

23-25. **Optical Soc. of America**, 48th annual, Chicago, Ill. (OSA, 1155 16th St., NW, Washington 6)

23-1. **Association of American Medical Colleges**, Chicago, Ill. (R. H. Young, 303 E. Chicago, Chicago 11)

25. **Transport Mechanisms**, symp., St. Louis, Mo. (R. Rubright, Jewish Hospital of St. Louis, 216 S. Kings Highway, St. Louis 10)

25-27. **American Heart Assoc.**, 36th annual, Los Angeles, Calif. (American Heart Assoc., 44 E. 23 St., New York 10)

27-1. **American College of Surgeons**, 49th annual clinical congr., San Francisco, Calif. (ACS, 40 E. Erie St., Chicago 11, Ill.)

28. **American Soc. of Safety Engineers**, Chicago, Ill. (A. C. Blackman, ASSE, 5 N. Wabash Ave., Chicago 2)

28-29. **Combustion Inst.**, western states section, Los Angeles, Calif. (A. S. Gordon, Code 5059, U.S. Naval Ordnance Test Station, China Lake, Calif.)

28-29. **Pediatric Surgery**, intern., Paris, France. (D. Pellerin, Hôpital des Enfants-Malades, 149, rue de Sèvres, Paris 15^e)

28-30. **Antimicrobial Agents and Chemotherapy**, 3rd interscience conf., Washington, D.C. (E. E. Tretbar, American Soc. for Microbiology, 230 N. Michigan Ave., Chicago 1, Ill.)

28-30. **Electronics**, 19th natl. conf. and exhibition, Chicago, Ill. (NEC, 228 N. LaSalle St., Chicago 1)

28-30. **National Council for Geographic Education**, Columbus, Ohio. (L. Kennamer, Univ. of Texas, Austin)

28-31. **Technical Association of the Pulp and Paper Industry**, 18th engineering conf., New Orleans, La. (C. E. Green, B. L. Montague Co., Drawer 5428, Station B, Greenville, S.C.)

28-1. **American Inst. of Aeronautics and Astronautics**, 1st, Atlantic City, N.J. (Meetings Dept., AIAA, 500 Fifth Ave., New York 36)

28-2. **Stable Isotopes**, working conf., Leipzig, Germany. (Institut für Physikalische Stofftrennung, Deutsche Akademie der Wissenschaften, Permoserstr. 15, Leipzig 05)

29-31. **Aerospace Nuclear Propulsion and Power**, 2nd intern. symp., San Diego, Calif. (IEEE, Box A, Lenox Hill Station, New York 21)

29-1. **Plasma Phenomena and Measurement**, intern. symp., San Diego, Calif. (D. J. Niehaus, Bendix Corp., Research Laboratories Division, Southfield, Mich.)

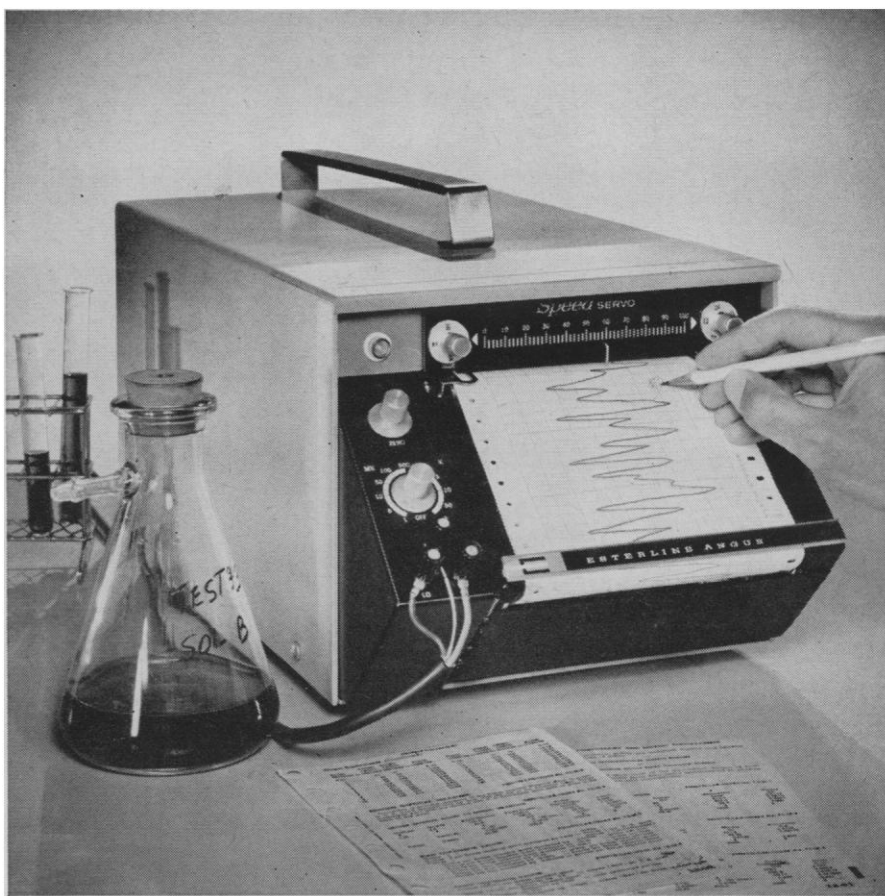
30-1. **Gulf Coast Assoc. of Geological Soc.**, 13th annual, Shreveport, La. (T. E. Godfrey, 201 Oil and Gas Bldg., Shreveport)

30-1. **Parenteral Drug Assoc.**, annual conv., New York, N.Y. (PDA, Broad and Chestnut St., Philadelphia 7, Pa.)

31. **American Federation for Clinical Research**, midwestern section, Chicago, Ill. (D. R. Korst, St. Joseph Mercy Hospital, Ann Arbor, Mich.)

31-1. **Materials**, intern. conf., Pittsburgh, Pa. (E. R. Schatz, Dean of Research, Carnegie Inst. of Technology, Pittsburgh 13)

31-2. **Paint Technology**, Federation of Societies, 41st annual, Philadelphia, Pa. (The Society, 121 S. Broad St., Philadelphia 7)



(Illustrated: New Portable Speedservo. Flush Panelgraph with 8" x 8" front also available.)

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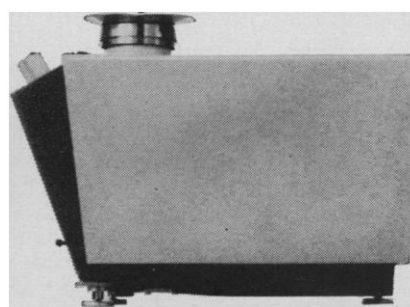
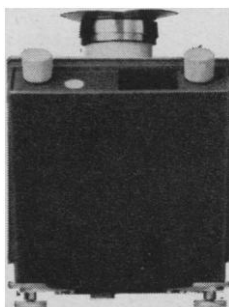
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ready to be loaded with the selected evaporant material. The beam material is changed by replacing the oven. Accelerating potential is 400 to 600 volts; analyzer potential is approximately three-eighths of the accelerating potential; filament current is 1.5 amp.—J.S. (Columbia Broadcasting System Laboratories, High Ridge Road, Stamford, Conn.)

Circle 1 on Readers' Service card

Electric oven with solid-state proportional temperature control is designed for ultra-reliable aging and storing of components, metals, parts, chemicals, and other materials. The control system incorporates solid-state circuitry, silicon control rectifiers, and a thermistor sensitive within 0.02°C . The 1800 series ovens give controlled temperatures up to 280°C . Control is within 0.2°C . The compact solid-state temperature control system eliminates common causes of electric oven failures. There are no relays, tubes, sliders, filled systems, or moving parts. The solid state controller efficiently proportions any single phase load on 120, 208, 220, or 240 volts, 50 to 60 cy/sec. Temperature is selected by a ten-turn potentiometer which has 1000 divisions. A Hi-Lo range selector switch doubles the maximum number of possible potentiometer settings. The chamber temperature is indicated on a sensitive, accurate pyrometer. The response of the controller to changes in the thermistor-probe sensing is many times faster than the controlled temperature changes, thus resulting in smooth, stepless control. An output meter, 0 to 100 percent, is provided. The control system includes Hotpack's independently circulated Limitstat which automatically prevents excessive temperatures. The conditioned air is circulated uniformly throughout the stainless-steel chamber by a motor-driven blower. Interior oven sizes are available up to 48, 24, and 36 inches.—R.L.B. (Hotpack Corp., Cottman and Melrose, Philadelphia 35, Pa.)

Circle 2 on Readers' Service card

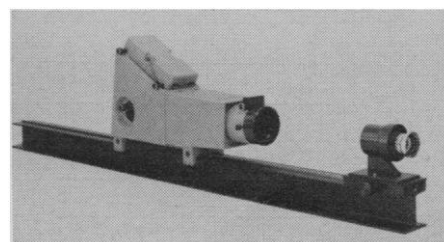
Instrument cooling kit (model DK-40) provides a source of cold that can be adapted to cooling radiation detectors or other instruments or components or for incorporation into apparatus for performance of measurements at temperatures below ambient. The cooler requires 145 watts at 117 volts, 60 cy/sec for operation. The cold is delivered to a rectangular plate measuring 3.75 by 4.25 inches. The cold plate is said to be capable of reaching -25°C rapidly in open air. Heat pumping capacity is 40 watts at zero temperature difference.—J.S. (Stoddart-Watson, Inc., 221 Crescent St., Waltham 54, Mass.)

Circle 3 on Readers' Service card

Nuclear magnetic resonance kit enables a student to build a proton magnetometer. Having been constructed and used by the student, the magnetometer can be readily dismantled for use by the next student, or it may be used for measurement of magnetic fields or for demonstration of nuclear magnetic resonance. The instrument consists of a marginal oscillator whose frequency is dependent upon the setting of a variable capacitor and the inductance of the probe-head coil. Nuclear magnetic resonance in the probe head loads the oscillator so that an absorption signal is produced. The signal is amplified by a three-stage transistor amplifier that will drive a pair of headphones or an oscilloscope. The probe head is small in diameter to permit measurement of magnetic field in narrow gaps and to allow nuclear magnetic resonance experiments to be performed with an inexpensive magnet.—J.S. (Scientifica, 148 St. Dunstan's Ave., Acton, London, W.3., England)

Circle 4 on Readers' Service card

Streak camera (model 770) is said to provide up to 3-nsec resolution. The instrument records 2-by-8-inch records on 70-mm film at 10 mm/ μsec maximum. Effective aperture at the film plane is $f/7.7$. The camera utilizes a 3000-rev/sec beryllium mirror turbine that is self-lubricated and operates on compressed air, with no helium require-



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

Robert L. Bowman (R.L.B.), with the assistance of Denis J. Prager (D.J.P.), 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 119. Circle the department number of the items in which you are interested on this card.

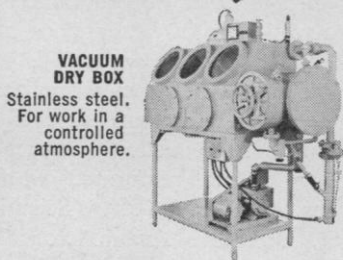
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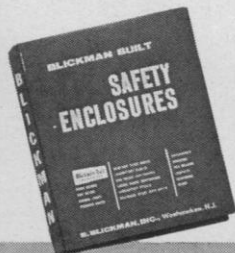
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ment. It is mounted on a 2.3-m H beam with the camera and objective lens mount aligned by a longitudinal key guide that runs the length of the beam. This makes possible interchange of objective lenses of various focal lengths without the necessity of realigning them with the camera.—J.S. (Beckman & Whitley, Inc., San Carlos, Calif.)

Circle 5 on Readers' Service card

Portable infusion pump works by electrolysis, uniformly generating a gas that moves a piston which drives the fluid. This battery-operated pump is available in 1-ml, 2-ml, and 10-ml capacities and the 1-ml pump measures 1.6 by 7.6 cm complete. The pumps may be driven at rates of from 1 ml per ½ hour to 1 ml per 24 hours. The 10-ml model features an automatic cut-off which stops the generation of gas at the end of the run. Sage micro-flow pumps can be used with any fluids compatible with glass. The pumping chamber and case assembly are autoclavable. They are designed for chemotherapy and other slow-rate infusion applications.—D.J.P. (Sage Instruments, Inc., 2 Spring St., White Plains, N.Y.)

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Small-angle generator is designed for calibration of angle measuring devices to 0.1 sec. The instrument consists of a beam pivoted on a cast-iron base using two hardened and lapped steel rollers between the lapped steel vees on the beam and on the base. A reflector is attached vertically to a right-angle bracket forming part of the beam. Angular tilts are generated by means of a micrometer screw. The micrometer drum is calibrated each second of arc and is read to 0.1 sec by means of a vernier. Total measuring range is approximately 3°. Angles can also be generated by gage blocks replacing the micrometer unit. A change of 0.005 inch in the size of the gage block generates an angular change of 1 min. A tolerance of 8 μinch on the gage block corresponds to an accuracy of 0.1 sec of arc.—J.S. (Engis Equipment Co., 431 Dearborn St., Chicago 5, Ill.)

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is thus obtained with samples as small as a milligram, or even less. These smaller samples are more uniform in temperature, and more uniformly exposed to the atmosphere. Transitions are sharper, and occur closer to the true transition temperature. The Cahn "Little Gem" TGA kit includes a platform for the RG electrobalance weighing unit, thermally insulated from the micro furnace below, Pyrex hangdown tubes, hangdown wire, quartz sample pan, and an analytical chromel-alumel thermocouple. The furnace consumes only 50 watts, and can be controlled by a low capacity autotransformer. Maximum furnace temperature is 650°C. It is easily lowered and rotated out of the way to change samples. A wide variety of commercially available temperature programmers can be added to the system if desired. Modern x-y recorders lend themselves to the most convenient ranges of mass change, down to 1 μg sensitivity. The temperature range of the "Little Gem" TGA kit is ideal for studies on plastics, pharmaceutical products, foodstuffs, and biological materials. Higher temperatures are required for geological and ceramic work, and can be obtained with the same balance, with the use of other accessories. Other accessories are also available for controlled atmospheres and vacuum, and larger samples.—R.L.B. (Cahn Instrument Co., Paramount, Calif.)

Circle 8 on Readers' Service card

The Hitachi RMU-6A mass spectrometer has a mass range extending to greater than M/e 1000 and is said to provide unit resolution at M/e 750. Detectability is given as better than 5 parts per million, and analysis sensitivity, greater than 550 divisions per micron Hg for normal butane. Utilizing a Faraday cage ion collector and a vibrating reed amplifier, the instrument operates with precision better than 0.5 mol percent and shows less than 1 div/hr drift. The instrument uses magnetic-field scanning with a compact, 8-inch-radius, 90-deg-sector electromagnet. A single spectrum can be scanned continuously from M/e 2 to 1000 without stopping the instrument. A variable micrometer collector slit, adjustable from outside the vacuum, allows the operator to control resolution and sensitivity and to measure beam widths directly. The inlet system, optionally either all glass or all metal, can be heated to 350°C with temperature control to permit measurement of samples of low vapor pressure. The

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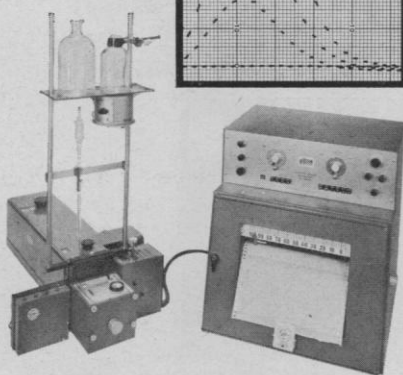
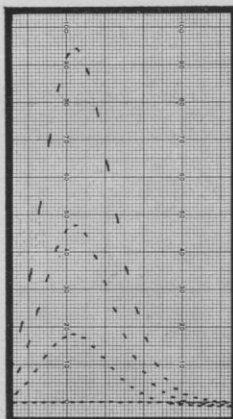
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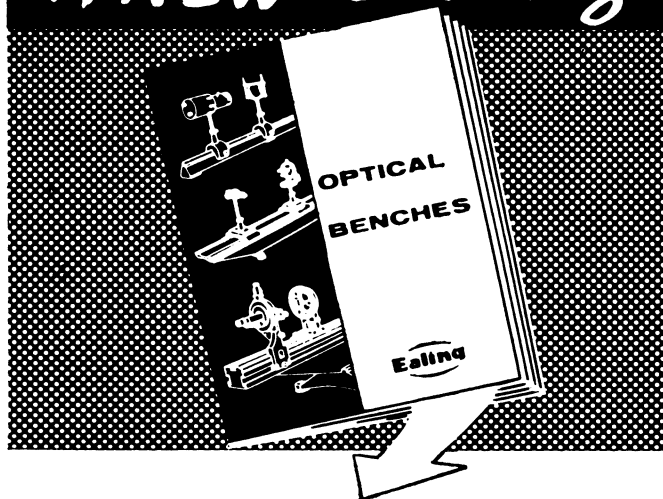
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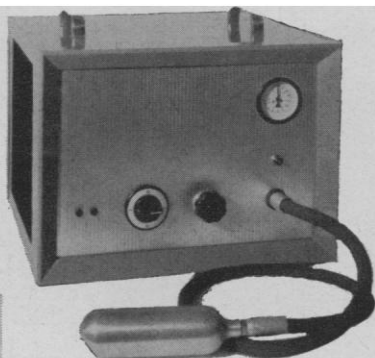
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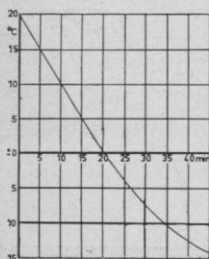
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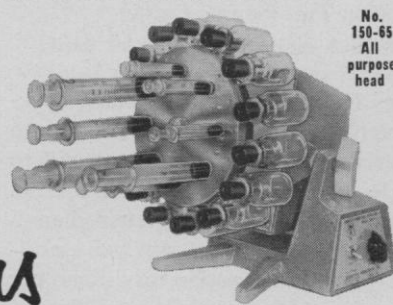
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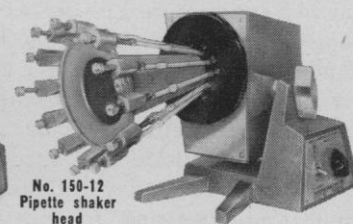
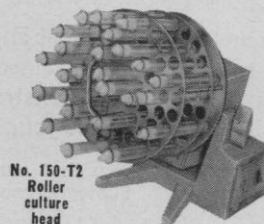
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sample can also be introduced directly into the ion source. Ion trajectory radius is 200 mm; deflection angle is 90 deg; maximum field is approximately 7500 gauss; ion acceleration voltage is adjustable between 1 and 3 kv and by steps to 5 kv.—J.S. (Perkin Elmer Corp., Norwalk, Conn.)

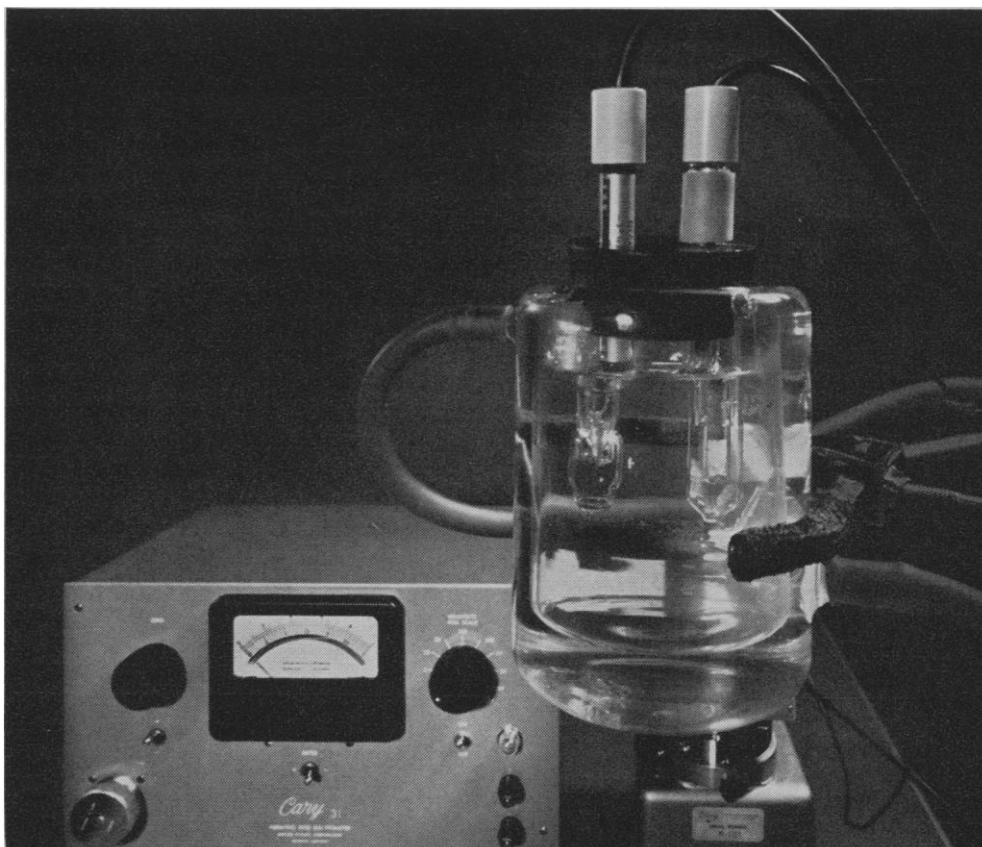
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Polarographic apparatus permits standard d-c dropping mercury, stripping analysis, rapid controlled drop, and a-c polarography to be performed for optimum utilization of the method for a wide variety of analyses. The Metrohm Polarecord (model E 261-R) provides a wide range of d-c voltage programs and current ranges, as well as a built-in first derivative recording circuit. The a-c modulator E-393 is available for locating the maximum slope of the polarographic waves. Recorder responds full scale (250 mm) in 1 sec and has a maximum sensitivity of 0.0001 $\mu\text{A}/\text{mm}$ with a measuring accuracy of 0.5 percent of full scale. Regular d-c and rapid techniques are applicable to concentrations down to $10^{-6}M$ while stripping technique can be used to extend the sensitivity to measure to $10^{-9}M$

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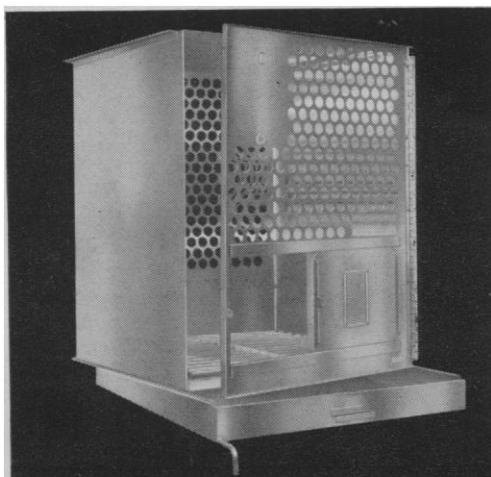
New data sheet on pH measurements plus details on Cary Model 31 are available by writing for Data File E233-103.

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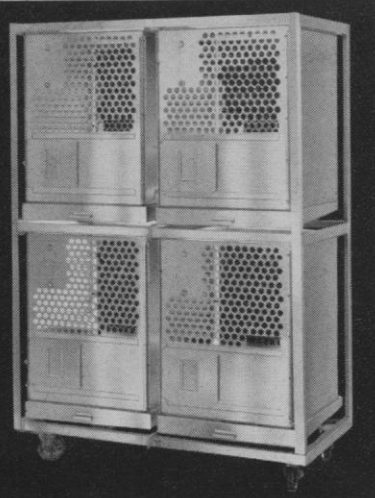


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where electrolysis is performed on a single mercury drop. The high versatility is possible because the chart speeds, voltage scan speeds, and compensation facilities required for the various techniques have been incorporated in one basic instrument with a recorder.—R.L.B. (Brinkmann Instruments, Inc., 115 Cutter Mill Rd., Great Neck, N.Y.)

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Laboratory model **arc-heated hyper-thermal tunnel** is a scaled-down version of larger research installations, designed for educational and smaller research establishments. It consists of a plasma generator, supersonic nozzle, control console, power supply, test chamber, vacuum pump and piping, and cables for interconnection. To operate the tunnel, with the vacuum pump running, a nitrogen flow is established through the plasma generator. The power supply is energized and the arc initiated. With the stable jet operating, the desired nitrogen and oxygen flow rates and power input are set. The plasma discharge device combines the high-temperature characteristics of an electric arc with a continuously released independent gas source to create a high-velocity jet flame of nearly neutral plasma. The plasma stream discharges into an aerodynamic mixing chamber and nozzle assembly in which the stream becomes uniform, and is then expanded to supersonic velocities. Nominal power input is 80 kw; enthalpy range is 2000 to 25,000 Btu/lb.—J.S. (Plasmadyne Corp., 3839 S. Main St., Santa Ana, Calif.)

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Colorimetric data can be obtained and recorded accurately and rapidly by means of a low-cost system introduced by Bausch and Lomb. Called the Data Acquisition System, it is simply a combination of the standard Spectronic 20 colorimeter, a strip chart recorder, and a flow-thru cuvette. Eliminating the need for test tubes, this cuvette uses a vacuum pump-probe and can be filled or emptied in several seconds. With this system, as many as four samples per minute can be run. A special adaptor allows the recorder to be used with the Spectronic 20 so that colorimetric data can be recorded as well as read on the meter. In this way accuracies of from 0.25 to 0.5 percent can be achieved.—D.J.P. (Bausch and Lomb, Rochester 2, N.Y.)

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Chemical Applications of Infrared Spectroscopy

Edited by C. N. R. Rao

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The work presents an invaluable introduction to the most useful physical technique available to chemists for the elucidation of molecular structure and for qualitative and quantitative analysis.

Gas Chromatography

Fourth International Symposium held under the auspices of the Analysis Instrumentation Division of the Instrument Society of America, June 1963

Edited by Lewis Fowler

Winter 1963/64, about 275 pp.

Gas Chromatography provides a wealth of new, informative data on applications of thermodynamic theory to gas chromatography (and the reverse), and advanced separation techniques. Proceedings of the first three symposia are also available.

Fifth International Congress for

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Philadelphia, 1962

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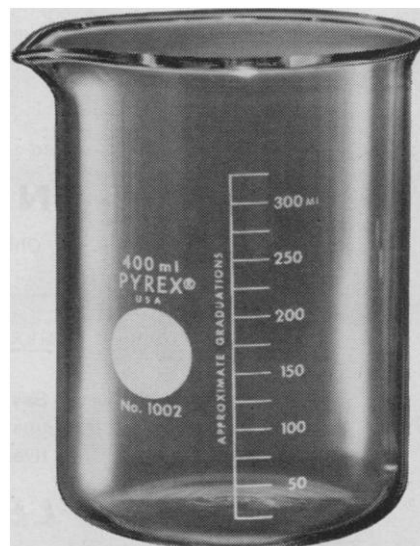
Solder-glass kit provides the experimenter with the means to build vacuum-tube structures of soft glass with expansion coefficients in the range of 80 to 100×10^{-7} per degree centigrade, using the solder glass to seal caps and headers to the tube body. It is available in 1-lb and 5-lb sizes and consists of a suspension of solder-glass powder in a nitrocellulose solution in amyl acetate. To use the material, the powder is mixed with the suspension vehicle to make a thick paste that is applied to the glass tube components over the sealing areas. After firing, the paste forms a permanent vacuum-tight glass seal. The firing operation gives best results when carried out in a furnace or oven, but flame sealing is said to be possible.—J.S. (Corning Glass Works, Corning, N.Y.)

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Tetrapolar resistive electrical impedance plethysmograph measures, and computes volume changes from 0 to 10 lit. for recording in cubic centimeters. Biological pulses are produced by movements, vascular expansion, and redistribution of blood cells and plasma based on ionic conductance. The first derivative or velocity of these biophysical phenomena is measured and recordable in cubic centimeters per second. The instrument includes the direct measurement of segmental resistive impedance from 0 to 1000 ohms and its changes to 1-percent accuracy. It is adaptable to a wide range of conventional recorders and biological problems, including respiratory volume described by Nyboer and his associates. Simultaneous electrocardiograms, electroencephalograms, and blood pressure recordings do not distort the fidelity of the measurements.—R.L.B. (Physical Dynamics Corp., 1683 Hawthorne, Grosse Points Woods, Mich.)

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Thermoelectric immersion cooler is a thermal pump weighing 1 kg and measuring 30 cm long, 7 cm wide, and 2.9 cm thick. In operation, tap water is passed through the central part of the unit at a rate of at least 1.9 lit./hr and is discarded into a drain. When the thermocouples located between the central part and the nickel-plated outer shell are energized by application of 3 volts d-c at 25 amp, the immersion cooler will initially pump 52 thermal watts when the liquid in which it is immersed is at the same temperature as the tap water. When the temperature



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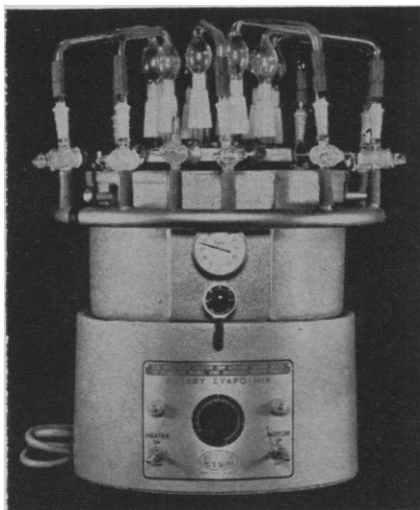
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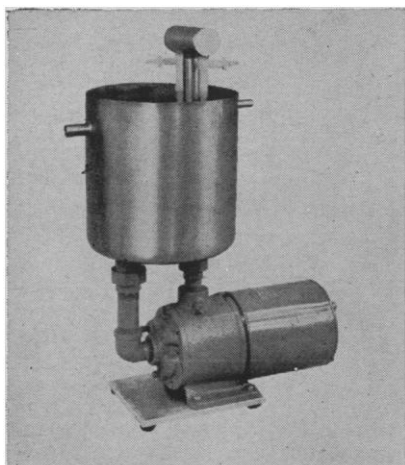
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outside the shell has been reduced 45°C below the temperature of the tap water, thermal pumping rate is 17 watts. By means of a thermoregulator in the a-c line to the d-c power supply of the unit, the temperature may be controlled below room ambient. The unit becomes an immersion heater when polarity of the current through the thermal pumps is reversed.—J.S. (Whirlpool Corp. Research Laboratories, 300 Broad St., St. Joseph, Mich.)

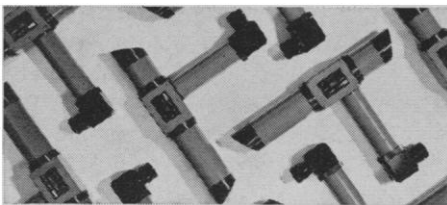
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Capacitance bridge (model B-541) features automatic balancing on all ranges and accuracy said to be ± 0.25 percent. The bridge is a transformer-ratio-arm type permitting two or three terminal measurements. Excitation frequency is 1000 cy/sec. The circuit employs ratio transformers operating in conjunction with an operational feedback amplifier and a phase sensitive detector. Three digit readings are obtainable on each of the instrument's seven ranges, the first digit being obtained by the setting of an 11-position decade switch and the other two being provided by direct meter readings. The decade switch functions as a coarse balance control, and the fine balance adjustment is automatically established by the feedback action. The meter registers the magnitude of the feedback signal and is calibrated directly in μf or pf. Range of the instrument is from 0.01 pf to 11 μf . Outputs are provided for digital voltmeters, limit switches, or recorders. Recorder output voltage is linear with capacitance. The bridge also measures loss factor with full-scale range 0 to 0.1 on any capacitance range.—J.S. (Wayne Kerr Corp., 1633 Race St., Philadelphia 3, Pa.)

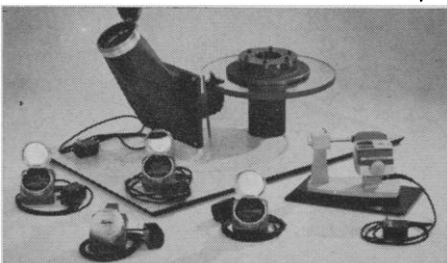
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Radiation shielding material is 76 percent lead by weight in combination with various light elements. It can be mixed and poured like concrete, precast like concrete, plastered, or painted. It is machinable and is said to be self-supporting and capable of structural usage. It is not damaged by exposure to snow, ice, rain, mild acids, mild alkalies, or immersion in water. It will not resist abrasion or undiluted strong acids and is structurally inferior to concrete. This material is said to have a very low activation rate from neutron flux and to be a good attenuator of neutrons.—J.S. (Chemtree Corp., Harriman, N.Y.)

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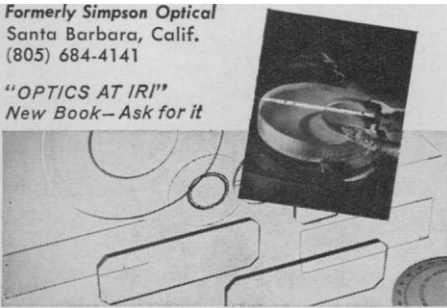
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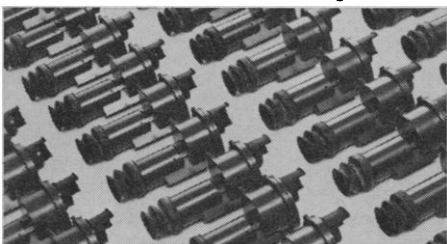
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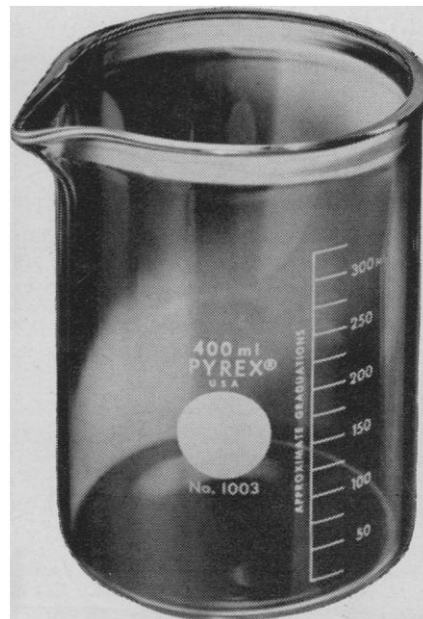
Survey meter is a portable, transistorized, ionization chamber instrument for monitoring exposure levels of x-rays and beta and gamma radiation. The detector, an ion chamber with a 0.7 mg/cm² aluminized mylar window, is protected by a movable shutter which discriminates between betas and gammas. Exposure is read on a 4-inch linear meter calibrated in mr/hr and five linear decade ranges give full scale readings of from 5 mr/hr to 50 r/hr. On the low scale range of 0 to 5 mr/hr the maximum personal dosage of 2 mr/hr can be determined accurately in the middle of the scale. The meter features transistorized printed circuitry and uses one standard mercury cell capable of 400 hours of operation. Battery condition is indicated by an external glow tube and the battery is accessible without disassembling the instrument. A radium source is included for checking the instrument. Applications include determining the effectiveness of shielding, monitoring the areas around reactors, accelerators, and x-ray machines, and surveying persons who have undergone radiotherapy.—D.J.P. (Atomic Accessories, Inc., 811 W. Merrick Rd., Valley Stream, N.Y.)

Circle 19 on Readers' Service card

Random access disk file (model 800) is modular in concept and is available with storage capacity ranging from 20,160,000 bits on a single disk to 161,280,000 bits on the full complement of eight disks. The disk assembly is mounted on an 11.5-inch drum to assure rigidity. Disks are spaced 1.5 inches apart to reduce air turbulence. Air-bearing read-write-erase heads are maintained approximately 0.5 mil from the disk surface and are mounted in a gimbal that allows freedom to compensate for slight variation in disk surface. A wide erase gap insures a 6-mil guard band between written tracks. Positioner and head assembly can be tilted out for ease of maintenance. Mechanical detents are used to hold positioning mechanisms at the selected positions.—J.S. (Analex Corp., 150 Causeway St., Boston 14, Mass.)

Circle 20 on Readers' Service card

The Handling and Storage of Liquid Oxygen, a 9-page bulletin, is divided into six sections covering general properties, hazards, safety measures, transfer and storage, shipping, and recommended safety instructions. Details are given on chemical composition, general appearance, chemical nature, physical



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properties, solubility, and stability of liquid oxygen. In addition, health, fire and explosion hazards, general safety measures, education of personnel, and personnel protection are also covered. Recommendations for liquid oxygen transfer and storage, including equipment specifications, loading and unloading instructions, applicable shipping laws and specifications for shipping containers, are outlined in this comprehensive bulletin. The bulletin, prepared by the Office of the Director of Defense Research and Engineering, is available gratis.—R.L.B. (North American Philips Co., Inc., Mendon and Angell Roads, Ashton, R.I.)

Circle 21 on Readers' Service card

X-y recorder (model HR-95T-N) incorporates a completely self-contained null detector for high-speed point plotting in addition to the normal recording function. The transistorized null detector has a sensitivity of 0.25 percent, equivalent to 400 channels on the x axis, and is said to be capable of plotting up to eight points per second, with an average of four points per second for normal recording. No adjustments are provided and no calibration is required. To achieve maximum plotting speeds, when the instrument is used to record the output of multi-channel analyzers, an advance signal is sent to the analyzer after a point has been plotted. An adaptable plug-in card provides any type of clear signal. An automatic advance signal drops the pen and commands the analyzer to advance at the rate of two channels per second should the y axis be driven off scale by an excessive input signal. An automatic standby disables the recorder when an oscilloscope is being used to view the signals.—J.S. (Houston Instrument Corp., 4950 Terminal Ave., Bellaire 101, Tex.)

Circle 22 on Readers' Service card

The Multicoder **shaft angle digitizer** system is said to sense angles with a precision of one part in 3,500,000 and to convert the angle information to a digital form suitable for numerical indication, digital computing, or data recording systems. Sampling rate range is 0 to 1 kcy/sec. The system uses a special Multisyn unit containing a 360-cy/sec Inductosyn, conventional pancake resolver, rotary transformer, and special flexible coupling. The phase-measuring digital electronic system employs a circuit said to be relatively insensitive to component variations.

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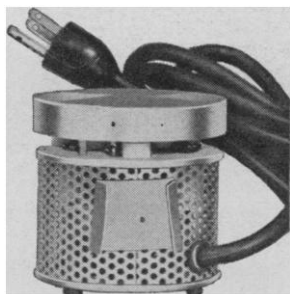


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Output is supplied in binary-coded-decimal form or straight binary, depending on the model.—J.S. (American Optical Co., 4709 Baum Blvd., Pittsburgh 13, Pa.)

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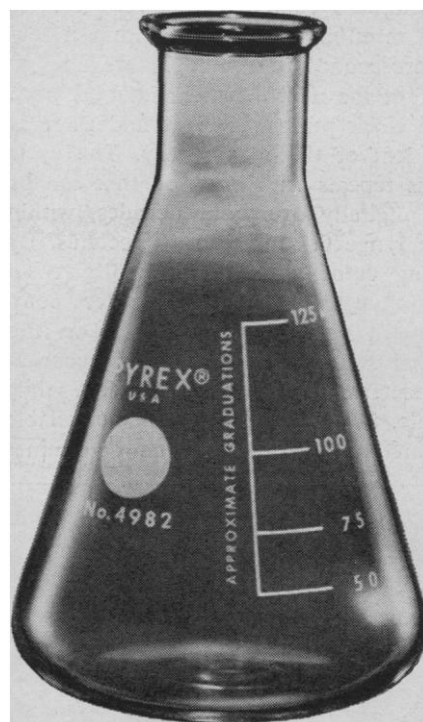
Transistor relay (model 32) is a heavy-duty semiconductor powered relay capable of switching 15-amp loads with no auxiliary relay needed. It is primarily intended to be used with open-and-close controls, such as thermostats to control baths or ovens. However, it can also be triggered by resistance changes of as little as 1 percent at maximum sensitivity. By varying the sensitivity, the resistance required to switch the relay can be varied from 15,000 ohms to 1 megohm. Response time is limited to 0.5 sec by a time delay, to reduce relay chatter. Silicon transistors are used to power the mechanical relay and reliable operation is claimed at ambients of from 15° to 45°C. The instrument measures 4 by 7 by 4 1/2 inches, and draws 5 watts from a 115-volt 50/60 cycle lens.—D.J.P. (Fisher Scientific Co., 415 Fisher Bldg., Pittsburgh 19, Pa.)

Circle 24 on Readers' Service card

Megohmmeter (model 2850) is a portable instrument powered by line alternating current. It provides direct reading of resistance on a 4-inch scale calibrated from 1 to 100 megohms. The range may be multiplied in decades to 10⁵ by means of a selector switch. Six ranges are available at either 500 or 50 volts d-c. Accuracy is ±2 percent over the greater portion of the scale range when used at 500 volts, and ±5 percent with 50-volt operation. A fused three-wire power input grounds the case and the instrument is protected from overload damage even in cases of direct shorting. Guard circuits control stray and leakage currents to assure accuracy at maximum sensitivity. A terminal is provided for external guard use and a selective return grounding circuit provides guarding flexibility.—J.S. (Associated Research, Inc., 3758 Belmont Ave., Chicago 18, Ill.)

Circle 25 on Readers' Service card

Digitimer provides a means of calibrating the time axis of the oscillograph, provision for adjusting the repetition rate or cycle period of the experiment, and the possibility of triggering oscillograph time-bases and stimulus generators at predetermined times within the period of the experi-



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ment. A time scale is provided to calibrate the time base of the oscillograph. This is derived from a quartz crystal clock pulse generator, giving 0.1-msec intervals, and driving a number of counter stages having decimal outputs. These outputs are combined to form a ruler type of time scale with intervals which can be selected within the range of 0.1 msec to 100 msec to be appropriate to the time base velocity in use. The repetition rate of the experiment is set by using the decimal counting stages to count a preset number of 0.1-msec intervals, and then resetting the counters back to zero. As the resetting is achieved within a few microseconds the counters are able to accept the next 0.1-msec interval from the clock pulse generator and there is no loss of timing accuracy. The cycle thus repeats with a period that can be set digitally over four decades, within the range 0.1 msec to 10 seconds. By using coincidence circuits to give an output when the decade counters complete a period previously set on the panel switches, output pulses occur at predetermined positions on the time scale. Six of these pulses are available from the instrument. One determines

the cycle period by resetting the counters, as described. Of the remaining five available for external use, one is fixed at the start of the cycle while the other four are adjustable in 0.1-msec steps to any time within the cycle period. In addition, two bi-stable circuits used as gates, opened and shut by the coincidence pulses, provide square waves of variable duration and of either polarity. They are useful (after suitable attenuation) for calibration signals for amplifiers or for setting the duration of an event such as a stimulus. Sufficient power is available to operate relays, allowing considerable flexibility in the external circuitry, together with electrical isolation. Crystal control is optional.—R.L.B. (Applied Electro-Physiology, National Hospital, Queen Square, London, W.C.1, England)


Circle 26 on Readers' Service card

Ultraviolet flashlight contains a 2-watt gaseous ultraviolet lamp powered by a solid-state power inverter operating from three standard, size-D flashlight cells. Physically it resembles a standard three-cell flashlight. It emits ultraviolet in the 3100- to 3900-Å region and will give a minimum of 2

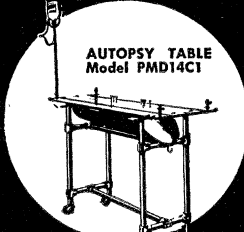
hours' service in intermittent use. Applications include detection of fluorescent tracer dyes, excitation of biological and mineral fluorescence, and product inspections.—R.L.B. (M. E. D. Electronics Inc., 102 West Jefferson St., Falls Church, Va.)

Circle 27 on Readers' Service card


Arc-lamp power supply is designed to operate xenon, xenon-mercury, and mercury high-pressure arc lamps at high efficiency and stability. The power supply utilizes a closed-loop circuit through a high-gain magnetic amplifier to dynamically stabilize the output current to ± 0.05 percent for line variations of ± 20 volts. When tested with an L250 xenon-mercury lamp, line variation of ± 20 volts gave light fluctuations of only ± 22 lumens out of 11,000. Output current is variable from 0 to 10 amp with voltages from 0 to 100; maximum available power output is 1.5 kva for starting surges. Lamp current and voltage are given on front panel meters. A push button provides 25 kv of rf power for starting the lamp. Output terminals are provided for lamp power and power for the lamp blower. A universal lamp



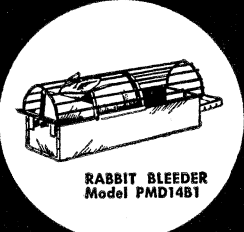
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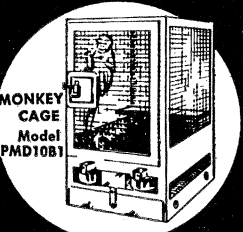
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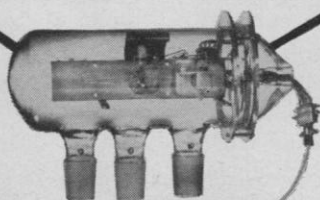
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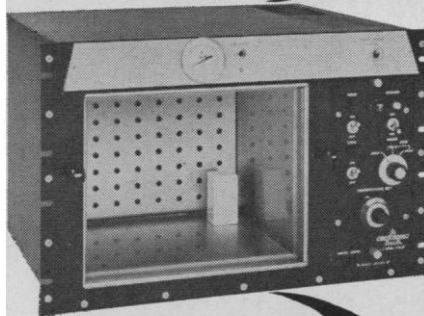
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too close to a corner?



Not in a Delta 8000
Low-Gradient Temperature
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All interior test space in Delta Design 8000 Low-Gradient Temperature Chambers is usable space—unlike many chambers which maintain their temperature gradient specifications only in the center area.

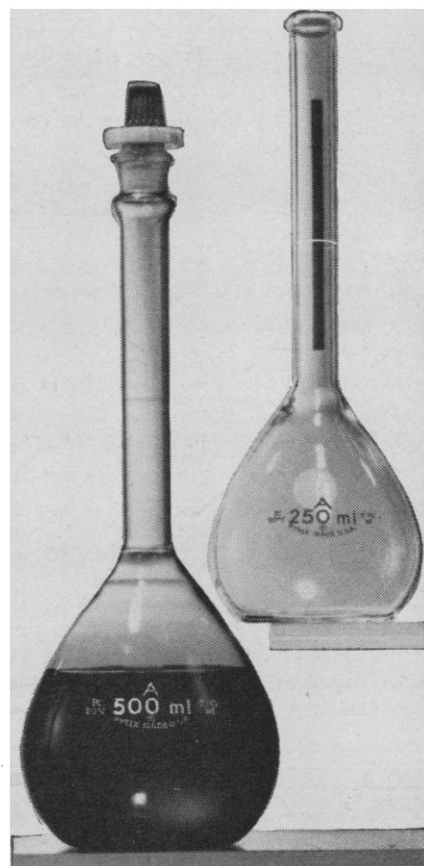
To prove the point, Delta measures and specifies the temperature gradients of its 8000 chambers—not only near the center—but also $1\frac{1}{2}$ " from each corner. Therefore, its specified gradients of $\pm 1\frac{1}{2}^{\circ}\text{F}$ at 300°F and $\pm 1^{\circ}\text{F}$ at -65°F apply to the difficult corner spaces as well as the rest of the chamber interior.

In competitive tests, a major semiconductor manufacturer reported the Delta 8000 was within its gradient specs while a competitive chamber advertising "gradients to $\pm 3\frac{1}{4}^{\circ}\text{F}$...and control to $\frac{1}{4}^{\circ}\text{F}$..." had gradients of $\pm 16^{\circ}\text{F}$ and temperature control variations of $\pm 4^{\circ}\text{F}$ when measured $1\frac{1}{2}$ " from the corners.

The Delta solid-state temperature controller provides control to 0.1°F at 300°F and less than $\frac{1}{2}^{\circ}\text{F}$ at -65°F . For automatic testing, mate the 8000 with the wide Delta line of programmers and pre-wired component trays.

And, because all Delta products are now sold and serviced by Non-Linear Systems, Inc., and its 22 factory offices located throughout the United States, you receive unmatched service right in your own area.

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What's your best buy in Volumetric Flasks?

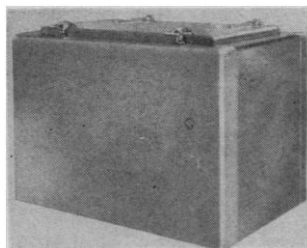
If you use stoppered flasks, it's No. 5642. This PYREX® brand flask gives you Class A accuracy *plus* the strength of uniform glass distribution in the walls *plus* the economy of polyethylene stoppers.

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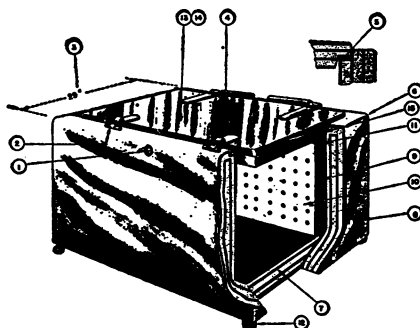
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All cabinets are manufactured of welded and polished stainless steel which contributes to cleanliness, appearance and serviceability. Efficiency has been accounted for in such features as high quality insulation, interchangeable storage inserts and size. The width allows passage through a normal door and the length is the only dimension changed in the three sizes. The cabinets are built with or without the CO₂ entering the storage compartment. The cabinet on the left is our standard model and the drawing below shows construction of the cabinet.

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2. Lock Type heavy duty door, lift handles.
3. Width permits access through narrow row doors.
4. Industrial type hinges.
5. Moisture seal.
6. Rounded seamless corners and edges.
7. Cork insulation with asphalt barrier layers for moisture sealing.
8. Welded and polished stainless steel.
9. Dry Ice Compartment.
10. Perforated stainless steel separator.
11. Water tight stainless steel storage tank.
12. Ball bearing casters.
- 13-14. Insulated handle on inside of door and stop.
15. Breaker strip to minimize heat conduction.



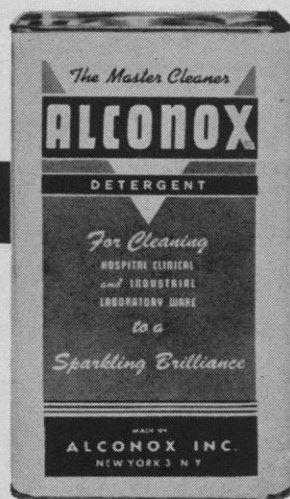
Model CS-34

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housing with built-in blower, ultraviolet transmitting optics, and spherical reflector is available for convenient mounting of high-pressure arc lamps.
—D.J.P. (Schoeffel Instruments, 355 Hillsdale Ave., Hillsdale, N.J.)

Circle 28 on Readers' Service card

Digital event recorders are available in two models, the DER-600 with a maximum 600-channel capacity, and the DER-2000 for monitoring up to 2000 channels. Both models operate at 100 kcy/sec, sequentially scanning up to 2000 channels in 2 msec and printing or reading out the time, direction, and channel numbers of any changes in channel status. Output can be into a line printer, paper-tape punch, or high-speed buffer for transfer to magnetic tape or for direct input into a computer. In operation, the event recorders initially scan all channels and record the status of each channel condition. On subsequent scans, readout occurs only on those channels where a change has taken place. Whenever a change does occur, the new status is stored in the instrument's memory for comparison during subsequent scans. Readout of all channels can be accomplished on command, manually or automatically. A 24-hr digital clock supplies a time reference to the output device every 10 min. Provision is made for artificial event generation for checkout purposes.
—J.S. (Packard Bell Electronics, Computer Div., 1905 Armacost Ave., Los Angeles, Calif.)

Circle 29 on Readers' Service card

Pipet-buret dispenses fluids and indicates the volume dispensed on a 4-digit counter which is coupled to a micrometer-driven plunger. The device is designed for one-hand operation or clamp mounting and has a trigger release for dispensing and resetting with one hand. Accuracy of 0.1 percent of dispensed volume is claimed, with readability to .01 percent. The device is available in .01, 0.1, 1, and 10-ml sizes with a variety of interchangeable tips.—R.L.B. (Manostat Corp., 26 N. Moore St., New York 13)

Circle 30 on Readers' Service card

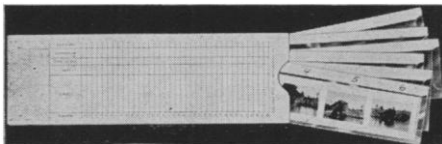
Two-color pyrometer measures continuously in temperature ranges from 1400° to 6500°F with temperature spans from 500° to 2000°F covered by a single scale. Scale readings are said to be linear and to be accurate within ±20°F on the 2000°F range for ambient temperatures up to 140°F. Auto-

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SCIENCE, VOL. 142

NEGA-TUBES

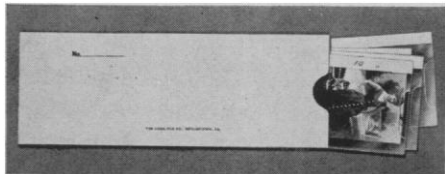
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NEGA-TUBES are thumb-out pockets with
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6—35mm \$.27
35-G-6—Glassine Envelopes; 6 strips of
6—35mm12



22-4-A (Shown) Acetate; 3 strips of 4—
2 1/4 x 2 1/4 film22
22-4-G—Glassine Envelopes; 3 strips of
4—2 1/4 x 2 1/4 film12



22-5-A (Shown) Acetate; 5 strips of 3—
2 1/4 x 3 1/4 film31
22-5-G—Glassine Envelopes; 5 strips of
3—2 1/4 x 3 1/4 film16
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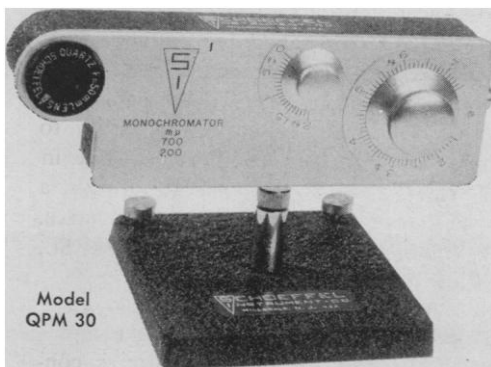
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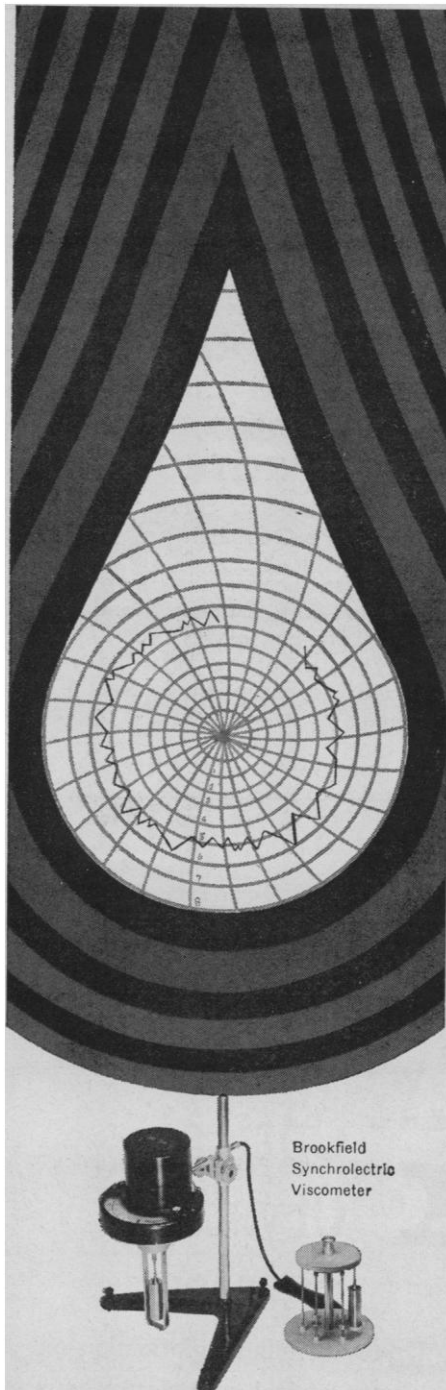


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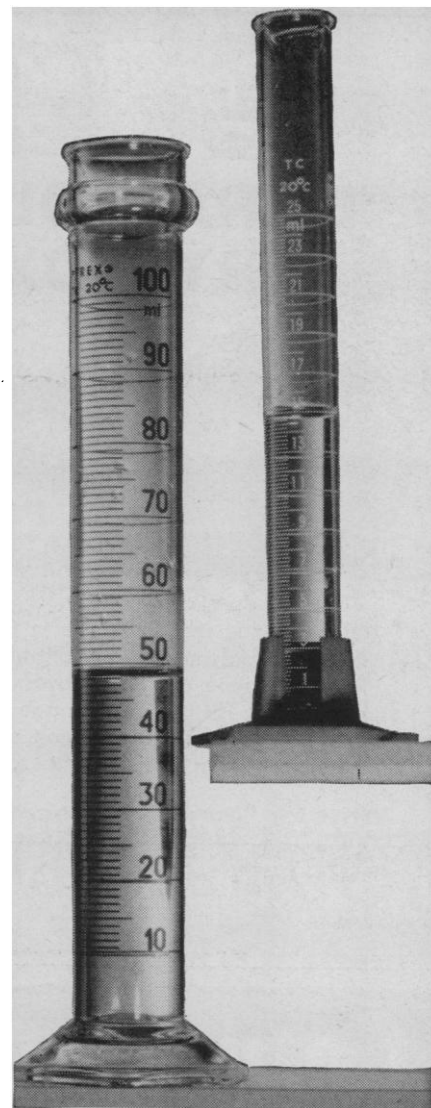
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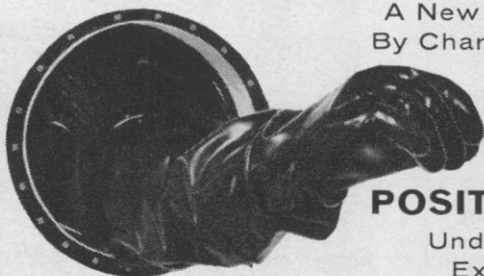


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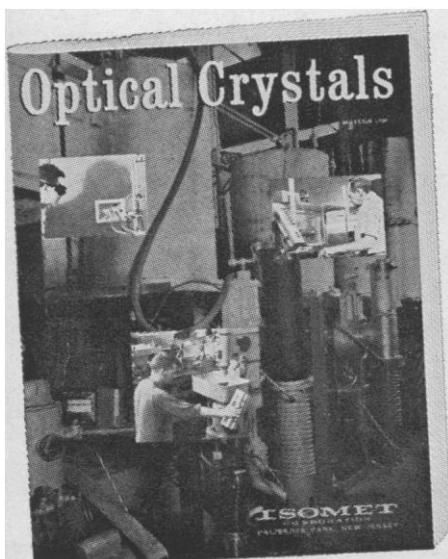
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matic compensation is provided for varying radiation intensity and a voltage regulator protects the phototubes from the adverse effects of high light intensities. Accuracy is maintained for line voltage variations between 105 and 130 volts. Manual calibration can be accomplished at any time during operation and automatic periodic calibration is optionally available. By either method, calibration can be accomplished within 5 sec. Field of view is adjustable from a minimum of 0.4 inch diameter at 36 inches, to a maximum of 4 inches diameter at 36 inches, and focusing range is 36 inches to infinity. Response time is $\frac{1}{60}$ sec for temperature changes less than 20 percent of range. Indication is provided by a 6-inch meter and output for recorder actuation is 0 to 100 mv at 1000 ohms.—J.S. (Milletron, Inc., 454 Lincoln Highway East, Irwin, Pa.)

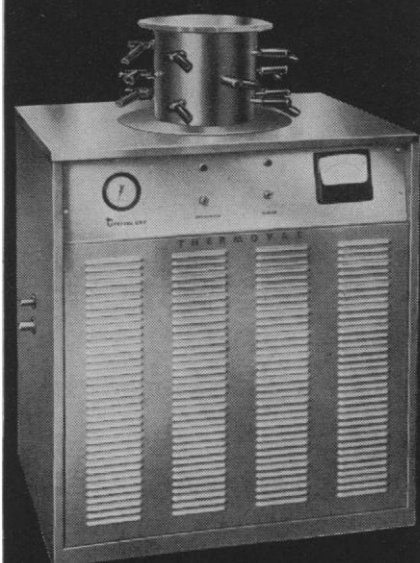
Circle 31 on Readers' Service card

Gallium-arsenide injection laser is available on a sampling basis. The unit is said to have produced coherent emission with input currents of less than 5 amp at liquid-nitrogen temperature. Emission wavelength of 8400 Å is almost centered on the peak of the response curve of conventional photomultipliers. The injection laser incorporates a diffused junction. Pumping occurs along the junction and coherent infrared radiation is emitted from the edge of the pellet. Current density requirement is 1000 to 10,000 amp/cm² and voltage requirement is 1.5 to 4 volts at 77°K. Typical values for the developmental type injection laser at 77°K are: threshold current, 20 amp; wavelength at maximum energy, 8400 Å; line width at threshold, 8 Å; junction area, 10⁻³ cm; laser radiation power, 0.5 watts. Actual values are specified with each crystal. The unit is supplied in a modified TO-5 package with a window at the top.—J.S. (Radio Corp. of America, Somerville, N.J.)

Circle 32 on Readers' Service card

Power supply (model 1101) provides ten different d-c voltages by use of plug-in voltage-regulator cards over the range 1 to 35 volts, both positive and negative. Each voltage-regulator card may be plugged into any one of ten receptacles, where the correct unregulated d-c voltage is picked up, and the regulated output is placed on a specific bus line according to the nominal voltage of the board. Nominal voltages supplied by the regulator cards are 5,

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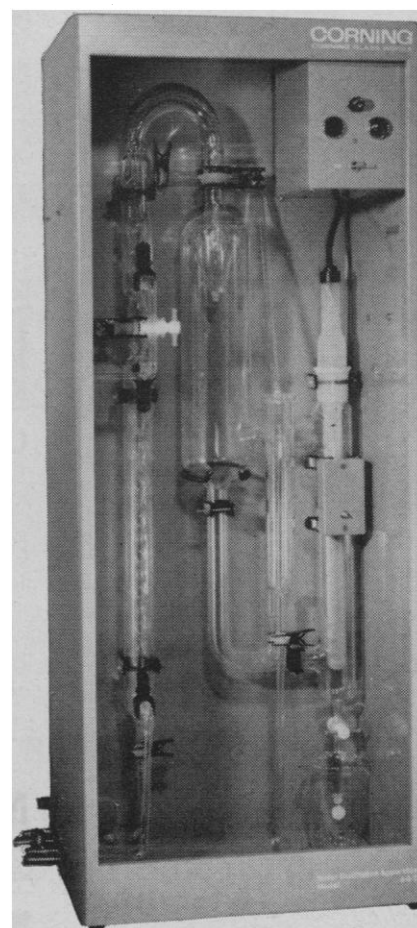
10, 20, and 30. Each has a screwdriver adjustment for output voltage, with range sufficient to give adequate voltage overlap between all nominal voltages. Each regulated voltage is capable of supplying 1 amp load current, and a total of 10 amp may be drawn from the power supply.—J.S. (Sturup Inc., Middletown, Conn.)

Circle 33 on Readers' Service card

Microfiltration centrifuge tube permits the use of centrifugal forces to move suspensions through millipore filters to separate materials of different particle sizes. The sectionalized stainless-steel tube separates into four sections. Membrane filters and supporting screens are inserted into the sections and tube. The first section of the tube is filled with approximately 3 ml of material. The tube is then placed in a shield and centrifuged at approximately 3500 rev/min. The centrifugal force causes the material to pass through the various filter stages, depositing particles of various sizes on the surface of the corresponding filter. This principle can be used for obtaining filtrate, for obtaining a precipitate, and for obtaining a concentrate. Membrane filters are available in pore sizes from 5 μ to 10 m μ .—R.L.B. (International Equipment Co., 300 Second Ave., Needham Heights 94, Mass.)

Circle 34 on Readers' Service card

Pulsed light source system (model STU-92) is designed for research in transient photoinduced phenomena. The system incorporates a Kerr cell pulser that provides arbitrary optical pulse shapes from a flash lamp with output duration and triggering capability in the nsec range. The flash lamp and the Kerr cell are contained in an enclosed and completely shielded optical bench assembly. Operation of the device commences with the triggering of the flash lamp producing a shaped optical pulse of approximately 5 μ sec duration. After a preset delay, the Kerr cell pulser is triggered, generating a pulse that modulates the duration and shape of the output pulse. The polarizers can be oriented so that the full duration of the flash lamp can be transmitted. Total energy is focused into an area 1.27 cm in diameter, approximately 18 cm from the aperture of the optical bench. Two types of pulsing systems are provided. One delivers a trapezoidal pulse of duration ranging from 5 nsec to the duration of the flash. The other provides a



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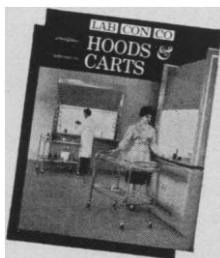
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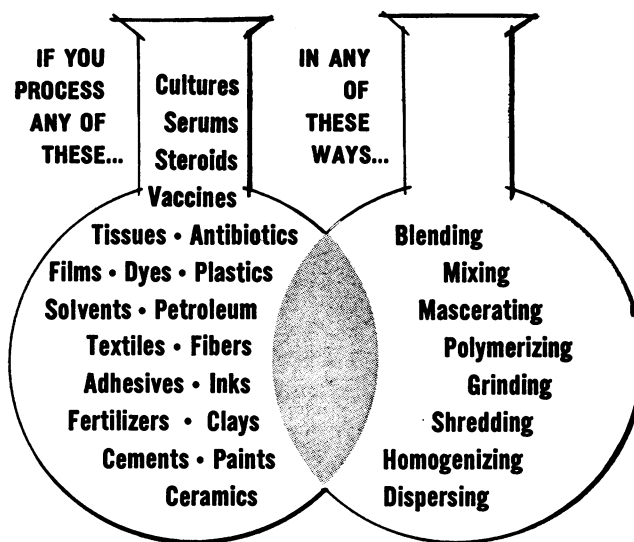
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pulse of 500 nsec on command. Narrow- and wide-band optical systems are available, the former having a range of 4200 to 7000 Å, the latter a range of 3200 to 12,000 Å.—J.S. (Electro-Optical Instruments, Inc., 922 S. Myrtle Ave., Monrovia, Calif.)

Circle 35 on Readers' Service card

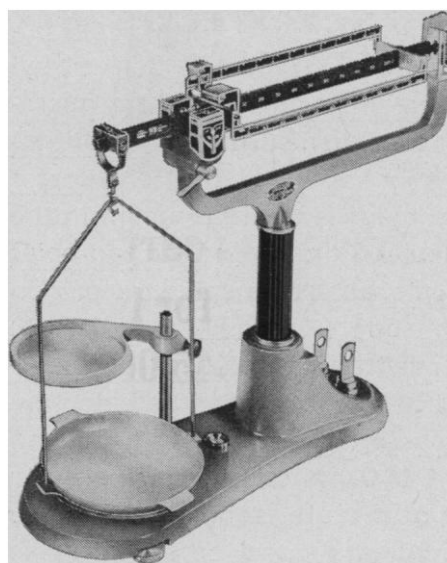
Determination of dissolved oxygen utilizes a polarographic oxygen probe. A sampler assembly brings air which is used to calibrate the instrument down into the liquid in which dissolved oxygen is to be determined. Calibration is performed just before reading and under conditions of temperature and pressure identical to those of the liquid to be read. Calibration can be accomplished in under 3 min and results compare within 0.3 ppm with Winkler titrations. The Model 51 also measures the temperature of the liquid and can be utilized for percentage O₂ measurements or partial pressures. A transistorized, battery-powered amplifier housed in a rugged, splashproof case with a fold-back handle makes the Model 51 an ideal field tool. An annular design of the polarographic electrode eliminates the necessity for rapid flow rates. The Model 5023 sampler is designed so that one-handed wrist action will provide sufficient flow in absolutely still water. This system allows on-the-spot checks of dissolved oxygen in streams and lakes, oceans and estuaries, sewage plants, effluents from industrial plants, biological growth media, and beer, wine, and other food-product liquids. A gas sampler is provided to allow monitoring of percentage of oxygen in gases as a secondary feature.—R.L.B. (Yellow Springs Instrument Co., Inc., Box 106, Yellow Springs, Ohio)

Circle 36 on Readers' Service card

Generator-detector (model 861A) is an audio-frequency generator and a sensitive low-noise detector ganged together as a signal source and null indicator for use in precision measurement work. The generator provides an adjustable frequency output in three ranges from 20 to 20,000 cy/sec. Output can be varied from 0 to 200 volts and four levels of impedance are available for optimum load matching. Maximum power delivered to any load is limited to 1 watt for protection of circuit elements. Output is provided for oscilloscope or phase-sensitive voltmeter reference and frequency measurement. The detector uses two tuned



MODEL 311 METRIC



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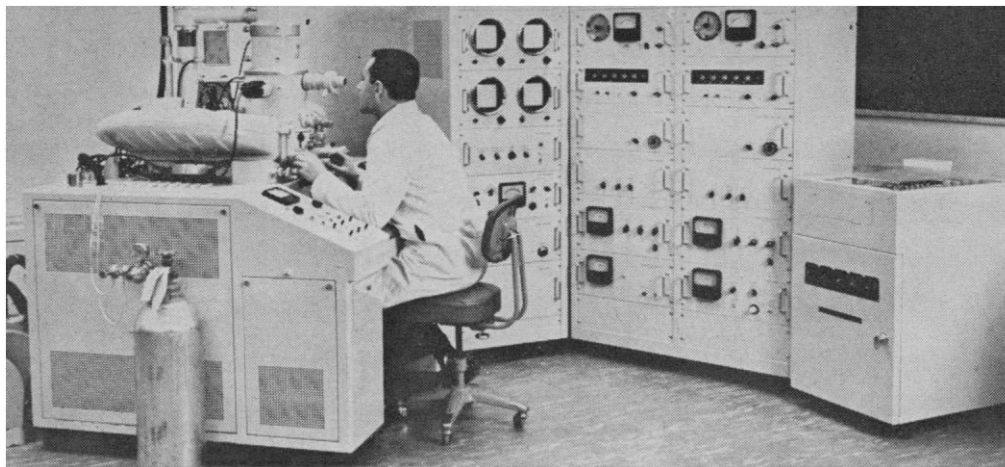
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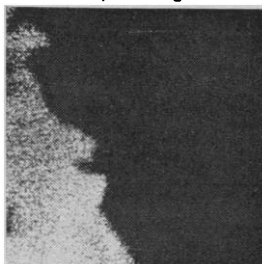
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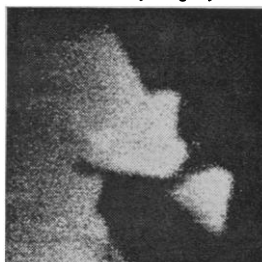
Specimen Chiefly Composed of
Pyrite (FeS_2) and
Chalcopyrite (CuFeS_2)



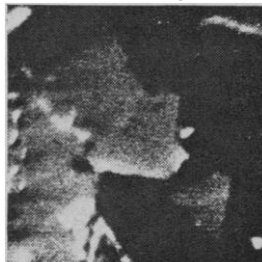
Optical Image



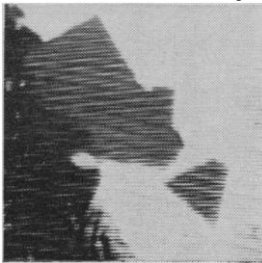
Characteristic X-ray Image by Cu $K\alpha$



Characteristic X-ray Image by Fe $K\alpha$



Back-scattered Electron Image



Absorbed-electron Image

stages. A selectivity control provides a choice of flat, broad, or sharp positions. The null detector indicator shows full-scale deflection with less than $1 \mu\text{V}$ input to the detector. After removal of a large signal, full sensitivity is restored in less than 0.1 sec on the highest sensitivity setting.—J.s. (Electro Scientific Industries, 7524 S. W. Macadam Ave., Portland 19, Ore.)

Circle 37 on Readers' Service card

Electromagnetic - coupling - coefficient slide rule is designed for transducer engineers and other users of piezoelectric ceramics. It reads directly coupling coefficients for commonly used modes in resonant and anti-resonant frequency measurements. Separate scales indicate f_a/f_r , and equivalent values of k_p , k_{as} , k_{at} , in accordance with IRE Standard 14.S1. The reverse side of the slide rule solves the exact equation for mechanical Q . The slide rule is available at no cost on company-letterhead request.—J.s. (Electra Scientific Corp., Electra Way, Fullerton, Calif.)

Circle 38 on Readers' Service card

Phase meter provides automatic measurement of relative phase from 0 to ± 180 deg, with any 20-deg range expandable to full scale, over the frequency range 2 to 100 Mcy/sec. The instrument operates by means of an electrically variable delay line that makes phase correction in one arm of the phase bridge to equalize the phase of the two signals being compared. The correction is directly proportional to the relative phase between the signals and is available as an electrical output. Frequency coverage is set by a series of five local oscillator bands. The local oscillator is tuned 1.5 Mcy/sec away from the test signal and phase measurements are made at the difference frequency of 1.5 Mcy/sec. Overall accuracy is said to be ± 1 deg or ± 2 percent of the total phase reading. Readings are said to be insensitive to amplitude changes as great as 20 db.—J.s. (Willtron Co., 717 Loma Verde Ave., Palo Alto, Calif.)

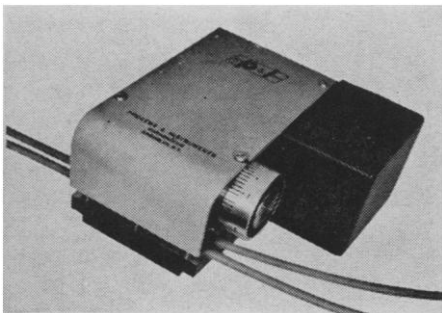
Circle 39 on Readers' Service card

Cavitation measuring instrument is designed to make determinations of the threshold of cavitation and of the effects on the threshold and on cavitation intensity of such factors as transducer design and location, use of detergents, liquid temperature, and tank design. The cavitometer utilizes the correlation

between relative cavitation intensity and the level of white noise generated by imploding cavitation bubbles. The instrument's probe signal is divided into two channels; one produces readout of the ultrasonic driving field signal, and the other produces readout of the average power of cavitation shock waves by amplifying and integrating the amplitude of white noise with the driving field excluded. The standard instrument uses a probe with a tip $\frac{1}{8}$ -inch in radius. The probe is in effect a contact hydrophone with signal arising only from bubble implosion on its tip surface, and is said to be unaffected by noise from other parts of the liquid.—J.S. (International Ultrasonics, Inc., 331 Centennial Ave., Cranford, N.J.)

Circle 40 on Readers' Service card

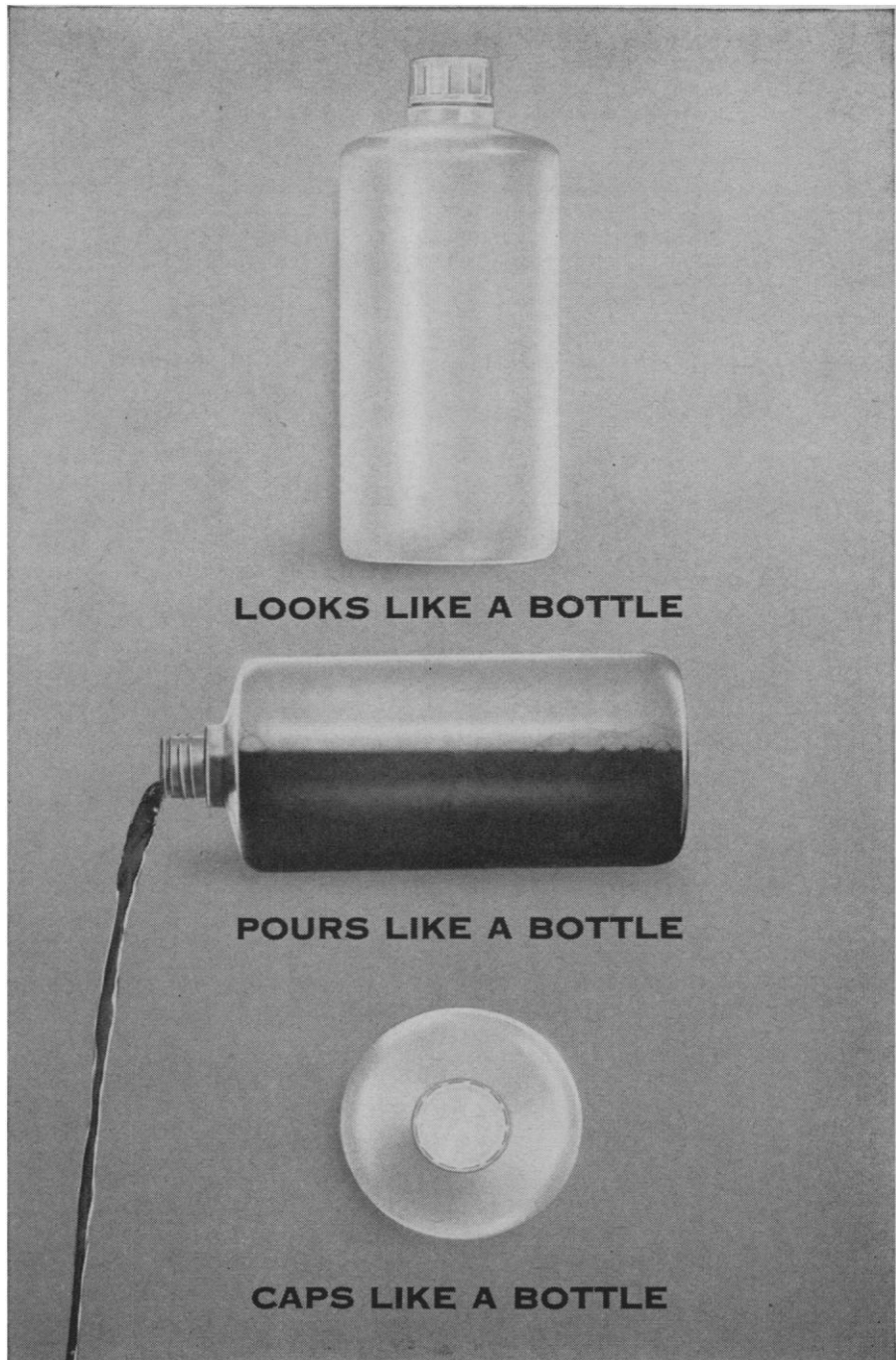
Infusion pump for regional therapy propels fluids inside of rubber tubing by means of cam-actuated fingers which successively compress small regions of the tube to move the contained fluid along. The cam sequence provides a highly accurate metering of the flow that can be reproduced to 2 percent or better by rotating a numbered dial to the appropriate position. The dial controls a mechanism which varies the effective stroke of the cams so that low flows can be obtained without slowing the speed of the fingers, thus maintaining a more constant flow.



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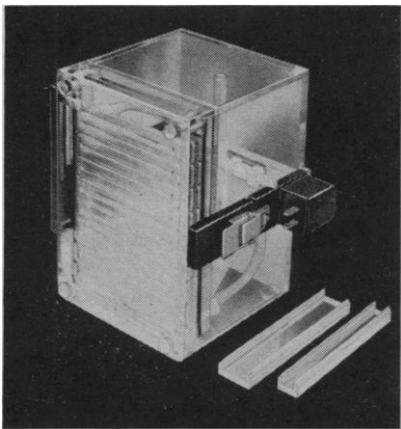
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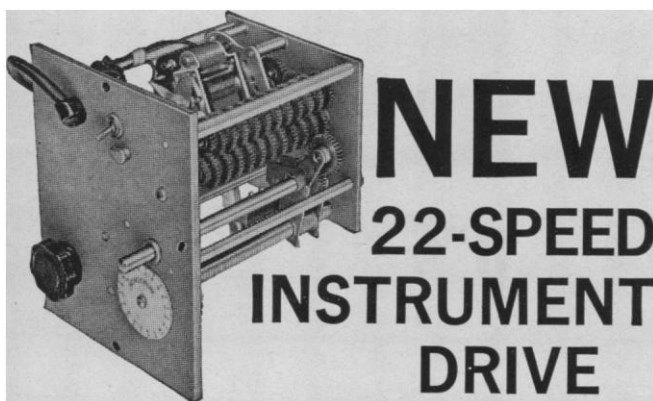


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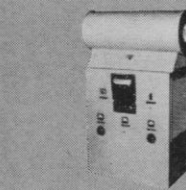
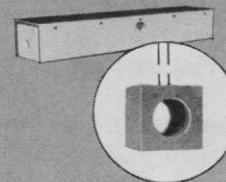


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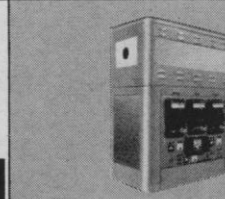
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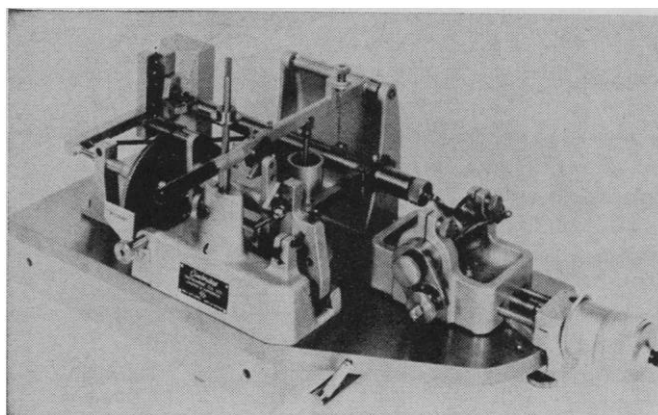
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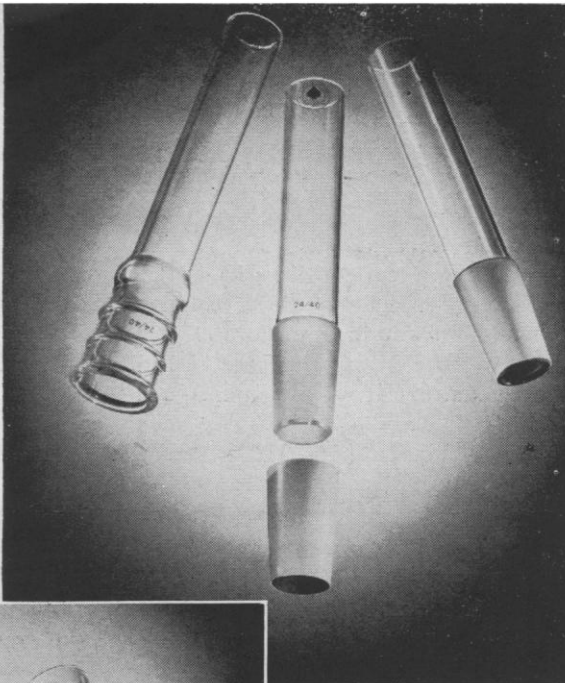
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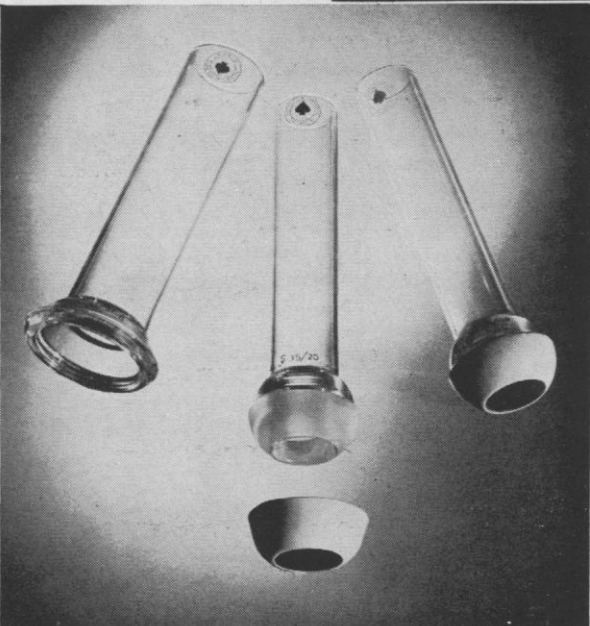
Frostmeter, for determining the depth of frost penetration in the soil, is a shaft-like device measuring 2.54 cm in diameter and 1.5 m long. A series of small vials housed in the plastic shaft are filled with a stable, bacteria-free liquid that freezes at -0.5°C . The device is inserted into the ground and as the frost penetrates the soil the vials freeze and explode progressively. The lowest broken vial indicates the depth to which frost has penetrated. A magnet inserted into the head of the frost-meter permits it to be found easily even while covered with snow or ice. New vials can be inserted for reuse.—J.S. (Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill.)

Circle 42 on Readers' Service card

Vacuum spectrograph, said to be the largest commercially available spectrograph, consists of a vacuum tank 50 inches in diameter at one end and tapering along its 40-ft length to a diameter of 36 inches. The vacuum tank does not constitute part of the structure of the optical system; the optical elements are mounted on concrete piers that, in the first instrument of this type manufactured, are independent of the building in which the instrument is housed. Large stainless-steel posts on which the optical elements are mounted pass through the vacuum-chamber wall via vacuum-tight flexible couplings. The vacuum chamber is divided into three sections: one containing the slit; another, the camera and phototube scanning assembly, when in use; and the third, the grating and its controls. Each of the sections is isolated from the others by means of large vacuum valves. The basic optical system is the Eagle arrangement with three independent controls, including grating rotation, grating translation, and plate position. All of these controls are calibrated and can be adjusted from outside the vacuum system. The grating is translated on stainless-steel rods over a distance of nearly 8 ft. Position of the grating can be reproduced to better than 0.1 mm. Rotary motion permits resetting of the grating within 0.002 deg. The grating holder itself is provided with micrometer adjustments in all orthogonal coordinates and can be rotated through 180 deg. Spectrum height can be adjusted from outside the vacuum chamber without causing a displacement in the spectral image of more than $1\ \mu$. A concave grating of 35-ft radius of curvature and ruled area 4 by 7 inches produces

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dispersion in the first order of 0.8 Å/mm. The normal wavelength range of the instrument is 400 to 8000 Å. The pumping system consists of two 11-inch diffusion pumps with a total pumping capacity exceeding 8100 lit./sec in the 10^{-5} Torr range. The large roughing pump has a capacity of 300 ft/min. The pumping system is said to be capable of evacuating the instrument from atmospheric pressure to 100 μ in less than 10 min. Cycling the instrument requires about 15 min.—J.S. (Jarrell-Ash Co., 26 Farwell St., Newtonville 60, Mass.)

Circle 43 on Readers' Service card

Variable-speed radiation chopper (model VSC-303) for infrared, ultraviolet, and visible light, features a range of 40-to-1 in chopper speed and an output signal synchronized with chopper modulation. The device is furnished in two parts. The first is a control unit that houses the power supply, transistorized amplifier, and frequency control. The second, the chopper unit containing the servomotor, tachometer, and synchronous rectifier, has provisions for mounting on a standard optical bench. The chopper may be combined with a power controller, an infrared source, and a fixed-frequency

filter in a single integrated unit to provide a portable infrared signal source with six selectable frequencies.—J.S. (Telewave Laboratories, Inc., 43-20 34 St., Long Island City 1, N.Y.)

Circle 44 on Readers' Service card

Computer of average transients applied to nuclear magnetic resonance spectroscopy greatly increases signal-to-noise ratio that limits the utility of NMR observations of biological materials present only at trace levels. The computer samples the analog signal spectra, masked by low-frequency noise. The spectra are converted into digital counts which are then stored in 400 memory addresses, starting from a known reference point. Additional signal spectra are added successively in the memory address. Since the signal of interest is phase-locked to the reference point, additional signals sum arithmetically. The background noise, being of random phase, will tend to cancel out as the summation process progresses. Computed results can be read out in analog fashion back onto the plotter associated with the spectrometer or digitally for further computer analysis.—R.L.B. (Mnemotron Div., Technical Measurement Corp., 202 Mamaroneck Ave., White Plains, N.Y.)

Circle 45 on Readers' Service card

Metalizing transfer tapes are designed for the preparation of high-quality ceramic-metal seals. According to the manufacturer, the use of these tapes permits control of thickness, density, and weight of the metalizing layer. The tapes consist of a backing layer and the metal layer that contains the metalizing compounds. Three types of metalizing compositions are available: moly-manganese, moly-titanium, and customer-specified combinations of metalizing mixtures. Thickness of the tape can be varied between 1 and 5 mil and special organic adhesive layers can be provided. Bond strength values are said to be 50-percent higher than are obtained by other techniques.—J.S. (Vitta Corp., Wilton, Conn.)

Circle 46 on Readers' Service card

Image converter tube (type 4449) is designed specifically for use as a high-speed shutter for electronic cameras. The tube uses electrostatic focus, a gating control grid that functions as the shutter, and an electrostatic deflection system that can produce three images on one photographic frame

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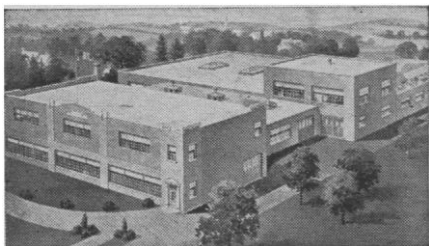
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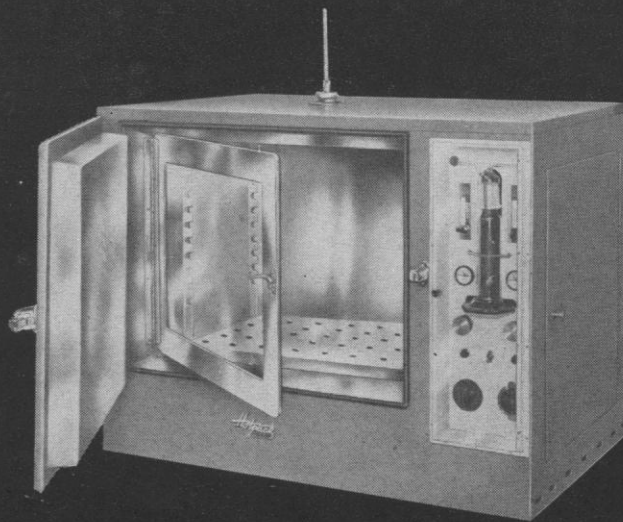
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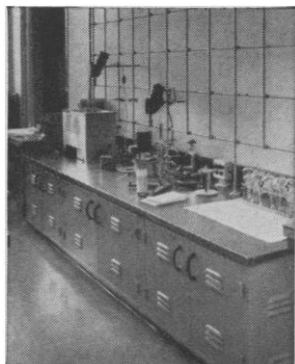
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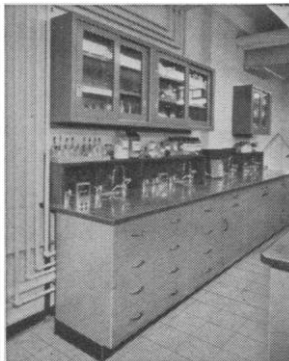
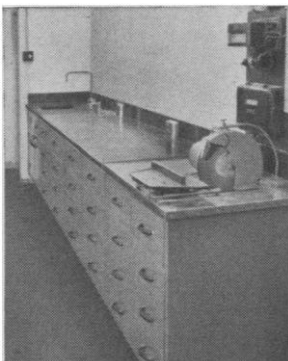
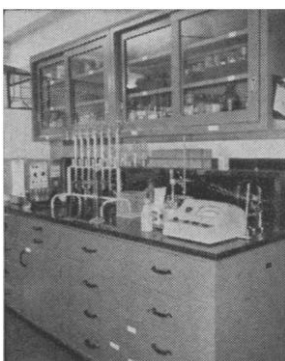
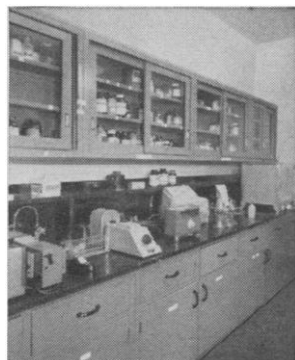
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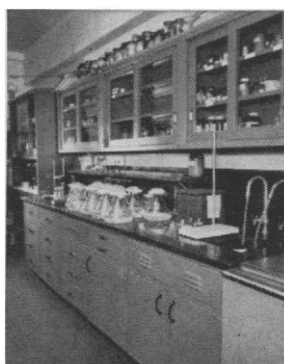
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Circle 47 on Readers' Service card

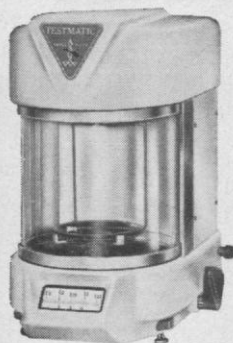
Surface recorder for measurement of surfaces that are too soft or too critical to be touched with a stylus uses microwaves to sense the surface without contact. The equipment consists of a power supply unit and a sensing unit. The sensing unit produces a stable pulse train of microwave energy and directs it onto the work surface in a suitably small area. By comparing the phase of the reflected microwaves with that of the output, it provides an electrical signal that is proportional to the position of the surface relative to the waveguide antenna. The signal actuates a recorder. The system is said to be useful with a wide variety of materials. It provides a displacement range of 0.16 inch with respect to the antenna. Setup consists of locating the waveguide antenna opening at the desired height and about 1/16 inch from the surface to be measured. Profiles are obtained in a matter of minutes and are said to be accurate to within $\pm 50 \mu\text{in.}$ —J.S. (Micrometrical Manufacturing Co., 3621 S. State Rd., Ann Arbor, Mich.)

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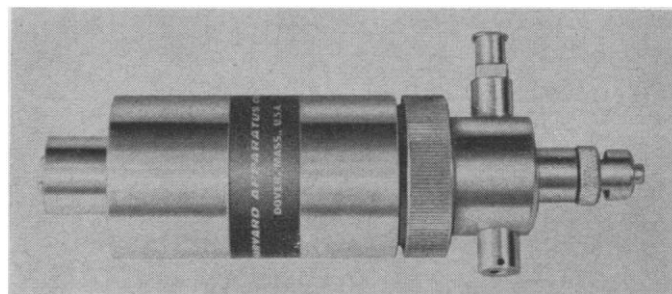
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LAMBDA PUMP SYSTEMS

The reliability, accuracy and light weight of the Lambda Pump Systems allow the design of experiments heretofore considered impractical. This new concept in pumping takes its name from the fact that the pump delivers 10 Lambda (0.01 cc.) of liquid at each stroke. The pump can be operated by either a light weight battery and timer, or an accurate AC Driver/Timer. Material to be injected is held in a reservoir which is connected to the pump. (A standard Fenwal Transfer Pack is recommended for this purpose.)

BASIC LAMBDA PUMP (cat. no. 1300-2) This is a solenoid-operated, positive displacement pump made of hardened and precision ground stainless steel. The pump is 4½" long and has a diameter of 1¼". Total weight is 8 ozs. It can be operated in any position and rapidly disassembled for sterilization. It is hermetically sealed when assembled. Fastest rate of pumping is 10 stokes/second, equivalent to 0.1 ml./sec. Rated volume is delivered at pressures in excess of 1000 mm. Hg. Reproducibility is $\pm 1\%$, while absolute accuracy is within $\pm 1\%$.

BATTERY-OPERATED SYSTEM This is a completely self-contained system which can be worn by a living animal in long-term experiments to simulate the effects of a gland. Complete freedom of motion is permitted. The basic Lambda Pump is driven by a rechargeable nickel-cadmium battery and a transistorized Timer (cat. no. 1300-3) which furnishes power pulses from the battery to the pump solenoid. The Timer is totally encapsulated, measures 1" x 2½" x 3¼", and weighs 6¾ ozs. A 20-turn micropotentiometer allows the pulse rate to be continuously varied from 1 pulse per second (.6ml./min.) to 1 pulse in 30 seconds (.02



1300-2 BASIC LAMBDA PUMP

ml./min.) with a reproducibility of $\pm 1\%$ from 0°C to 70°C. A choice of three batteries is available depending on the total amount of liquid to be pumped with one charge. Battery weights range from 7 to 21 ozs. Each battery can be recharged a minimum of 100 times by means of #1300-4 Battery Charger.

AC-OPERATED SYSTEM This system is designed for laboratory work where a small, accurate pump is required to operate from AC lines. The basic Lambda Pump is driven by a Pump Driver/Timer (cat. no. 1300-5) which furnishes 10 volts DC to the pump in pulse frequencies variable over a 1000 to 1 range. Pulse rates are produced from 10 pulses per second (6 ml./min.) to 1 pulse in 100 seconds (.006 ml./min.) in 1000 separate steps. A decade dial indicates exact delivery rate. Reproducibility is $\pm 1\%$.

Battery Operated Lambda Pump System, complete with pump, timer, one battery, and charger... \$427.00 to \$437.00
AC-Operated Lambda Pump System, complete with pump and pump driver... \$460.00

All prices f.o.b. Dover, Mass., U. S. A.

Bulletin 1300 and Catalog available on request.



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- **Range 195 to 800 millimicrons**
- **Excellent stability**
- **Line operated**

High resolution diffraction grating type, compact modular construction, a.c. line operated, range 195 to 800 m μ . Design and workmanship provide an instrument of outstanding accuracy, stability and versatility.

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Slits—continuously adjustable.

Wavelength accuracy—better than ± 0.5 m μ throughout range.

Wavelength reproducibility—better than 0.1 m μ .

Photometric reproducibility—better than 0.002 absorbance between 0 and 0.5.

9096-E. Spectrophotometer, Model 139, as described, complete with a.c. power supply, hydrogen and tungsten lamps, 4-place cell holder, set of 4 fused silica 10 mm matched cells, etc. For 115 volts 50 or 60 cycles, a.c. **2,300.00**

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slit programming differs significantly from the manual slit over-ride feature which has, until now, been used in low-cost infrared spectrophotometers. Manual slit over-ride permits the analyst, at any point in the spectrum, to widen the slits more than the normal slit program value. As the scanning progresses, the slits stay constant until the normal program width is greater than that manually set, after which the slits resume the normal program. In contrast, variable slit programming provides a true proportional increase or decrease in slit widths over the entire range of the new instrument. In this way, energy/resolution levels can be set as needed for any type of analysis, with conditions remaining at the same relative values automatically over the entire recorded spectrum. The new instrument uses diffraction gratings in the first order only, with filters to eliminate higher orders. This permits increased optical efficiency, shorter optical path, and mechanical simplicity as compared to foreprism-grating instruments. Accessory equipment available includes a slow-scan unit providing a speed of 72 minutes per range, permitting the instrument to readily achieve resolution approaching one wave number with an auxiliary readout. In addition to wavelength expansion, the auxiliary readout permits transmission scale expansion from 1 to 10 \times . The spectrophotometer weighs 45 kg. It operates on 105 to 125 volts, 60-cy power, with 50 cy/sec also available.

—R.L.B. (Perkin-Elmer Corp., Main Ave., Norwalk, Conn.)

Circle 49 on Readers' Service card

Depth indicator for oceanographic applications is said to be accurate to ± 1 percent of full scale and to be free from errors caused by underwater currents. Temperature compensation eliminates the need for computation of depth over the operating temperature range from 1 $^{\circ}$ to 50 $^{\circ}$ C. The system, designed to withstand the environment of sea-going vessels, consists of two units. The first is an underwater module containing a potentiometer-type pressure transducer and the second is a rack-mounted shipboard circuit and control console. The system operates as a bridge circuit. Hydrostatic pressure acting upon a Bourdon tube in the submerged unit causes the tube to move a potentiometer in proportion to pressure. Sea depth is read from a digital counter on the console. Standard circuitry is designed to accommodate

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Ideal for applications requiring slow, uniform infusion of fluid over long periods of time, as in chemotherapy, drug experiments on unrestrained animals, feeding nutrients to tissue cultures, etc. Model 085 is a miniature 3" long x 3/8" diameter; others are comparably compact.

The Sage Micro-Flow Pump* works by electrolysis, uniformly generating a gas that moves a piston which drives the fluid. Can be set to pump at various rates.

Each pump comes complete with 1 ml/hr rate setter component, battery, and supply of electrolyte. Set of 4 interchangeable flow rate setters for different rates (1 ml/1/2 hr; 1 ml/2 hr; 1 ml/8 hr; 1 ml/24 hr) costs only \$20. Extra batteries and electrolyte are available. Rate setters are permanently re-usable.

*Patent Pending

Also available from Sage: *Line-operated Syringe Pumps* covering flow rate ranges from 0.08 ml/day to 40 ml/min.

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any one of three pressure transducers for depth ranges of 0-to-300, 0-to-1,000, and 0-to-3,000 ft respectively. A single shipboard unit can accept readings from three separate pressure-sensing modules by switching a transducer selector on the control panel.—J.S. (Daystrom, Inc., Manchester Rd., Poughkeepsie, N.Y.)

Circle 50 on Readers' Service card

Submerged rotator holds stoppered test tubes, syringes, flasks, or bottles clipped on a plastic disk while they are rotated in a water bath. The disk is driven by a belt which transmits power from a motor above the surface of the bath liquid. Submerged parts are constructed of plastic and aluminum protected by epoxy paint for resistance to water.—R.L.B. (Scientific Industries, 220-05 97th Ave., Queens Village, N.Y.)

Circle 51 on Readers' Service card

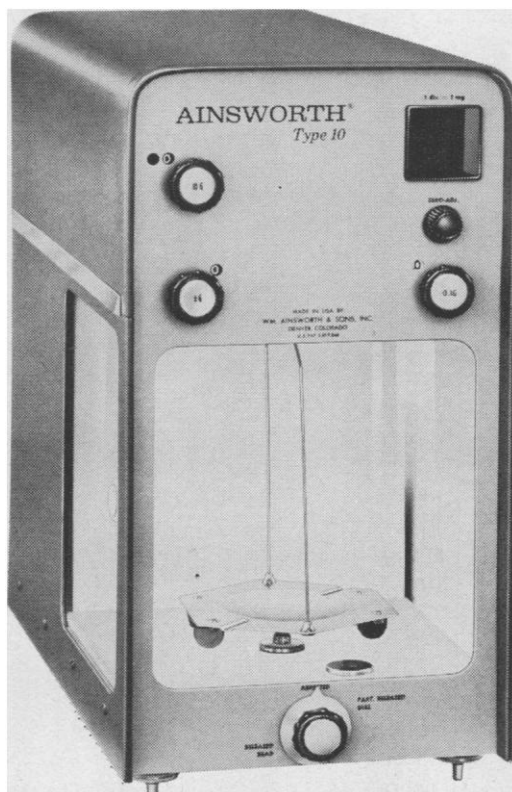
Evaporagraph (model KR-1A) provides Polaroid color photographs of the infrared image of a scene in approximately 1 minute. The evaporagraph is a thermal imaging device that converts infrared radiation into a visible image by differential condensation of oil on a thin membrane. Differences in thickness of the oil, related to differences in intensity of radiation incident on the membrane, cause white light to be reflected as different colors, giving a visible representation of the thermal image. By combination with the Polaroid camera, the color information can be recorded. This information is valuable because it extends the dynamic range available in a black-and-white image. The largest number of grays normally distinguishable in a black-and-white evaporagraph record has been eight. With color film, 20 shades can be isolated, and wherever this is insufficient, several orders of spectra can be used to extend the range.—J.S. (Baird-Atomic Inc., 33 University Rd., Cambridge 38, Mass.)

Circle 52 on Readers' Service card

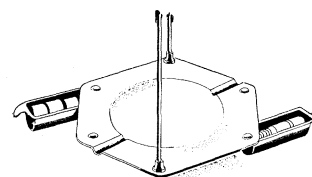
Portable crystal puller is said to be designed to exploit all existing crystal-growing technology and to provide researchers with the necessary electro-mechanical components conveniently assembled in one instrument. The device consists of a pull rod that grips the crystal melt and simultaneously retracts and rotates it at preselected rates as required to form a crystal of specific size and characteristics. Linear travel

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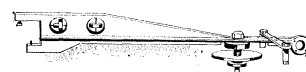
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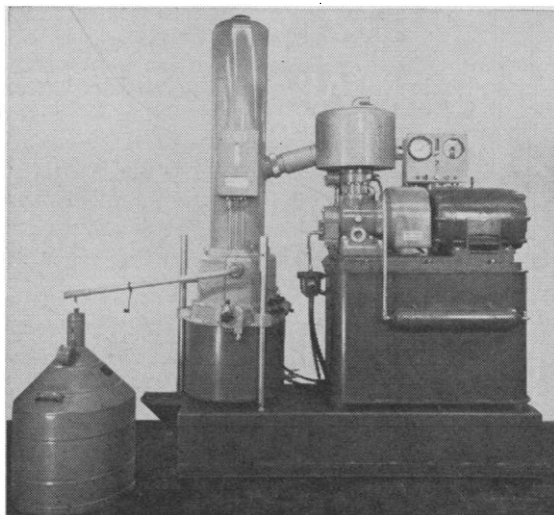
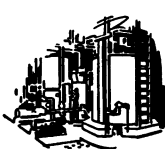
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of the pull rod is adjustable between 0.03 and 2 in./hr; rotation between 5 and 116 rev/min; quick lifting and lowering between 0.12 and 6 in./min. Maximum pull-rod travel is 18 inches. The equipment may be operated in several positions allowing the pull rod to traverse horizontally or vertically. Adapters are available for the techniques of Bridgeman-Stockbarger, Verneuil flame fusion, horizontal and vertical gradient, float zone melting, and others. Other optional accessories include: travel cut-out switches, thermocouples, rf coils and thermocouple filters, temperature controllers, crystal seed holders, and resistance furnaces.—J.S. (Will Scientific, Inc., Box 1050, Rochester 3, N.Y.)

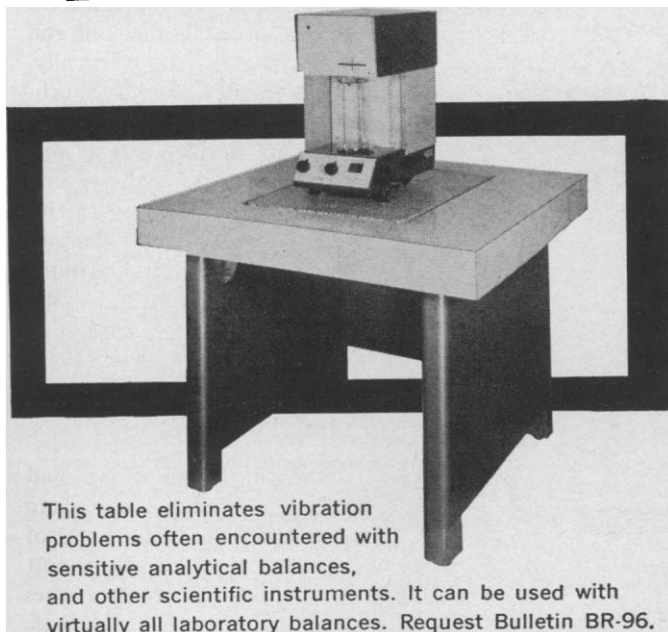
Circle 53 on Readers' Service card

Radio telescope for teaching and demonstration applications is said to embody all of the basic functions of large installations without high cost and complexity. The instrument uses a 4-ft-diameter aluminum parabolic reflector to achieve a beam width of approximately 1.8 deg at the X-band operating frequency of 10 kMcy/sec. Two identical feed horns illuminate the reflector so that two independent antenna beams are generated. The reflector and horn feed system are mounted on an equatorial mount. Declination angle is manually controlled and hour angle is motor driven. The entire receiver front end section is mounted on the movable portion of the support assembly to avoid the necessity for rotary waveguide joints. The telescope receiver has a total input noise temperature of approximately 800°K. The bandwidth of 8 Mcy/sec and integration time of 10 sec results in a peak-to-peak fluctuation level of 0.8°K so that the telescope is capable of detecting signals less than 1°K. A portable chart recorder incorporated for indication and storage of output information may be located up to 100 ft from the telescope. An optical telescope is provided for sighting the radio telescope.—J.S. (Triconix, Inc., Bear Hill, Waltham, Mass.)

Circle 54 on Readers' Service card

Photometer (model 356) is capable of measuring illumination levels of the sky within the range of 10^{-1} to 10^{-6} ft-lam and is designed for automatic integrated and recorded readout for a period of as long as 1 month, unattended. Accuracy is said to be ± 5 percent within the total range. Ten ranges of measurement are provided and the correct operating

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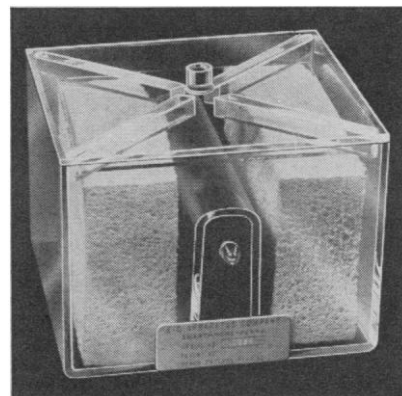
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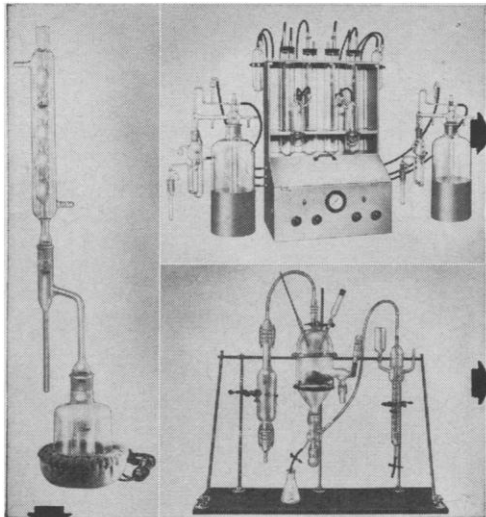
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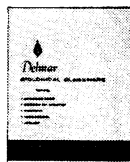
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FAT EXTRACTOR (Wistreich) for rapid moisture and fat determination. Reduces 24-hour task to 3 hours (proven against AOAC method, correlation coefficient .99). Apparatus includes reflux condenser, receiver arm and special 780 ml flask with two compartments arranged so solvent returns from condenser di-

rectly to inner compartment. On completion of the process, fat has collected in the graduated receiver, solvent is in the inner flask cell and moisture has been dissipated or collected. Price complete . . . only \$75.00 each. For full details, ask for Fat Extractor Bulletin

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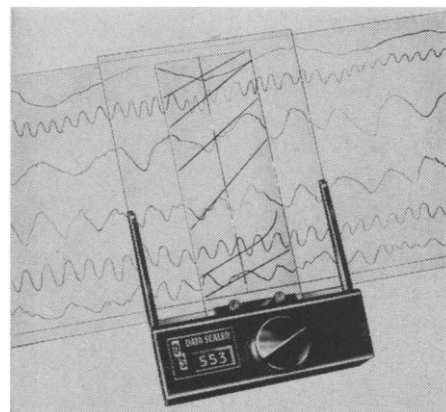
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range is automatically selected by the light level being measured. By changing objective lenses, the field of view of the instrument can be varied from a maximum of 135° to a minimum of 0.5° . The photometer system is comprised of a detector assembly containing optical elements, multiplier phototube, amplifier, and a calibrated light source and shutter that automatically prevent bright sunlight from reaching the phototube; an automatic on-off unit that turns the system on during twilight and night and removes power at other times; an integrating computer and control assembly; a recorder with automatic printing device for range level; and a tripod adjustable in height, elevation, and azimuth.—J.S. (Optomechanisms, Inc., Engineers Hill, Plainview, N.Y.)

Circle 55 on Readers' Service card

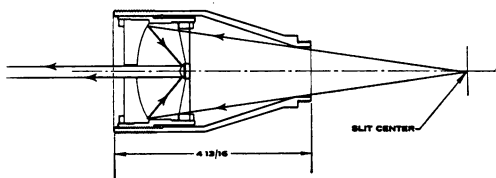
Data scaler is a manual instrument for interpretation of strip-chart records. The scaled answers appear in digital form on a three-digit counter. A drive knob is connected to the counter and to an overlay holder by means of a gear train. As the drive knob is turned, it will cause the counter to add or subtract and move the overlay holder left or right. For making readings, a vertical reference hairline is positioned over the point to be read. The transparent overlay is then moved by means of the knob so that sloped or curved lines drawn on the overlay intersect the vertical hairline at the point of interest. Single or multiple channels can be read



directly, with each channel having its own zero reference and scale factor. Both rectilinear and curvilinear records can be read and the device handles linear and nonlinear calibrations. Resolution up to 1000 counts per inch is said to be obtainable. The device will read records up to 12-inches wide.—J.S. (Data Scaler, P.O. Box 378, Westfield, Mass.)

Circle 56 on Readers' Service card

Cassegrain collimator is designed for use in applications requiring a small, rugged, efficient, achromatic device to collect wide-angle divergent radiation and convert it into a collimated beam of concentrated radiation. Less diver-



gent as well as already collimated radiation can be accommodated by adjustment of primary and secondary mirror positions. This permits entrance radiation to be either collimated or focused. Specific collimators are said to collect all of the exit slit radiation from monochromators having exit numerical apertures as high as 0.4 and produce a ray bundle 2 to 10 mm in diameter, collimated to 2 min of arc. Collimator element mounts and housing are of black anodized aluminum. The housing can be obtained in a wide range of configurations to allow mounting to specified instruments.—J.S. (Quanta Laboratories, Inc., 5815 Columbia Pike, Falls Church, Va.)

Circle 57 on Readers' Service card

Velocity monitoring system (model 133A) for detecting the movement of remote objects records changes in the quantity of reflected light from the object under observation. Observation is made through a 6-inch $f/2.7$ lens focusable from 20 ft to infinity. The lens is collimated to a slit 0.003 inch wide and 0.600 inch long to an accuracy said to be 3 sec of arc. The slit can be rotated for either horizontal or vertical measurements. The monitoring system consists of an alti-azimuth mount said to be accurate to 7 sec, with tangent screw movements; the lens; an optical head that can be removed from the tripod assembly; a preamplifier; and power supply and tripod. The instruments are used in pairs for velocity measurements, the time elapsing from the passage of an object through the optical fields of successive screens being used to compute velocity. For acceleration measurements, three or more instruments are used. The instruments are said to be operable in light levels varying from 15 ft-lam to more than 5000 ft-lam.—J.S. (Optomechanisms Inc., Engineers Hill, Plainview, N.Y.)

Circle 58 on Readers' Service card

11 OCTOBER 1963



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	Up to 40 mev protons.	Up to 100 mev protons.
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Mounting	Side-entry mounting on a BNC connector. Also available without connector.	
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Linearity	$\pm 1\%$ for Beta particles.	
Rise Time	1-2 μ sec at room temperature. 0.1 — 0.2 μ sec at liquid nitrogen temperature.	
Bias Voltage	25-400 volts dc — for complete charge collection at low noise level.	

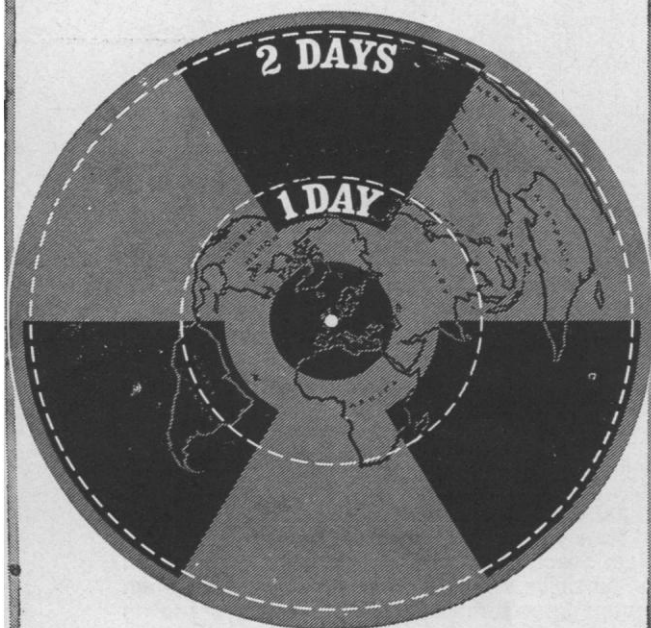
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Type BLD-5050 list price \$143.34, Type BLD-6130 list price \$264.27. All prices are FOB New Haven, net 30 days — delivery 2-3 weeks. For further information contact Sales Department: Tel 787-7181, TWX: 203-772-0676.



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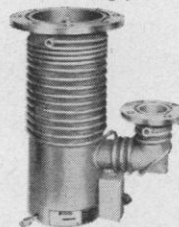
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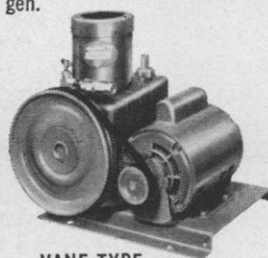
VACUUM GAUGES

A variety of Kinney vacuum gauges includes the KTG Thermocouple Gauge (3000 to 1 micron range), the KDG Discharge Gauge (10 microns to 2×10^{-7} torr range), and the TD-1 McLeod Gauge (150 torr to 1 micron range).



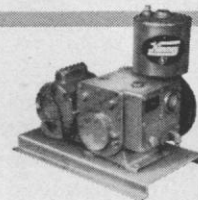
DIFFUSION PUMPS

Kinney Series KDP Diffusion Pumps provide maximum pumping speeds in 2", 4", and 6" sizes. They obtain pressures of 4×10^{-7} torr unbaffled, and 1×10^{-8} torr when combined with the Model KDB baffle using liquid nitrogen.



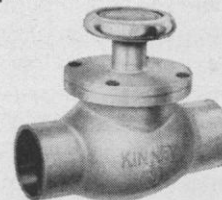
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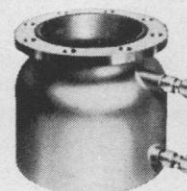
CAM AND PISTON MECHANICAL PUMPS

Kinney produces the highest quality in mechanical pumps ranging in size from 2 to 850 cfm. Series KS and KD Single Stage Pumps attain pressures below 10 microns; Series KC Compound Pumps deliver pressures below 0.2 micron.



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Kinney's complete line of vacuum valves includes series DC Diaphragm Valves, Series BB and OB Bellows sealed Valves, Series KRV Right Angle Valves, and Series G Gate Valves. They are provided for soldered, threaded, or flanged connection and for manual or air operation.



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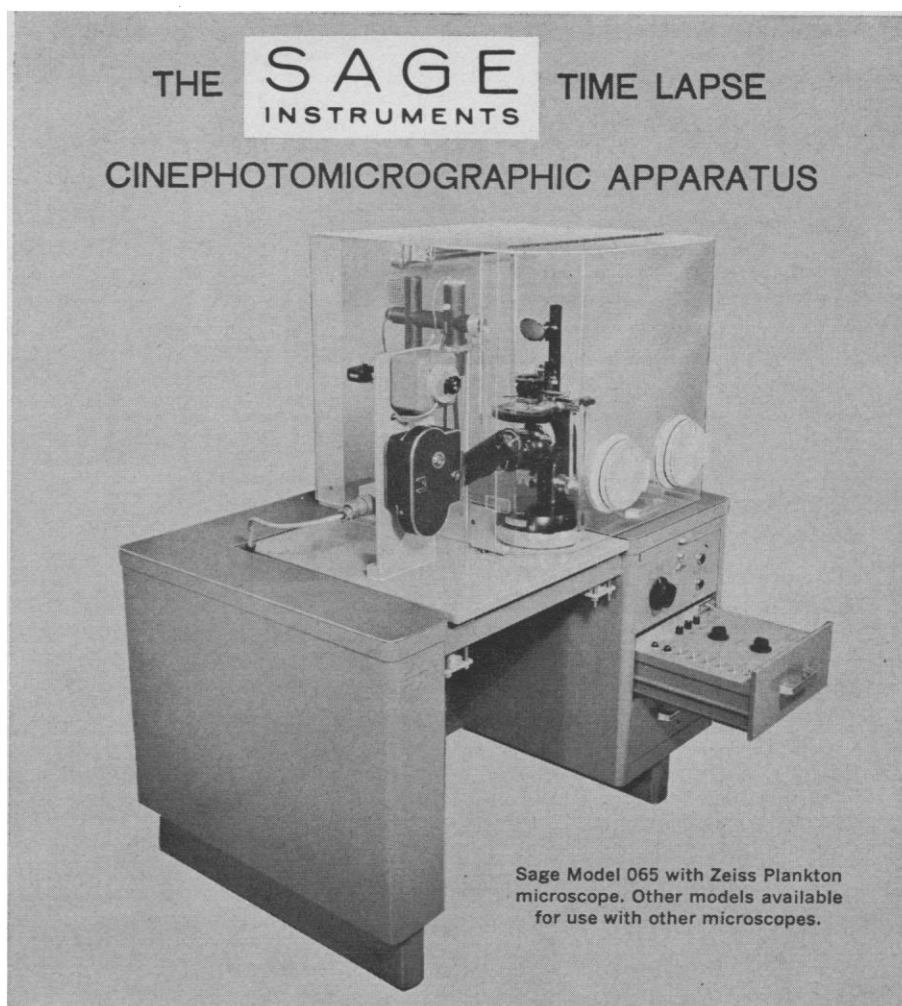
Decade attenuator (model TAD-50A) is designed to cover the frequency range from d-c to 1000 Mcy/sec. It is comprised of three separate turret attenuators covering respectively 10 db in ten steps, 50 db in five steps, and 50 db in one step. Combined, they can provide any attenuation value from 1 to 110 db in 1-db increments. Each of the turret units consists of a rotor that carries pi-section resistive elements. As the shaft is rotated, separate pads make connection through silver-plated contacts with the input and output BNC connectors. Maximum errors at 900 Mcy/sec are said to be 0.5 db for the 1-db-step turret, $0.5 \text{ db} \pm 5 \text{ percent}$ for the 10-db-step turret, and 3 db for the 50-db-step turret, and insertion loss less than 0.5 db at this frequency and less than 0.2 db at 30 Mcy/sec.—J.S. (Telonic Industries, Inc., 60 N. First Ave., Beech Grove, Ind.)

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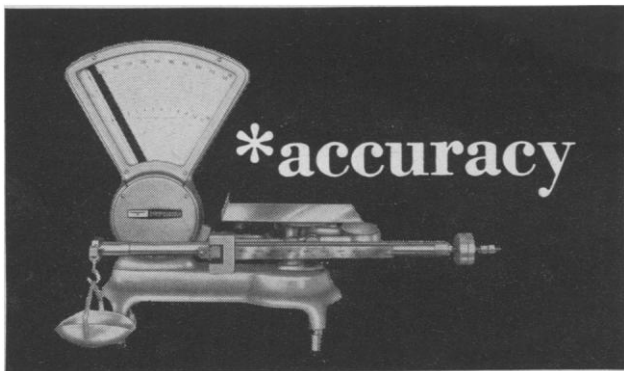
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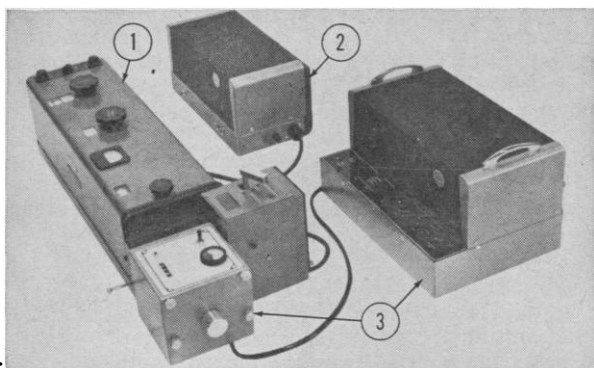
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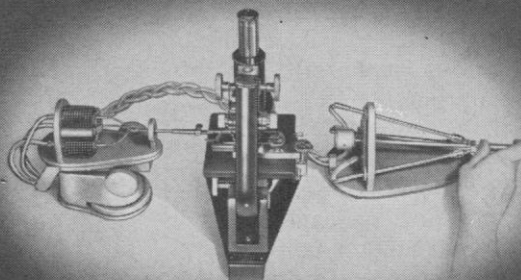
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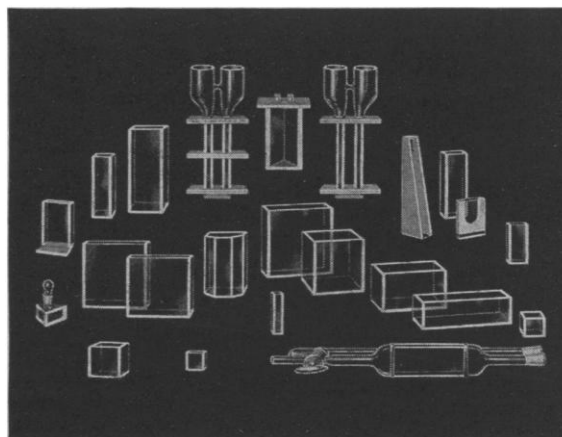
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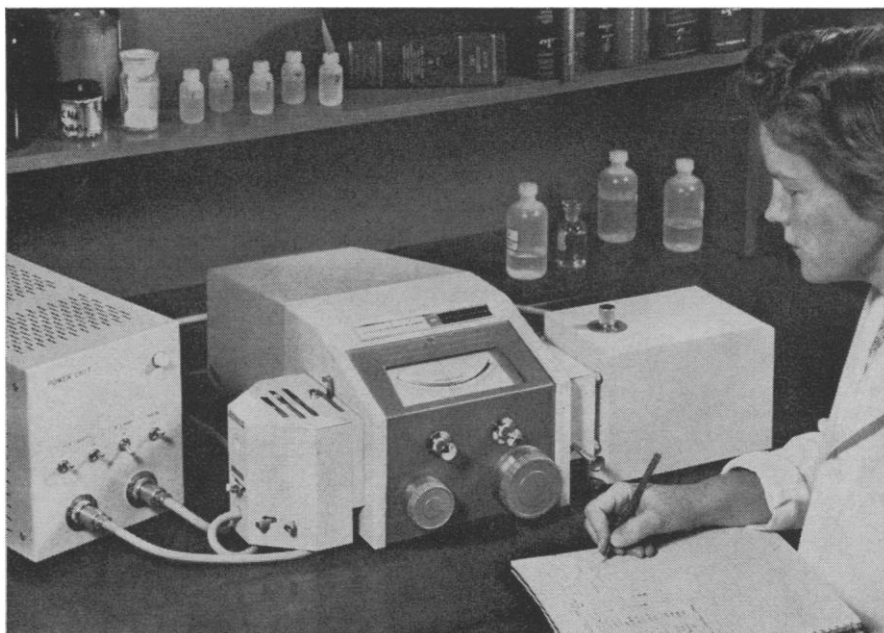
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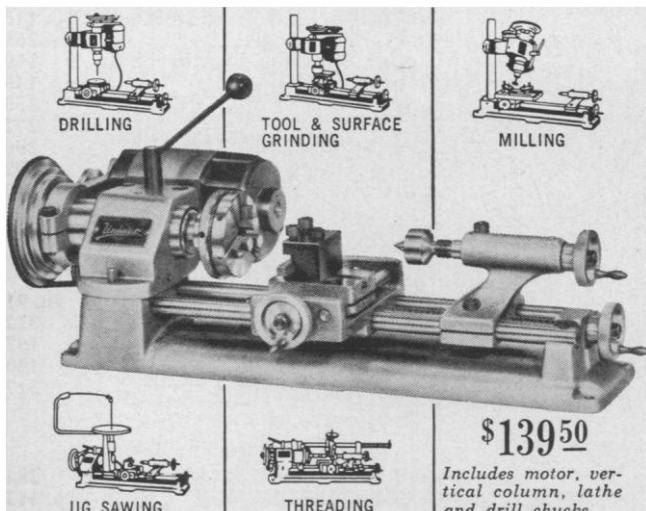
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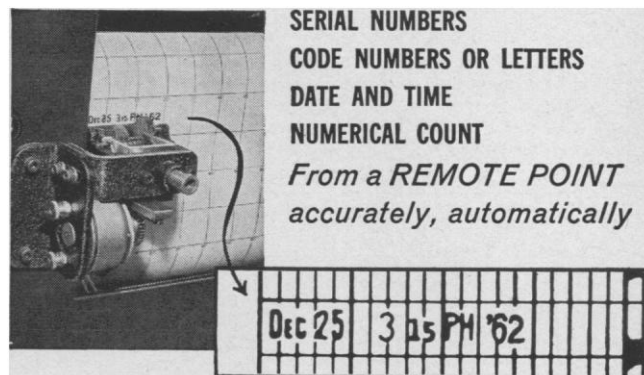


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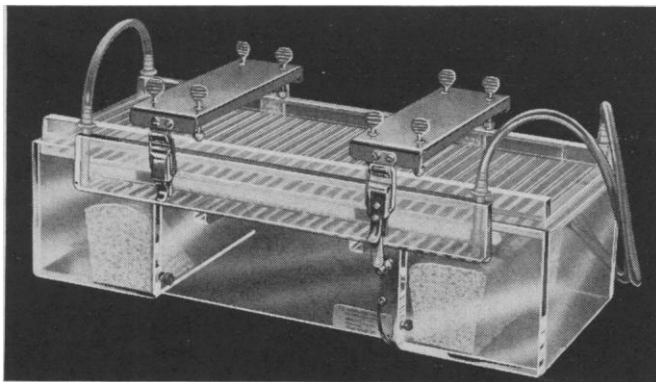
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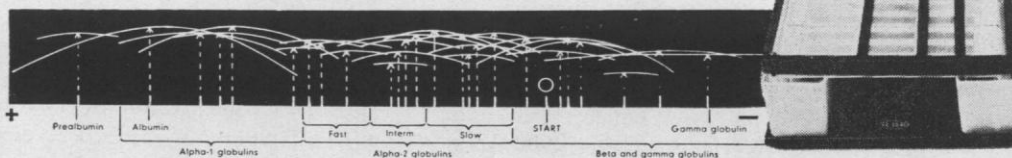
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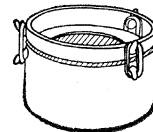
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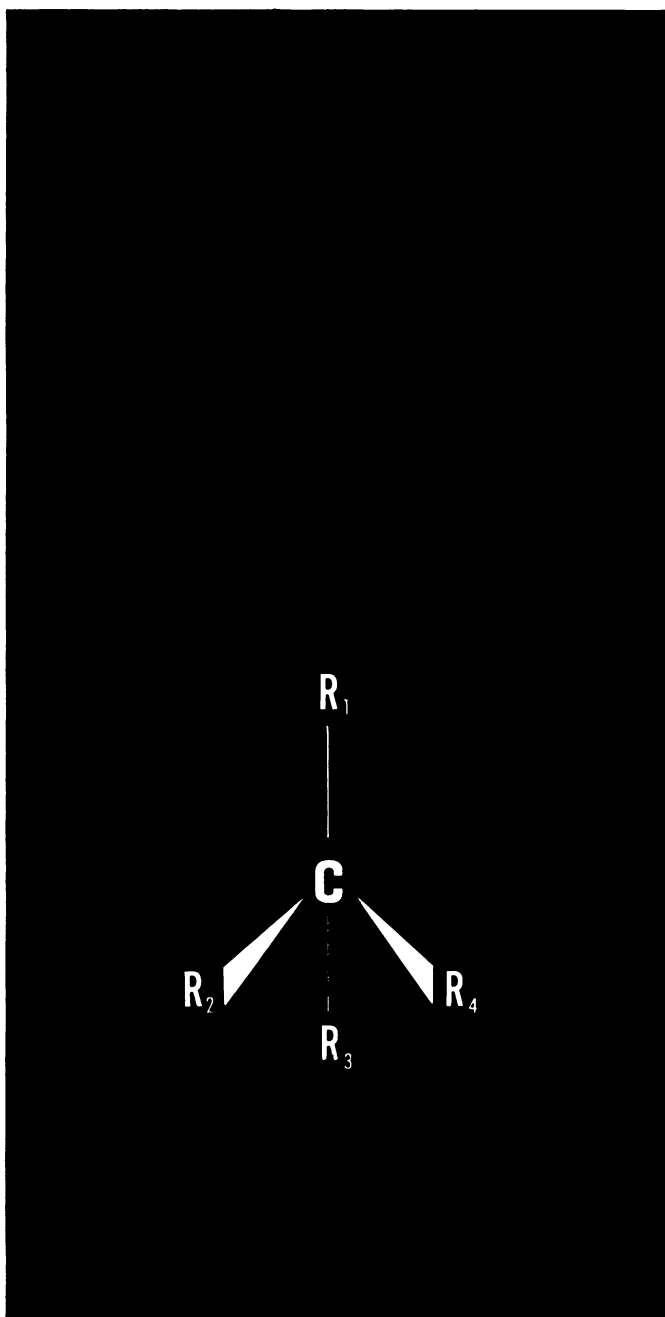
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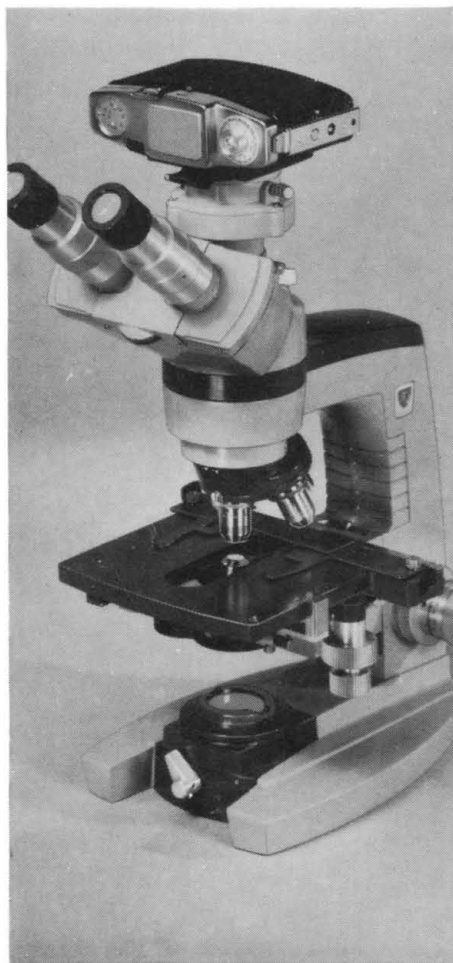
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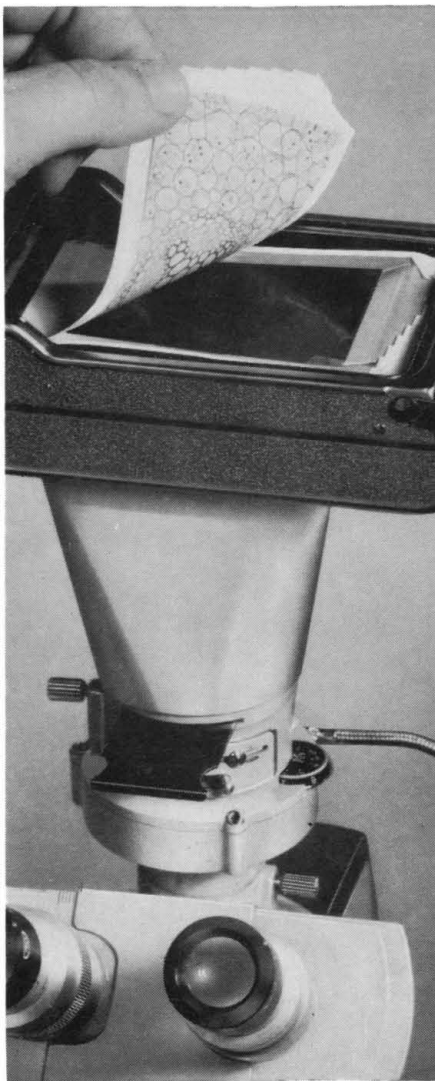


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