purchased separately and used in any combination. Each organ is supported above the base plate by a plastic strut (two on the liver). A double ball-joint arrangement provides flexible positioning for varying the thickness of tissues between the organ and the skin and the spacing between organs. Organs are easily inserted into the phantom by removal of a large circular access plate in the top. Other abdominal structures are available on a custom basis, including a simplified intestinal tract, a spinal cord (with or without human vertebrae), and major arteries. The phantom is fabricated throughout of optically-clear cellulose acetate butyrate. The shell is 2 to 3 mm thick, the organ shells 1 to 2 mm thick, and the end plates 1 cm thick. All entrance ports and other fittings are sealed with neoprene O-rings. The phantom is packed in a durable wooden case. If a concentrated radioisotope solution has been used, two ports on the top plate may be connected to tubing for continuous flushing and organs may be flushed similarly. The organ-scanning phantom is accurately tissue equivalent for x-rays, gamma rays, and bremsstrahlung, when the shell and organs are filled with water or a suitable aqueous solution. Tissue equivalence for neutrons and protons requires that the phantom have the same chemical composition as the human body. A special solution has been developed which contains essentially correct proportions of oxygen, carbon, hydrogen, nitrogen, phosphorus, sulfur, potassium, sodium, chlorine, magnesium, calcium, and iron. A variety of tumors may be positioned anywhere within an organ. Solid plastic spheres and ovoids produce "cold spots" when the organ is filled with a radioisotope solution, and hollow plastic spheres and ovoids produce "hot spots" when filled with a more concentrated solution than that in the organ itself. Scans, which normally require weeks or months to duplicate with patients, can be made in a few hours and yield data which has greater reliability and consistency. Research applications include systematic ex-

ploration of new techniques, development and improvement of scanning apparatus, neutron depth-dose measurements, neutron activation studies, and development of bremsstrahlung-scaning procedures.—R.L.B. (Atomic Accessories, Inc., Valley Stream, N. Y.)

Circle 14 on Readers' Service card

The A601R series of **rectilinear recorders** uses permanent-magnet moving-coil pen motors to record over an active chart width of 4.5 inches. Rectilinear recording is achieved by means of a lever and pulley arrangement that requires only two pivot points. Instruments in the series are available for measurement of d-c microamperes, d-c milliamperes, d-c amperes, d-c volts, a-c amperes, and a-c volts, with various ranges provided for each. Expanded ranges can also be provided. Accuracy is said to be +1 percent on many ranges and +2 percent or better on all ranges. Ink recording is used, with a 3 months' ink supply being contained in the instrument. Response time is approximately 0.5 second for 99 percent of the final value. Event marker pens that record by means of a lateral motion of 0.1 inch can be provided in one or both margins. A choice of left-hand, right-hand, or center zero is available in d-c instruments and left-hand or right-hand in a-c instruments. Chart drives include spring motors and electric motors. Normally, chart speeds of ¾, 1½, 3, 6, and 12 in./hr or in./min are provided. Speeds up to 3 in./sec can be provided.—J.S. (Esterline Angus Instrument Co., Inc., Box 596, Indianapolis 6, Ind.)

Circle 15 on Readers' Service card

Gamma counting system Tobor handles samples from point sources to 10 liters. It features a large, shielded counting chamber with two scintillation detectors that maintain uniform geometry and efficiency for samples with wide variations in physical shape and volume. The dual-detector design insures constant count rate, independent of volume, for samples having similar activity and diameter. This method simplifies analysis of large-volume samples because it eliminates the need for diluting or concentrating to a standard volume. Most common-size beakers, flasks, and graduates, in addition to animals as large as monkeys, can be accommodated. Access ports at the front and rear of the counting chamber permit in vivo arm and leg measure-

ments. Tobor is available with a selection of crystal types and sizes ranging from 3-inch-diameter sodium iodide to 7-inch-diameter plastic scintillators. Two 3- by 3-inch sodium iodide crystals provide 22-percent efficiency for Cs-137 in a 10-percent window, with 9-percent resolution and less than 60 count/min background. Samples as low as 10 mμc can be measured. The instrument will operate with both single-channel and multichannel analyzers. The outputs of the dual detectors can be summed, or taken individually for driving coincidence or anti-coincidence circuits.—R.L.B. (Nuclear-Chicago Corp., 359 E. Howard Ave., Des Plaines, Ill.)

Circle 16 on Readers' Service card

Small **divided circle spectrometer** for the educational laboratory is also suitable for other applications where readings to 1 minute are satisfactory. Telescope and collimator are factory leveled. The prism table has a long range of vertical adjustment. A 14× Gauss eyepiece is standard equipment and accessories include an eyepiece illuminator, polarizing attachments, 360-deg prism table protractor, replica grating and holder, and adjustable gate diaphragm.—J.S. (Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.)

Circle 17 on Readers' Service card

Vacuum deposition monitoring system (model 220) is designed for thickness control of transparent and opaque films or multilayer combinations of such films. The system includes a light source and pickup head on a single mounting, a solid-state amplifier, and power supply, and a monitor disk support. Included are four narrow-band interference filters, ten glass monitor disks, shielded connecting cables, and an instruction manual. Available accessories include additional narrow-band filters from 400 mμ to 2.5 μ, additional monitor disks, and extension columns for longer or shorter disk supports.—J.S. (Optics Technology, Inc., 248 Harbor Blvd., Belmont, Calif.)

Circle 18 on Readers' Service card

Disposable filters sterilize and clarify fluids and remove smoke from gases. The filter medium, called ULTIPOR, consists of a layer of fine inorganic fibers, epoxy bonded to the upstream side of a cellulose fiber base. It is claimed that these filters eliminate the cost, flow reduction, and clogging prob-

lems of other filters. The medium is available in three grades with nominal removing ratings of 0.45, 0.15, and 0.02 μ, and with absolute (100 percent) removal ratings of 3.0, 0.35, and 0.07, respectively. The 0.45-μ grade removes bacteria quantitatively from gases and cleans gases of fine aerosols such as smoke. The 0.15-μ grade removes bacteria quantitatively from liquids and will provide a clear effluent. The 0.02-μ grade is experimental but it is known to remove some of the larger viruses. The filter medium is incorporated into disposable, high-area, corrugated cartridges which are available singly or in assemblies with effective areas ranging from 100 in.^{2} to 120 ft^2 with connection sizes from ¼ to 3 inches.—R.L.B. (Pall Corp., Glen Cove, N.Y.)

Circle 19 on Readers' Service card

Laser power supply (model 330) is designed to operate at voltages from 0 to 10,000 volts for pulsed energy discharge applications. Energy storage as high as 20,000 joules is provided at the full 10 kv. The power supply also provides a separate 500-volt trigger source that includes a thyratron switch to energize gas discharge light sources. A trigger pulse receptacle is located on the front panel for oscilloscope locking. Safety interlocks disable all power for protection of operating personnel. The equipment is also disabled if maximum voltage is exceeded. Cycling time as short as 2 sec can be provided. Additional energy storage banks are furnished in 1000-joule increments.—J.S. (Electro Powerpacs, Inc., 5 Hadley St., Cambridge 40, Mass.)

Circle 20 on Readers' Service card

Precalibrated pressure transducer is a thin, low-inertia, vacuum-sealed sensor with a pressure range of −10 to +10 lb/in.^{2} (gage). It is constructed of embossed alloy steel plates separated by a dielectric, and vacuum sealed. Under external pressure the plates deform elastically to bring the plates closer together, and change the electrical capacitance of the unit. This transducer is 1 by 1 by 0.035 inches, can be mounted with cement or pressure-sensitive tapes, and comes with 10 ft. of Teflon-insulated shielded cable, 1/16 inch in diameter. Its transient response is 90 percent of full scale in 70 μsec. Linearity is 0 to 10 lb/in.^{2} ± 2 percent, hysteresis is less than 1 percent, and the transducer has a zero pressure capacitance of 500 $\mu\mu$f and a sensitivity of 6 $\mu\mu$f/lb in.^{2} Calibration is done at the factory and each unit is shipped with a photograph of the results along with its calibration curve. A screw driver adjustment on the transducer plug resets an auxiliary circuit so that it has proper zero load capacity and overall sensitivity. The device is made to be used directly with the Filpip Pressure Readout Systems, but a simple a-c bridge can be employed.—R.L.B. (Spitz Laboratories, Inc., Yorklyn, Del.)

Circle 21 on Readers' Service card

X-ray powder diffraction furnace and controller is designed to provide specimen temperatures up to 1850°C. The noble-metal alloy sample holder is mounted on an alumina support pedestal that can be aligned by means of three differential screws that adjust for rotation, tilt, and translation independently. The heating elements of platinum-rhodium alloy are wound spherically to provide homogeneous temperature distribution. The furnace is both air- and water-cooled and is sealed so that measurements can be made in controlled atmosphere. A compatible power supply and controller maintain the furnace temperature within ±2°C up to 1000°C; ±5°C up to 1600°C; and ±10°C to the upper limit of the furnace.—J.S. (Tem-Pres Research, Inc., William St., State College, Pa.)

Circle 22 on Readers' Service card

High-speed digital logic system (model 100) is an asynchronous data processor said to be capable of operating at 10-nsec intervals or at rates up to 100 megapulses per second. The system uses a dual discriminator as a general-purpose pulse shaper for preceding coincidence circuits, time-to-pulse-height converters, and scalers. It contains two separate discriminators with maximum sensitivity 100 mv into 50 ohms, capable of operating at the 100 Mcy/sec repetition rate. The and/or unit used in the system has three coincidence and one anti-coincidence unit. Inputs are a-c but internal circuitry is d-c coupled. In the "or" mode, up to six inputs can be accommodated. Signal requirement is 250 mv at 50 ohms. Stability of the system over a 24-hr period is said to be better than 0.1 nsec over the temperature range 20° to 40°C. Front panel switches permit check of discriminator threshold, resolving time, maximum repetition rate, and input time clip.—J.S. (Chronetics, Inc., 9 Elm Ave., Mt. Vernon, N.Y.)

Circle 23 on Readers' Service card

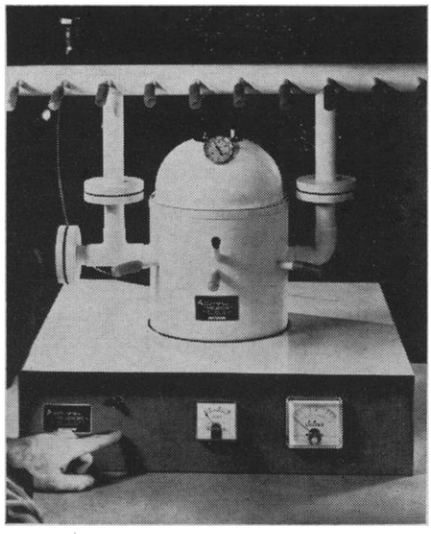
Acoustic spectrum analyzer (model LPP-4) covers frequency range of 4 to 20,000 cy/sec. The band from 40 to 20,000 cy/sec is scanned automatically and is displayed on a 3-inch cathode-ray tube. A second band from 4 to 2000 cy/sec is tuned manually. The high-persistence screen of the cathode-ray tube is calibrated with log scales for frequency versus amplitude presentation. Sensitivity is 0.001 volt full scale and 90 db attenuation is provided in 10-db steps. Three selectivity ranges are provided: all-pass operation in which the entire signal is monitored; wide-band filter for quick spectrum survey; and narrow-band filter for detailed examination of the spectrum. Input impedance is 100,000 ohms. Chart recorders and other auxiliary indicators can be accommodated. The instrument is portable and is designed for field use.—J.S. (Panoramic Electronics, Inc., 520 S. Fulton Ave., Mount Vernon, N.Y.)

Circle 24 on Readers' Service card

D-c differential voltmeter (model 660) measures voltage by the potentiometric method. In the circuit arrangement of the instrument, the voltage reference is a 500-volt power supply employing a temperature-compensated Zener diode reference. A Kelvin-Varley voltage divider performs the potentiometric function, and the null detector is a chopper-stabilized vacuum-tube voltmeter. The 500-volt reference is used in conjunction with the divider to null the source voltage. Differences between the internal and source voltages are measured by the null detector that indicates both direction and magnitude off null. The voltage required to achieve true null is read directly from the five in-line dials of the divider. Specifications provided by the manufacturer include limit of error, ± 0.02 percent of reading between 100 mv and 500 volts, with ± 0.005 percent repeatability; Zener reference stability 0.002 percent per year; power supply stability better than 0.005 percent indefinitely; maximum null sensitivity 100 μv full scale with 2.0 μv resolution. Output is provided for 10-mv recorder.—J.S. (Keithley Instruments, 12415 Euclid Ave., Cleveland 6, Ohio)

Circle 25 on Readers' Service card

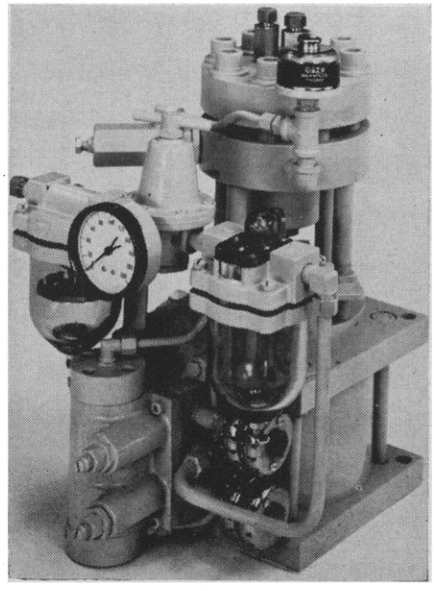
Freeze drying apparatus utilizes liquid carbon dioxide instead of solid carbon dioxide ice for refrigeration. It is claimed that liquid CO_2 stored in the usual tanks is more convenient to use and store than solid CO_2. The instru-



ment is always ready for use and the refrigeration is said to perform as effectively as the more expensive mechanical refrigeration units. A manifold model is constructed of Heliarc welded stainless steel and has six ½-inch ports on the tank and 20 ½-inch ports on the manifold. Electronic vacuum gauge and temperature indicators are provided.—R.L.B. (Associated Testing Laboratories, Inc., 200 U.S. Highway 46, Wayne, N.J.)

Circle 26 on Readers' Service card

Versatile new **air-operated diaphragm compressor** is designed to handle corrosive or toxic liquids and gases with absolute purity. At 16 inches high and 52 lb (single-end), and 28 inches, 86 lb (double-end), the two available models are characterized by their compact design and versatility. The diaphragm-type design ensures that materials being compressed never come into contact with working members of the machine, thus they are well suited to laboratory, chemical, petrochemical, and missile ground support roles where absolute contamination-free operation is a must. Compressors are particularly useful where gas must be compressed into laboratory or pilot plant reactors—where the flow of one or more gases is to be proportioned into a chemical process —or where contamination poses a problem. Absence of any electrical components permits use in explosive atmospheres. Owing to absence of any stuffing boxes, compressors are completely leakproof; they may be used with safety with highly toxic or explosive gases or liquids. Unit is capable of taking suction pressures up to its discharge pressure. Compressors are adaptable to either gas or liquid media. Changeover from one to the other is accomplished merely by interchanging a set of inlet and discharge check valves located in the upper head plates.—R.L.B. (American Instrument Co., Inc., 8030 Georgia Ave., Silver Spring, Md.)



Circle 27 on Readers' Service card

Temperature programmer (model 240M) operates in the range 0 to 1000°C. The instrument can be operated at any one of 12 discrete heating rates from 0.5° to 30°C/min. Power output up to 1500 watts is standard but can be increased if required. Chromel-alumel thermocouples are used to indicate and regulate temperature. The control system uses the proportional principle. Power is supplied by silicon controlled rectifiers with full phase control of both cycles of a-c power. The equipment functions also as an isothermal controller making possible a stepwise program in which periods of linear temperature increase are combined with periods of isothermal operation. All functions of power, control, and temperature indication are self-contained in the single unit.—J.S. (F & M Scientific Corp., Starr Rd. and Route 41, Avondale, Pa.)

Circle 28 on Readers' Service card

Hydrogenator permits hydrogenation of unsaturated organic compounds at atmospheric pressure and temperature. One to 1000 g of material may be hydrogenated without pressure equipment or hydrogen cylinders. The Brown² Hydrogenator is based on the generation *in situ* of active catalysts by the treatment of platinum metal salts with sodium borohydride. After catalyst generation, hydrogen is generated from

sodium borohydride solution. An automatic valve delivers sodium borohydride only as the system requires hydrogen for the hydrogenation. Hydrogen may be generated either in a separate vessel and introduced into the hydrogenation flask, or generated directly in the hydrogenation flask. The amount of sodium borohydride solution added can be read with an accuracy of 1 percent, allowing the extent of hydrogenation to be followed. The device consists entirely of laboratory glassware and may be assembled in a few minutes. Applications include hydrogenation of double and triple bonds, reduction of various functional groups, rate studies, and catalysis. —R.L.B. (Delmar Scientific Laboratories, Inc., 317 Madison St., Maywood, Ill.)

Circle 29 on Readers' Service card

Rotary index head (model THM 102) is designed for checking placement of elements on encoder disks, commutators, and switch plates, and location of engraved indications on dials and plates. Accuracies of ±3 sec are said to be achieved without use of verniers. The device uses a plunger-mounted restrained gear rack that engages a precisely machined, freely-rotating 720-tooth master gear; a slide adjustment for rapid manual phasing adjustment; and a micrometer adjustment for angular readout to 30 sec. No leveling is required, since the index wheel and base are integral. Components up to 8 inches in diameter can be accommodated. An adjustable microscope way permits an item with depth up to 4 inches to be mounted for either angular or dimensional checks. All elements handled by the operator are stainless steel.—J.S. (Computer Instruments Corp., 92 Madison Ave., Hempstead, N.Y.)

Circle 30 on Readers' Service card

Sage **three-flask blood tonometer** provides an accurate and convenient method for blood equilibration with known gas mixtures. It consists of a standard water bath (18 by 12 by 7½ inches) which holds temperatures to ±¼ °C, a mechanism which swirls three angle-neck distilling flasks at 180 rev/min, and accessory tubing and syringes. The calibrating gas passes through a bubbler where it is warmed and saturated with water vapor, then through a water trap, and into the tonometer flask via a needle in another neck. In operation, 10 ml of blood are added to each flask and swirled for about 5 minutes, thus creating a film of

blood on the tonometer wall, while subjected to continuous gas flow (300 ml/min) of known composition. A 10-ml syringe set in a rubber sleeve in the center neck of each flask permits anaerobic removal of contents.—R.L.B. (Sage Instruments, Inc., 2 Spring St., White Plains, N.Y.)

Circle 31 on Readers' Service card

Recorder (model SRL) is designed especially for transmittance and absorbance recording. It provides a choice of direct or logarithmic response for plotting an electrical variable or its logarithm with respect to time or with respect to any other variable that may be synchronized with time. A panel range control permits adjustment of full-scale range between 9 and 100 mv. Precalibrated range plugs may also be used to provide standard ranges from 1 to 125 mv. All ranges are potentiometric with no voltage dividers loading the measuring circuit. Log response is provided by means of nonlinear gears. The instrument is supplied with cables for synchronization with the wavelength drive of the Beckman model DB spectrophotometer. Time for full-scale pen travel is less than 1 sec. Accuracy on the linear scale is said to be ±0.25 percent, and on the logarithmic (absorbance) scale, ±0.003 at 0.4 absorbance.—J.S. (E. H. Sargent & Co., 4647 W. Foster Ave., Chicago 30, Ill.)

Circle 32 on Readers' Service card

Heated glass inlet system permits liquids and solids to be introduced into mass spectrometers at temperatures up to 350°C. Designed for use with CEC's type 21-103C mass spectrometer, the 21-084 inlet system allows introduction of liquids and solids which can not normally be analyzed because of their insufficient vapor pressure. Prior to this, only compounds that vaporized at temperatures up to 150°C could be analyzed. The inlet unit is 44¼ inches high by 14½ inches wide by 20½ inches deep. The upper portion contains an oven to vaporize samples; the lower section contains the vacuum system and controls. Glassware in the system includes a 2-liter expansion volume, inlet and exit lines, and four magnetically actuated valves. Liquids are introduced directly into the expansion volume through a gallium-covered frit by means of a capillary tube or pipette. Sensitivity is calculated on the basis of volume, since a micromanometer cannot be used at the oven's operating temperature. Relative pressure mea-

surements can be obtained from total ionization measurements if the 21-103C has been modified for this purpose. A solid inlet port for the introduction of solid samples is available as an optional accessory. Sensitivity for solids is calculated on the bais of sample weight. —R.L.B. (Consolidated Electrodynamics Corp., 360 Sierra Madre Villa, Pasadena, Calif.)

Circle 33 on Readers' Service card

Isostatic presses are available with pressure ratings up to 100,000 lb/in.^{2} A 20,000 lb/in.^{2} model is said to maintain its working pressure continuously for a minimum period of 30 days without significant leakage. The vessel is of 4340 alloy steel with a 12-inch inside diameter and 90-inch inside length. A taper plug "O"-ring closure is used. Ten ⅛-inch electrical leads rated at 5 amp, one ¼-inch pressure vent valve, and one ½-inch rupture assembly are incorporated into the removable closure. An air-driven pump is furnished for pumping. A 45-lb/in.^{2} supply is required to develop and maintain 20,000 lb/in.^{2} in the vessel.—J.S. (Pressure Products Industries, Inc., Hatboro, Pa.)

Circle 34 on Readers' Service card

Magnet charger (model 2470) incorporates a capacitor bank of 20,000 μf operating at a maximum electromotive force of 150 volts. Energy storage is 225 joules. Voltage level on the capacitor bank can be varied from 35 to 150 volts maximum in steps of 25 volts. Booster units, each consisting of a 20,000 μf capacitor bank, can be added. A noninductive shunt is provided for measurement of the peak magnetizing current applied to the charging fixture. A triggered-sweep oscilloscope is required for measurements of this type. The charger is nominally rated at approximately 30,000 ampere-turns per inch, depending upon the fixture used. It can handle Alnico V magnets up to 2.5 lb depending upon magnet configuration. Small sizes of barium ferrite material can be magnetized to saturation.—J.S. (Radio Frequency Laboratories, Inc., Boonton, N.J.)

Circle 35 on Readers' Service card

All-glass water still is a package unit, with a capacity of 3 lit./hr. The still has all electric and thermostatic controls built in and will produce glass-distilled water of extreme purity. The product is mounted in a metal cabinet and all components are cushioned by neoprene-coated brackets. There is no contamination from metallic surfaces because all wet surfaces are constructed of inert materials. Components include Pyrex brand glassware, a Vycor brand immersion heater, and a Teflon stopcock. The unit produces pyrogen-free water of extremely low conductivity, and has produced from tap water single distilled water with a total solids content of 0.5 parts per million and 0.6 μmho conductivity. For water of even higher purity, the unit can be adapted to work as the second stages for a double distillation process. Primary applications for this still will be in laboratories engaged in medical research and trace element analysis. The new still operates on 220 to 250 volts, weighs 60 lb, and is 44 inches high, 17 inches wide, and 12 inches deep.—R.L.B. (Corning Glass Works, Corning, N.Y.)

Circle 36 on Readers' Service card

Oceanographic current meter is said to measure velocities of deep-sea currents from 1 mile in 3.5 days to 20 knots, about three times greater than any known ocean currents, according to the manufacturer. The instrument incorporates a transistorized amplifier and is said to be powerful enough to provide a signal for direct recording over 5 miles of cable. Power requirement is 20 mw. Normal output is in digital form that can be recorded directly on magnetic or paper tape or that may be used to drive counter or meter readouts. Inertia of the rotor of the velocity sensor is reduced by using high-strength plastic. Bearings are seawater-lubricated sapphire and output signals are provided by a photoelectric revolution counter. The unit weighs 12 lb. in air and 6 lb in seawater. All parts sensitive to pressure are protected to 35,000 ft. —J.S. (General Dynamics Corp., 1 Rockefeller Plaza, New York 20)

Circle 37 on Readers' Service card

Three-phase power supply (model 2113 C) furnishes power at 400 cy/sec +0.025 percent over the temperature range −10° to +45°C. The supply, designed for laboratory use, uses a tuning-fork–controlled oscillator as its frequency source. Input power can range between 105 and 125 volts and from 50 to 400 cy/sec. Output is three phases, each at 0 to 130 volts and 12 watts. Source impedance is 25 ohms per phase maximum. Regulation is 5 percent no load to full load, and distortion is 2 percent maximum. In op-

eration, the signal from the tuning fork oscillator is fed through a wave filter to a phase-splitting network and each phase is then fed through a 12-watt voltage and power amplifier. Improved regulation is obtained by 30 db negative feedback from the output transformer secondaries. Meters indicate phase and line voltages. Other frequencies and accuracies can be provided.—J.S. (Bulova Watch Co., Inc., 61–20 Woodside Ave., Woodside 77, N.Y.)

Circle 38 on Readers' Service card

DynaZoom phase contrast microscopes in 12 individual models have been designed to meet the requirements for observing specimens which are colorless or differ little in refractive index from their surroundings. The dark phase contrast system provides each constituent of the specimen with a differentiation proportional to its optical path. Both constant- and variable-power models are available. With the latter, the microscopist can view any specimen continuously from one through two times the objective-eyepiece factor, at an infinite number of powers within the range. Overall magnification ranges from 17× through 1940×. One stand will accept a choice of monocular, binocular or photo-binocular bodies. Focusing is controlled by low-position, concentric, coarse- and fine-adjustments knobs, and an automatic stop and safety clutch prevents damage to focusing mechanism, slides, or objectives.—R.L.B. (Bausch & Lomb, Inc., Rochester 2, N.Y.)

Circle 39 on Readers' Service card

Large-screen display oscilloscope (model 279) uses a 17-inch cathode-ray tube to show as many as four low-frequency traces simultaneously. An electronic selector switch permits viewing of one, two, or four traces, each with independent Y gain and shift controls. The Y amplifiers operate from d-c to 10 kcy/sec with maximum sensitivity greater than 10 cm/v. Sensitivity of the X amplifier is greater than 8 cm/v through its bandwidth from d-c to 8 kcy/sec. An internal synchronized time base provides variable sweep times from 1 msec to 1 sec. External time-base signals can also be used. Full X gain and shift facilities are available in either mode of operation. An auxiliary slow-speed time base is available for sweep times from 0.5 to 30 sec.—J.S. (Technitron, Inc., 2444 Wilshire Blvd., Santa Monica, Calif.)

Circle 40 on Readers' Service card

High-intensity microphone (model MA299601) is a self-generating transducer said to have negligible vibration sensitivity. Vibration cancellation is accomplished by connecting a sensitive seismic system in opposition to the microphone system. The microphone operates over the temperature range −65° to +250°F with less than ±1.5 db change from room ambient response, according to the manufacturer. A modification of the design can be used to measure boundary layer conditions up to 1200°F for short periods of time. Sensitivity is −102 db relative to 1 v/μbar. Resonant frequency is 27 kcy/sec and capacitance is 2400 pf. Linearity is within ±0.5 db over the range of the instrument. The microphone weighs 0.75 oz and measures 0.76 inch in diameter and 1.04 inch long.—J.S. (Gulton Industries, Inc., 212 Durham Ave., Metuchen, N.J.)

Circle 41 on Readers' Service card

High-voltage accelerator (model PEA-3S) is designed to simulate the radiation environments of space. The accelerator uses cascaded rectifiers driven in parallel from a high frequency oscillator. As an electron accelerator, 10 ma of electrons are available from 0.5 to 3.0 Mev. When converting to x-rays, the unit has an output of 10,000 r/min at one meter. As a positive ion accelerator, the unit provides up to 4 ma of hydrogen, deuterium, or helium with a duo plasmatron ion source. Pulsed operation is available for both electrons and positive ions. The model M-1000 pulse accessory offers pulses of adjustable width and amplitude from 1 μsec to steady state. Varying pulse shapes and amplitudes can be programmed to simulate a desired dynamic radiation pattern. The accelerator is 20 feet long and 6 feet in diameter and weighs approximately 30,000 lb. It can be used either horizontally or vertically.—J.S. (Radiation Dynamics, Inc., 1800 Shames Dr., Westbury Industrial Park, Westbury, L.I., N.Y.)

Circle 42 on Readers' Service card

New **plant growth chamber** has five shelves with over 13 square feet of usable shelf space and occupies 5¾ square feet of floor space. The growth chamber offers controlled conditions for plant and insect studies. It is also useful for cultural incubations, plant germinations, accelerated aging tests, sample storage, and many biological and biochemical applications. The tempera-

ture range is 40° to 120°F with the lights "off"; with the lights "on" the range is from 45° to 120°F. Control accuracy is within ±1°C. Humidity is injected into the forced air stream, providing uniform humidity conditions throughout the work area. Relative humidity range is from ambient dew point to 90 percent. The growth chamber permits a choice of either lights and humidity, lights only, or humidity only. This is in addition to the standard heating and refrigeration system. Besides the normal heating and cooling controls there is a separate "on" and "off" switch and indicator light for the fluorescent lamps, plus a 24-hour timer control. Additional timers may be incorporated, also, to permit different "on-off" light arrangements. Fail-safe operation is built-in. A dial thermometer on the door extends into the chamber. Four standard 24-inch fluorescent lamps can be arranged one above each shelf, all concentrated above a single shelf, or other arrangements to suit.—R.L.B. (Lab-Line Instruments, Inc., 3070-82 W. Grand Ave., Chicago 22, Ill.)

Circle 43 on Readers' Service card

High-energy **vacuum ultraviolet discharge lamp** (model 630) of the Hinteregger type, mounts directly on the entrance slit of the spectrograph or monochromator. A built-in blower cools the cathode to prevent evaporation or sputtering of the electrode materials at high energy levels. Capillary and anode are water cooled. The cooling system allows handling of 1000 watts continuously and up to 8000 watts intermittently. Type of gas, pressure, and excitation determine the line spectra or continuum produced. A flow-through system allows rapid changeover from one to another of a variety of gases. The lamp can be used either with a window or windowless. For windowless operation, a cam-operated sliding plunger seals against the entrance slit jaws, limiting the gas leak to a 5-mm length of the slit width. A special mounting plate is available for adapting the light source to instruments of other manufacture.—J.S. (McPherson Instrument Corp., 530 Main St., Acton, Mass.)

Circle 44 on Readers' Service card

Counting and printing system for measuring fast pulsed radiation from particle accelerators can utilize up to thirty 25-Mcy/sec transistorized scalers. Two or more systems may be used in parallel. The system — scalers, logic circuit, and automatic readout, provides visual readout and simultaneous printout. Printout rate may be four per second. Specifications provided by the manufacturer include: resolution, 40 nsec in triple pulses; sensitivity, 500 mv minimum for triangular pulses of 6 nsec base width; maximum pulse height 10 volts; manual and electronic reset; binary-coded-decimal output with 24 wires per scaler; readout nondestructive. Optional circuits permit additional readout technique, including punched tape and typewriter.—J.S. (Numec Instruments and Controls Corp., Apollo, Pa.)

Circle 45 on Readers' Service card

Ionization chamber (model 1C-5) is designed for remote automatic measurement of ionizing radiation flux. The instrument is sensitive to radiation from any direction over a wide dynamic operating range. The instrument consists of a thin-walled, stainless-steel, nonmagnetic and corrosion-resistant sphere containing inert gas and equipped with a self-contained charging mechanism and output amplifier. In operation, ionizing radiation penetrating the wall of

the sphere discharges a previously charged conductively coated quartz rod. As the charge is dissipated, a 10-μ quartz filament contacts the rod, recharges it, and then springs back to its next position. The process repeats itself, generating pulses at a frequency proportional to the intensity of the radiation. The pulses appear across a resistance in series with the fiber and are coupled to a high-impedance amplifier. Frequency of the output signal can vary from one pulse in 7 hours to 100 per second, equivalent to a flux range of 0.01 mr to 50 r/hr. The 5-inch-diameter chamber permits passage of alpha particles of 40 Mev or greater, beta particles equal to or greater than 0.5 Mev, protons of 10 Mev or greater, and all gamma rays. The instrument tolerates temperature environments from −50° to +150°C.—J.S. (Electro-Optical Systems, Inc., 300 N. Halstead St., Pasadena, Calif.)

Circle 46 on Readers' Service card

Small volume metering pump is designed for the precise, reproducible metering of small liquid volumes. The flow rate of the pump is adjustable over a range of 3 to 180 ml/hr, and may be expanded to 700 ml/hr with an optional two-speed coupling. Accuracy of flow rate is 0.1 ml/hr over a 24-hour period against back pressures varying from 2 to 1,000 lb/in.^{2} The rate is reproducible in increments of 0.1 ml/hr through a vernier control knob on the pump. Including motor and mounting plate, the pump needs less than 1 ft^2 of bench space. It is expected to have wide application in column chromatography, industrial process systems, and laboratory control systems—wherever small volumes must be metered accurately, with reproducible settings, independently of varying back pressures.—R.L.B. (Spinco Div. of Beckman Instruments, Inc., Palo Alto, Calif.)

Circle 47 on Readers' Service card

Superconducting magnet makes the high-strength magnetic field it produces available outside of the bath of liquid helium in which the magnet must be immersed. The intense field of the air-core magnet is available in air at room temperature. The magnet is a coil of wire about 4 inches long, 4 inches in overall diameter, and weighing 5 lb. It is wound with a continuous strand of superconducting niobium-zirconium wire 0.01 inch thick. The air core has a diameter of 2 inches with a working diameter of 1 inch left after subtracting the space required by the Dewar container. Magnetic field is 30,000 gauss. In operation, a current is initiated in the coil, with an automobile-type storage battery. The battery is then disconnected and the current and the magnetic field it generates persist without loss as long as the temperature of the coil is kept at about 7°K.—J.S. (Westinghouse, Pittsburgh, Pa.)

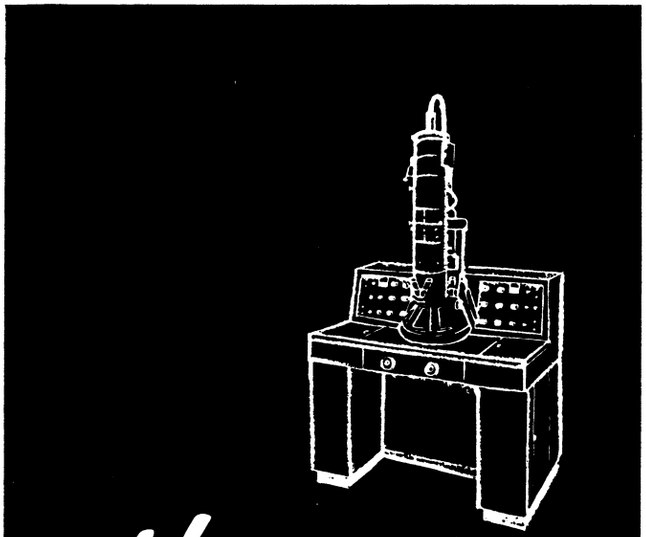
Circle 48 on Readers' Service card

Voltage reference (model PVR-1A) is a solid-state instrument that provides a six-digit dialout for any standard-cell voltage from 1.01000 to 1.02000 volts d-c. Stability is said to be ±0.0005 percent per °C from 10° to 40°C; regulation 0.001 percent for a 10-percent line-voltage change; linearity 0.002 percent. Stability for constant line and temperature is stated to be ±0.002 percent per month and ±0.004 percent per year. Output can be shorted for long periods of time without damage to the instrument. Output impedance is 5000 ohm/v. A Zener diode is used for internal reference. In addition to the adjustable output, a fixed output of 1.00000 volt d-c is also provided.—J.S. (Calibration Standard Corp., 1031 Westminster Ave., Alhambra, Calif.)

Circle 49 on Readers' Service card

Optical tracking sensor (model 381A) is designed to distinguish satellites and missiles against a stellar background by computing the difference in relative angular rates. This capability is provided by programming into the instrument the angular rates of the space vehicle's predicted trajectory. The instrument will detect a star of the 12th magnitude or an equivalent target, at night, and a 5th magnitude star in daytime. The sensing mechanism uses a multiplier phototube with trialkali photocathode. An automatic gain control circuit maintains linear tracking signals independent of illumination. Built-in oscilloscopes monitor relative position and intensity of the target for visual observation of the magnitude and orientation of off-axis deviation. The instrument features interchangeable telescopes with standard reflector of 40-inch focal length, 8-inch diameter, $f/6.3$, and a zoom telescope for boresighting and positioning. Angular field of view is adjustable from 1 min to 2 deg.—J.S. (Optomechanisms, Inc., Engineers Hills, Plainview, N.Y.)

Circle 50 on Readers' Service card



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Plant Physiologist, Biochemist, Ph.D., 2 years' postdoctoral, prefers research primarily or combination with teaching. Box 64, SCIENCE. 3/15

Senior Research Chemist: Ph.D., 1955. Age 54, wife, no children at home. Synthesis: nitrogen-carbon-oxygen heterocyclics, H. E. solid and liquid fuels, organometallics, organic phases of boron and light metal hydride chemistry. Research and development: tars, asphalt, felt, resins, butadiene and related compounds, oils, Freons, rubber gaskets, protective coatings. Desires challenging responsible growth position. Government clearance. Free to relocate. Salary lower teens. Box 71, SCIENCE. X

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(a) **M.S./Ph.D. Bacteriologist**; virology research; mideastern university. (b) **Nutrition Research**; M.S., histology, anatomy and embryology experience; West Coast university; to $8000. (c) **Ph.D. Organic Chemist**, reticuloendothelial system, neoplasia basic research; academic appointment available; East. (d) **Ph.D. Immunophysiologist**, medical instrumentation, contract research; academic appointment; South Coast. (e) **Ph.D. Microbiologist**, research, possible teaching; southeastern medical college; around $9000. (f) **Ph.D. Physiologist**, background in biophysics, biochemistry; establish research requirements for aerospace medicine; southwestern research foundation. (g) **Enzyme Research Assistant**, B.S. chemistry major or minor; central college; $6000. *Faculty Appointments*: (h) **Ph.D. Zoologist**, and **M.S. Biologist**; West Coast liberal arts college. (i) **Ph.D. Chemistry**, teaching, research in biochemistry, organic and physical chemistry. (j) **Physics Chairman**, southeastern technology institute; $9600 (9 months). Many other opportunities available for both junior and senior scientists. Please write Science Division, **The Medical Bureau, Inc.**, *Burneice Larson, Chairman*, 900 North Michigan Avenue, Chicago 11, Illinois. X

Positions Open-September 1963. **Molecular Biology** (microbiology, general biology) **Physical Science** (astronomy, meteorology, or physics); **Mathematics**—two positions (one topology); **Zoology** (anatomy, embryology)—temporary; **Geology** (physical, historical, paleontology)—temporary. Training and experience: doctorate or with course work completed. Teaching and research. Salarl range $6000–$10,000. Chairman, Division of Science and Mathematics, **State University College, Plattsburgh, New York.** 3/22, 29

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Applications should be forwarded to Dr. A. C. Cuthbertson, **Department of Chemistry, Box 133, Sackville, New Brunswick, Canada.** 3/1, 8, 15

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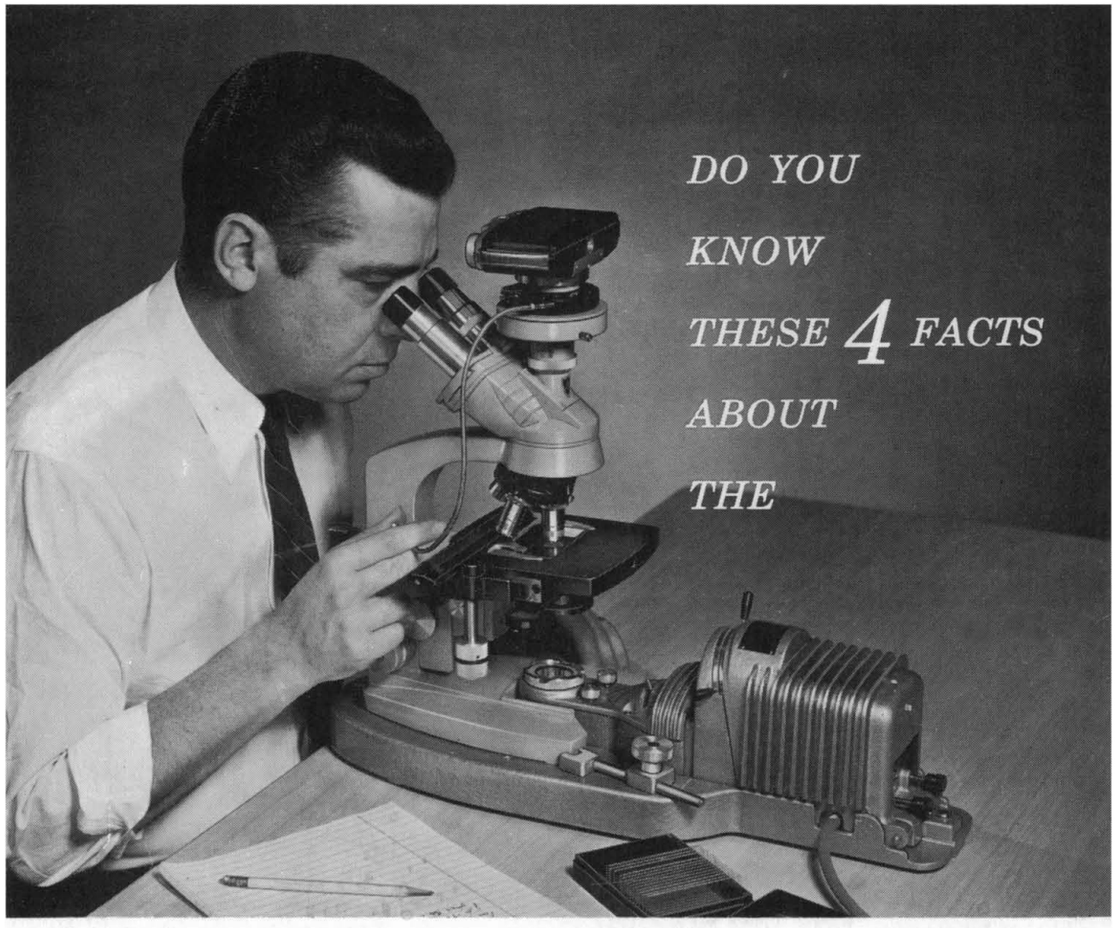

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