SCIENCE

30 March 1962

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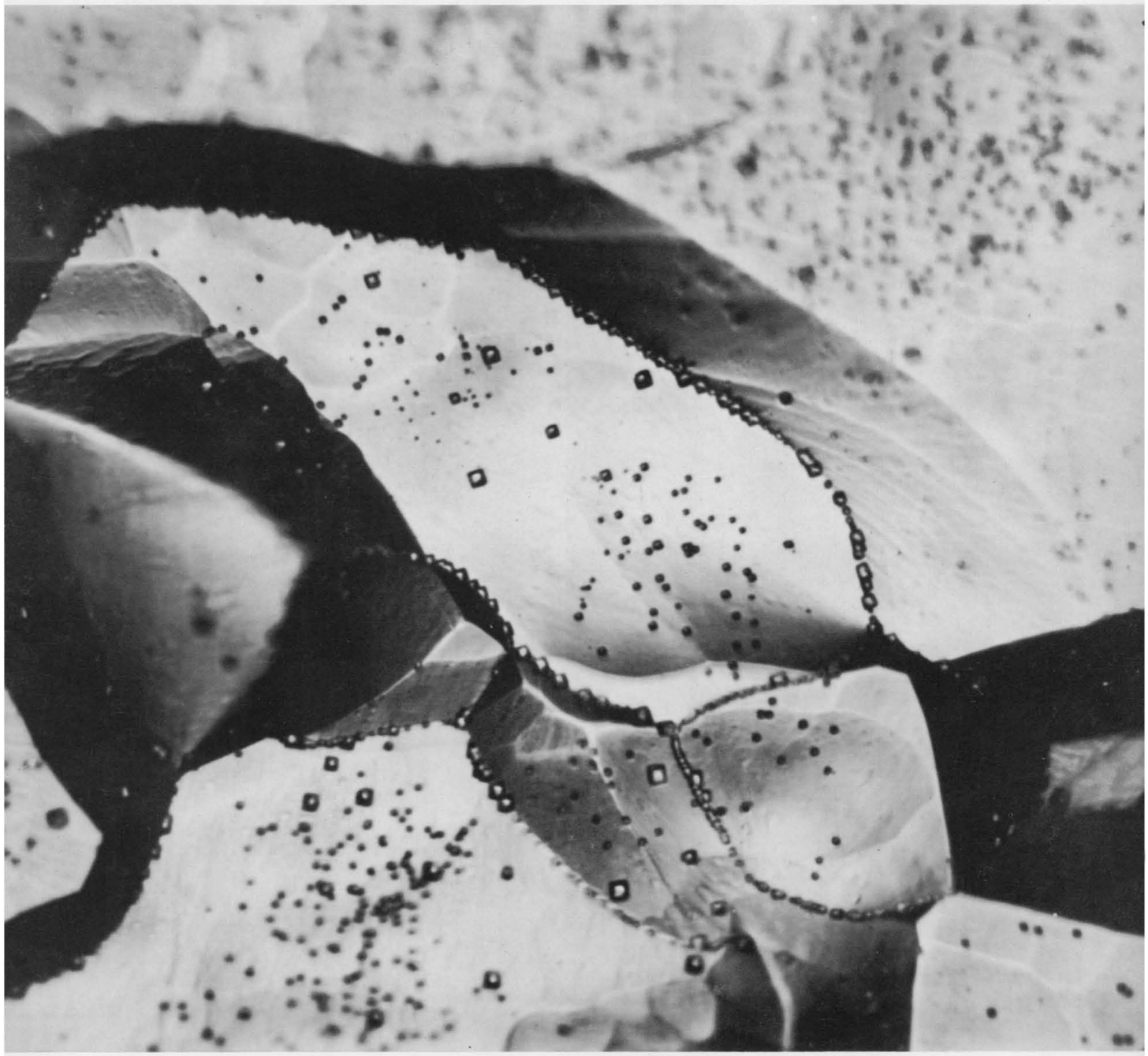
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Index Issue

The Vanguard Model 1000 VOLUMATIC Fraction Collector

The Vanguard VOLUMATIC is a completely transistorized self-contained unit employing an advanced technique for volumetric collection of chromatographic separations. Hold-up and mixing in volumetrically controlled separations are virtually eliminated when fractionation is performed with the Vanguard VOLUMATIC. Using a unique principle of repetitive cuts for a single separation, in conjunction with a photoelectric sensing device, the VOLUMATIC will collect from one to ten times the siphon volume in each test tube. The operator merely dials the number of times he wishes the siphon to fill and discharge before advancing to the next test tube. Employing this technique for collection of 5 X siphon volume for example, only the hold-up present from the last one-fifth of the first fraction is mixed with the first one-fifth of the second fraction, *an 80% reduction in mixing.*

Transistorization of all components assures absolute reliability of operation and allows continuous cold-room operation without modification.

The cast aluminum instrument cabinet affords the strength and rigidity needed for large columns and ancillary equipment, yet the entire unit weighs less than 50 lbs. Positive indexing of the stainless steel dispensing head to succeeding inner rows is achieved through mechanical gating which assures continued reliability. Compact size (25 in. wide x 30 in. long x 6 in. high) promotes maximum utilization of valuable laboratory and cold-room space. Heavy gauge, large capacity aluminum turntable (245 samples in 13mm. or 15mm. size) is supplied with handle and base-mounted rubber feet for easy removal and use as test tube tray.

Interchangeable turntables for 13mm., 15mm. and 18mm. test tubes are offered as standard accessories. To meet varying requirements a complete selection of siphons is also available. To increase the versatility of the Vanguard VOLUMATIC, transistorized time and drop counting plug-in units are also available.

Complete unit including siphon and turntable of choice with 4 ft. column support rod priced at $695.00, F.O.B. LaGrange, Illinois.

P.O. Box 244
La Grange, Illinois
FLeetwood 4-5656

VANGUARD INSTRUMENT COMPANY

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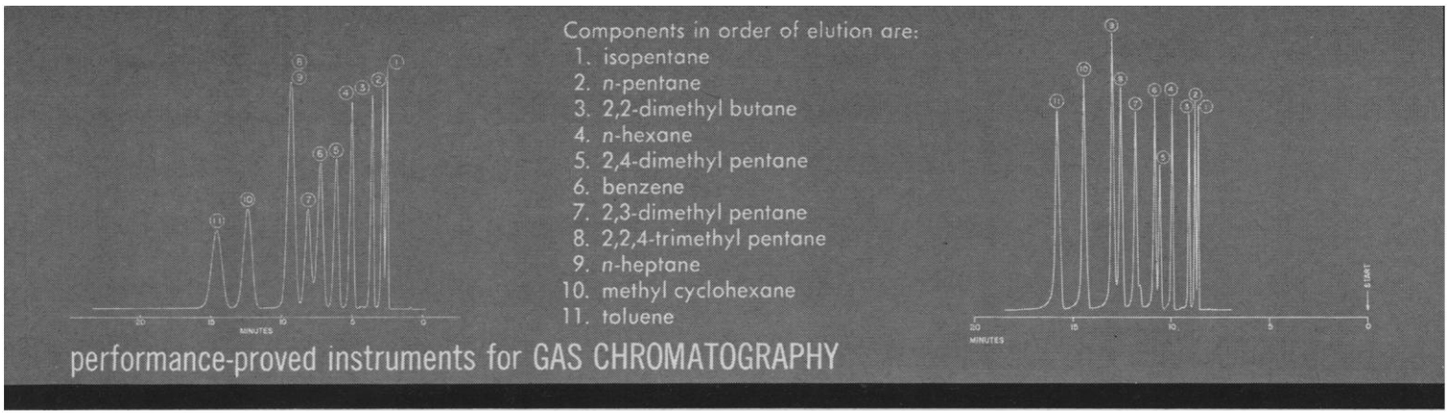


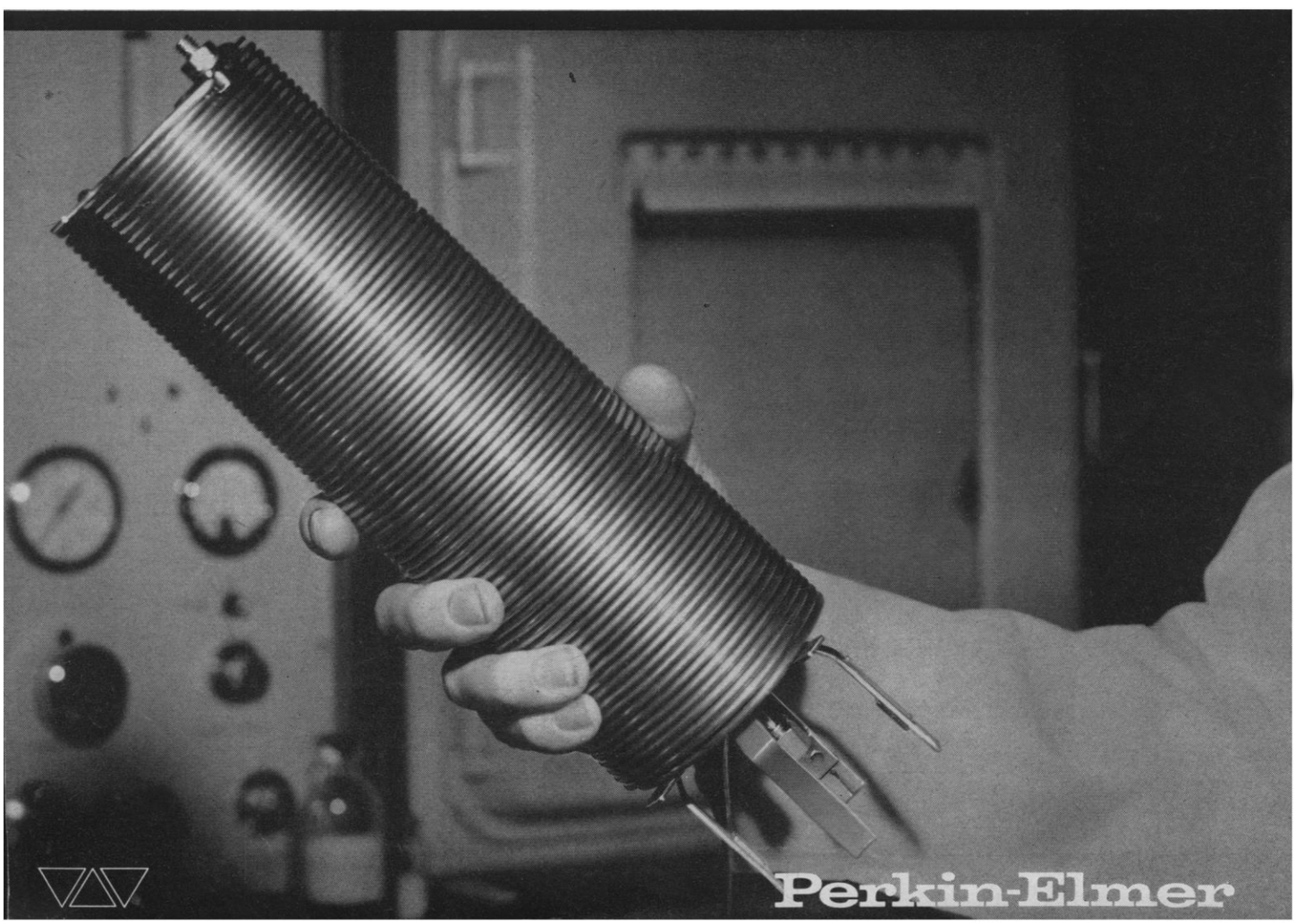
Chromatograms show (left) analysis of hydrocarbon mix on 1/4" packed column, with squalane substrate on Chromosorb-W. At right, the same 11-component mix, run on a 300-foot Large Diameter Golay column, same detector, column temperature 48°C lower. Note improved resolution, particularly on peaks 8 and 9.

NEW G. C. COLUMN GIVES GOLAY RESOLUTION WITH THERMAL CONDUCTIVITY DETECTORS

With new Perkin-Elmer *Large Diameter* Golay Columns (U.S. Patent No. 2,920,497), you can add the tremendous resolving power of the Golay column to gas chromatographs with conventional thermal conductivity detectors. Heretofore, Golay columns have been available only in capillary size, requiring accessory ionization detector and sample splitting apparatus.

The new columns, 1/8" in outside diameter, are supplied in standard 200 and 300 foot lengths wound on a mandrel for easy installation on the detector in the oven chamber of a Perkin-Elmer Model 154D or 154L Vapor Fractometer. No sample splitting is required. They perform well-resolved, highly-sensitive analyses at a significantly lower temperature than normally required for packed column operation.

Large Diameter Golay Columns are available in a variety of standard substrates, and can also be built in other configurations and special substrates, to your order. For information on these and on Perkin-Elmer's complete custom column facilities, write to Instrument Division, Perkin-Elmer Corporation, 910 Main Avenue, Norwalk, Connecticut.



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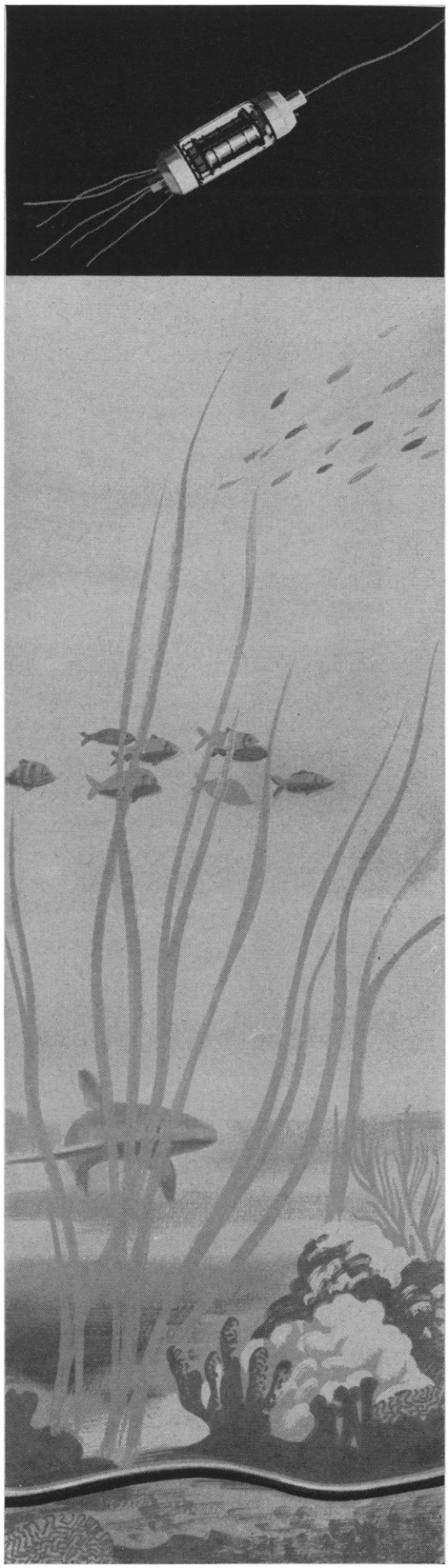
SCIENCE

Cover

Strain-free grain structure of pure aluminum (99.999 percent) produced by subjecting the cold worked metal to thermal treatment above a specific minimum temperature. The strain-free structure shown is revealed by direct chemical attack (× 700). See page 1110. [R. Brown and J. G. Morris, Department of Metallurgy, University of Kentucky]



50,000,000 tube hours... an unusual electron tube still keeps undersea voice signals strong

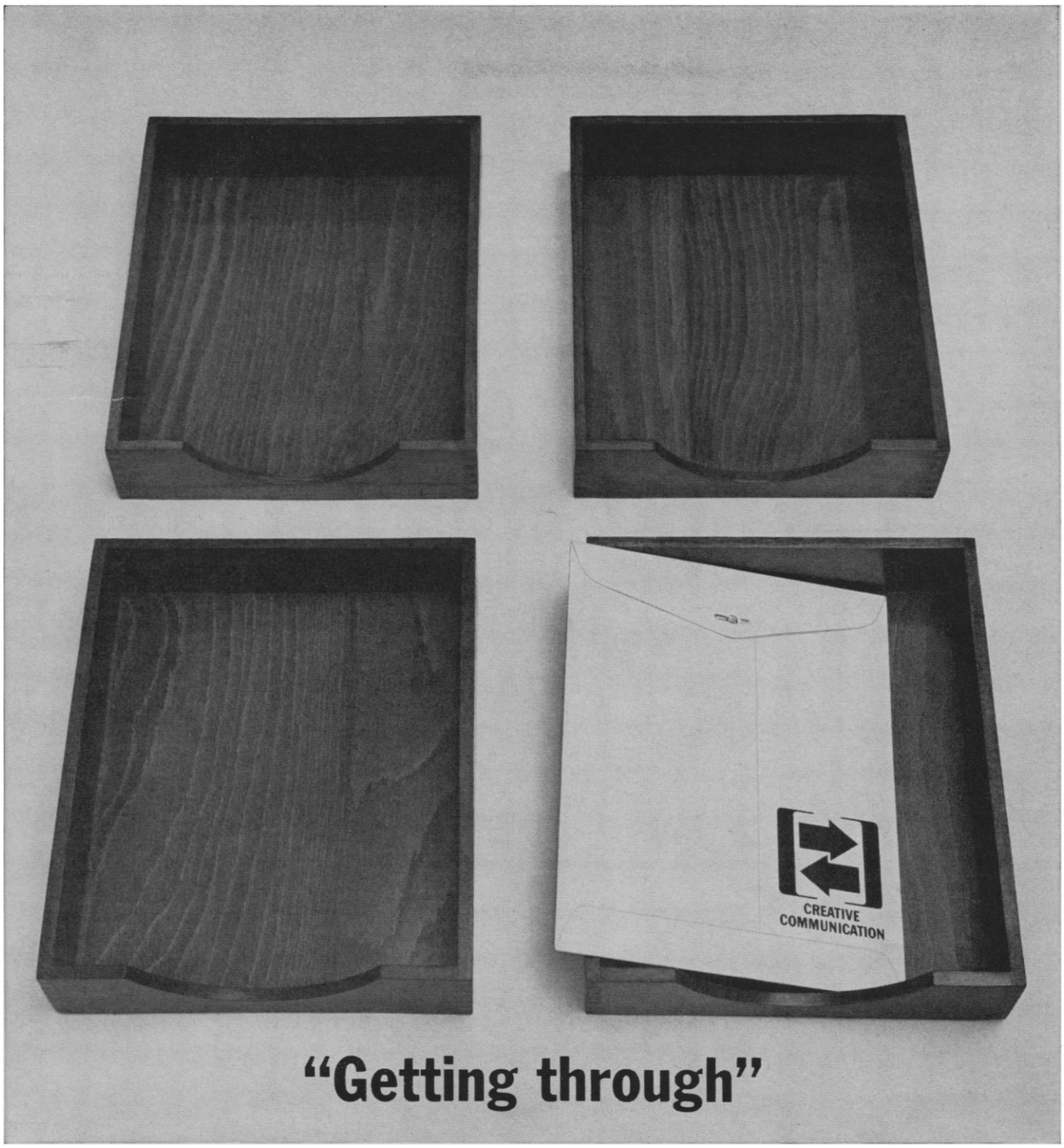
Deep on ocean floors, from North America to Europe, between Key West and Havana, Florida and Puerto Rico, under the Pacific to Hawaii and Alaska—in 20,000 miles of undersea telephone cable—a special kind of electron tube is setting a remarkable record for reliability.

This four-inch-long electron tube was designed, developed and fabricated at Bell Telephone Laboratories to operate with no attention for 20 years or more. It is part of the submarine cable repeater manufactured by Western Electric which faithfully and reliably amplifies voice signals transmitted along undersea coaxial cables.

All of the 1608 tubes built into the repeaters have operated to date without failure for a total of over 50,000,000 tube hours, or an average of three-and-a-half years. The oldest have been in service since the first deep-sea repeatered telephone cable was laid 12 years ago.

Years before it was put to use, Bell Laboratories scientists and engineers began developing this undersea tube, another example of forward-looking technology that has made the Bell Telephone Laboratories the world center of communications research and development.

BELL TELEPHONE LABORATORIES



"Getting through"

One of the frustrating problems of communication involves "getting through" to the right party. This is as true in our industry as it is in any other. Important and informative technical facts frequently are not made available to those immediately concerned. Or information gets "lost" and arrives too late to be incorporated into new product plans or sales programs. At CYANAMID FINE CHEMICALS DEPARTMENT this communicative obstacle is resolved early in client relations and maintained clear throughout. This proper channelling of information is an important first step toward establishing an effective and constructive system of communication—another of the many unique services you can expect when you communicate with . . .

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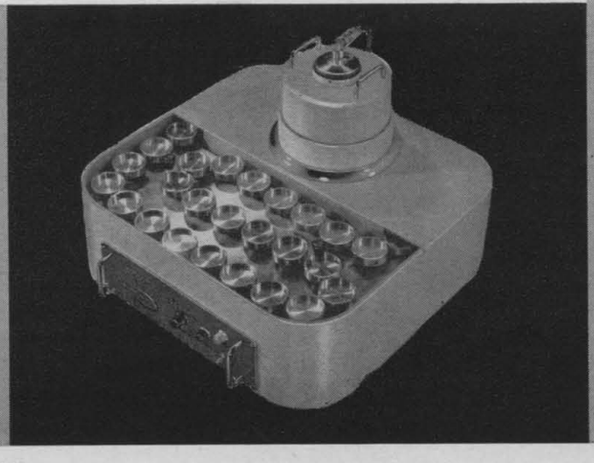
Whether you need complete counting systems or specialized instruments, you should talk to Tracerlab. Tracerlab offers a complete line of tested and proved quality instruments. Counting Systems, Scalers and Scaler Spectrometers, Ratemeters, Automatic Sample Changers, Detectors, Data Printers, Scintillation Equipment—all of the most advanced design and guaranteed capabilities—are available to you from this single source.

For further information on the complete line of Tracerlab nuclear instruments and accessories, write for General Catalog F.

Tracerlab's SC-54 Auto/Well Sample Changer is ideal for gamma sample counting. In conjunction with a Tracerlab Scaler and Data Printer it automatically counts 50 samples in vials. Data Printer provides tape record of time, counts and CPM.

Photo shows sample transfer action

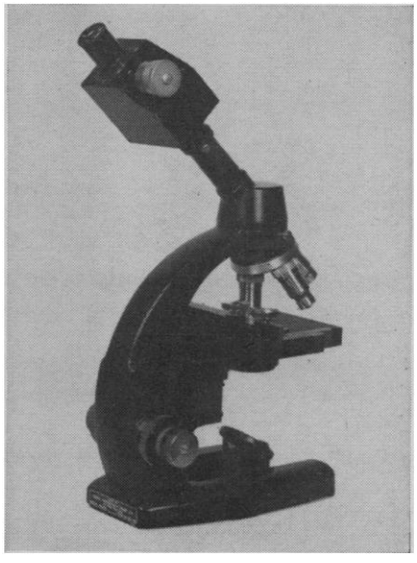


The new Tracerlab SC-100 Multi/Matic Sample Changer automatically handles up to 50 one- or two-inch samples. One of Tracerlab's newest developments, it can be used with Geiger Tubes, Scintillation Detectors as well as Tracerlab's new series of Superthin window (less than 125 micrograms per CM^2) flow counters.

COOKE BRIEFS

Particle Size Analysis and Precise Measurement

The New Cooke-A.E.I. Image Splitting Microscope (Patent Applied For)



Inaccuracies in measurements made under the microscope are nearly always due to uncertainty as to the precise location of the reference line used (either the wire of a filar micrometer eyepiece or the graduations on a graticule). Location of the reference line at the very edge of an object is inherently difficult, tiresome, time-consuming and rarely is the location precisely the same from operator to operator.

With the new Cooke-A.E.I. Image Splitting Microscope measuring settings of a type to be described can be made easily, with extreme precision and unequalled operator-to-operator repeatability. Here, briefly stated, are some of the characteristics of the instrument:

1. Measuring accuracy is as high as 0.125μ (0.000005″), depending upon the Numerical Aperture of the objective in use.

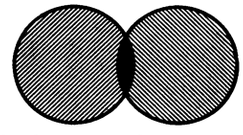
2. Comparative measurements can be made *without actually measuring.* Operator can determine at a glance which particles in a field are larger than, smaller than or equal to a particular dimension.

3. Rigidity of the microscope, or a lack thereof, does not affect accuracy. Measurements can even be made on slowly moving objects.

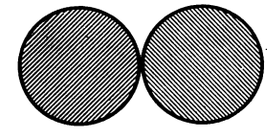
The Image Splitting Microscope consists essentially of a special prism assembly mounted in a conventional compound microscope system. Prisms are linked to a micrometer screw by means of which their angular relation to each other can be varied. When the prism faces are parallel to each other, two images of the object, exactly superimposed and appearing as one, will be visible in the eyepiece. As the micrometer screw is turned the images move (or shear) across each other. Four different relations of the two images are possible:

A 

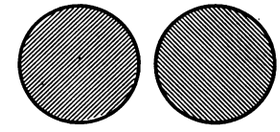
Double images of object, exactly superimposed. Prism faces parallel — zero shear.

B 

Images of object overlapping. Amount of shear less than object dimension.

C 

Images of object just touching. Amount of shear equal to object dimension.

D 

Images of object apart. Amount of shear greater than object dimension.

The edge-to-edge setting (as in C) is made with great precision, since both images are of identical appearance and sharpness and the transition from bright to dark in the area between the images is very distinct. To avoid confusion in a crowded field of view color filters can be introduced, coloring the two images distinctively.

To make an exact measurement, setting is made to the relation C, then to the reversed relation C and the total amount of micrometer run read off. Calibration of this value for the various magnifications produced by the microscope system is routine. With calibration the amount of micrometer screw shear is readily converted into an absolute measurement. Figures B, C and D show how the comparative "measurements", mentioned under 2. above and of such value in particle size analyses, are made.

Table 1. Performance Data

Objective Power (1.5X Magnification Factor in Prism System)	Reading Accuracy		Maximum size object which can be completely sheared (10X eyepiece in use)	
3X (N.A. 0.1)	0.0001″	2.5μ	0.06″	1.5mm
5X (N.A. 0.15)	0.00008″	2.0μ	0.04″	1.0mm
10X (N.A. 0.28)	0.00004″	1.0μ	0.02″	0.5mm
20X (N.A. 0.50)	0.000026″	0.6μ	0.01″	0.25mm
40X (N.A. 0.65)	0.0000128″	0.325μ	0.005″	0.12mm
100X (N.A. 1.30)	0.000005″	0.125μ	0.0025″	0.06mm

Note 1. Under very favorable conditions estimations can be made to twice the above accuracies.

Note 2. It is possible to detect conditions of image overlap indicating values so small that they cannot be measured with the micrometer. (For instance, small variations in diameter of fine wires or rods.)

References

Dyson, J. *Precise Measurement by Image Splitting*, J. Opt. Soc. Amer. **50** 754, 1960

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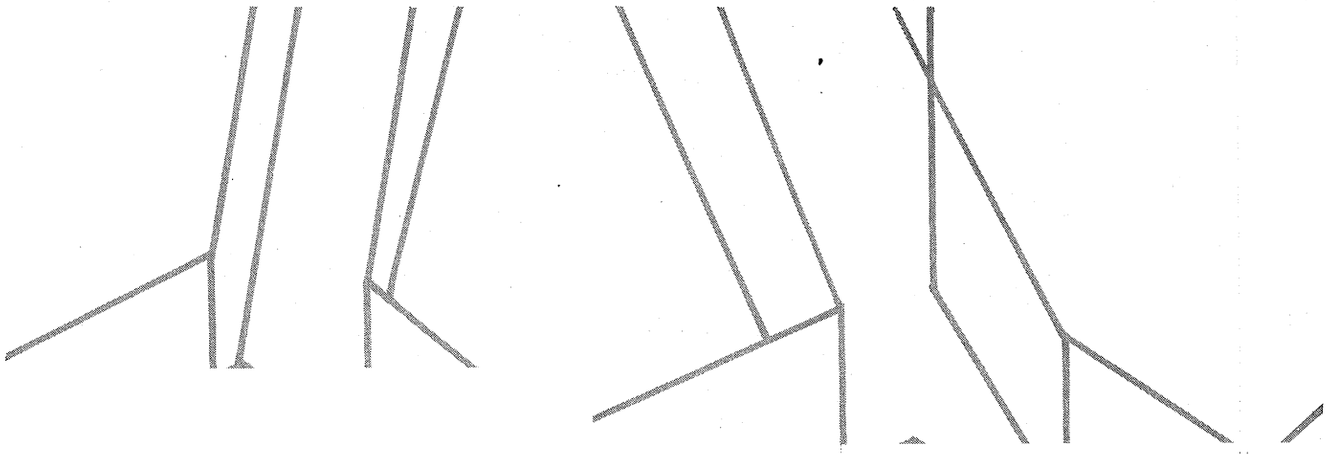

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RESEARCH EQUIPMENT

GARDINER, NEW YORK

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Mutual Aid

The United States Government, through numerous agencies—the Atomic Energy Commission, the Department of Defense, the National Aeronautics and Space Administration, the National Institutes of Health, the Department of Agriculture, and the National Science Foundation—supports research by foreign scientists in foreign countries to the tune of some $60 million per year. In addition, a large but untabulated amount is spent to help foreigners attend scientific meetings here, to help our scientists attend meetings abroad, to support international science conferences, and to support research programs such as continuing research in the Antarctic or the prospective 11-nation investigation of the Indian Ocean. These ventures in aiding foreign science or supporting work of American scientists abroad are justified by the interest of the granting agencies in obtaining results of value to their missions or by the benefits to our foreign relations that flow from strengthening science and technology in the recipient countries. Exchange programs, on the contrary, are based on the assumption that scientific cooperation is in itself good for international relations.

In view of the diversity of scientific enterprises of this kind, it is little wonder that the agreement reached by President Kennedy and Prime Minister Ikeda of Japan last June to seek ways to strengthen scientific cooperation between their countries attracted little notice. Subsequently, under the auspices of the U.S. Department of State and the Foreign Ministry of Japan, a joint committee was appointed to meet in Tokyo last December. This United States–Japan Committee on Scientific Cooperation, under the alternating chairmanships of Dr. Kankuro Kaneshige of the Japanese Atomic Energy Commission and Dr. Harry C. Kelly of the National Science Foundation, came up with some recommendations for appropriate areas of cooperation. What makes these recommendations worth considering here is not that they foreshadow earth-shaking events but that they represent the first steps in a novel approach to international scientific cooperation. For one country to support the scientists of the other, as has been our practice, is not the intent. On the contrary, the plan is to look for problems of interest to both countries and then to set up joint scientific teams to carry out the research. Both countries will contribute men, materials, and financial support, in the expectation that the results will be of value to both.

One panel of scientists from each country has been appointed to select problems for oceanographic scientific investigations in the Pacific Ocean, another to study the ecology and plant and animal geography of the Pacific area, and still others to consider cancer research, exchange of scholars, and exchange of information and materials. Among the specific problems under discussion are those of seismology, tsunamis and typhoons, and air pollution.

In May the panels will meet in Washington to get down to detailed planning. If all goes well, this pioneering effort may set a new pattern for international cooperation in science: the touchwords will be mutual aid, not foreign aid.—G.DuS.

New Products

Medical radiation analyzer (model 15-5) is a transistorized beta-gamma scintillation monitor for direct accurate measurement of radioisotopes used in diagnostic procedures concerned with thyroid behavior, metabolic activity, blood volume, and so on. A well 3½ inches deep and ⅞ inch in diameter accommodates relatively large volumes of liquid or solid samples. Measurements can also be made within the patient. This model has a counting rate of 600 count/min in a field of 0.005 mr/hr at energy levels greater than .15 Mev. Gamma response is above 0.15 Mev, and beta response above 0.5 Mev. A 0.22-μc cesium-137 source gives a counting rate of 14,000 count/min, 3 inches from the scintillator, and a counting rate of 150,000 count/min in the well.—R.L.B. (Franklin Systems Inc., Dept. S82, P.O. Box 3250, West Palm Beach, Fla.)

Automatic microburet is designed to slowly and continuously deliver a predetermined volume of liquid for production of uniform spots of sample at the origin of paper chromatographs. The instrument is loaded and adjusted in about 60 seconds after which the motor driven pipette delivers the sample to the paper. When the spotting is complete, a slip clutch will start to click signaling completion of the operation. It is claimed that the instrument can put 250 μl on smaller more uniform spots in 2 hours than a technician could apply in 3 hours.—R.L.B. (Ace Glass Inc., Dept. S91, Vineland, N.J.)

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

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

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

The information reported is obtained from manufacturers and other sources considered reliable. Neither *Science* nor any of the writers assumes responsibility for the accuracy of the information.

Address inquiries to the manufacturer, mentioning *Science* and the department number.

Random-event oscilloscope camera (model 364) is a high-speed drum-type camera that provides a total writing time of 6.99 msec at top drum speed of 8600 rev/min with film velocity 400 ft/sec. Designed for floor mounting, the camera covers most oscilloscope face sizes with an image-ratio range from 2:1 to 10:1 referring to the standard 35-mm film used in the instrument. The lens focusing range is 10 inches to 3 feet. Working aperture at the film plane with a 2:1 object-to-image ratio is $f/2.8$. Operating speed is controlled by a built-in variable transformer.—J.S. (Beckman & Whitley, Inc., Dept. S75, San Carlos, Calif.)

A portable **opacity meter** is designed for measurement of light transmission of paper. In operation, light is passed through the sample under test, and, after two or more reflections from the mat white surface of a light chamber, it is picked up by a photoelectric cell. The photoelectric current is fed through an integrating circuit to the metering circuit and is read directly as percent opacity. Opal-glass standards are supplied for calibration.—J.S. (Thwing-Albert Instrument Co., Dept. S98, Penn St. and Pulaski Ave., Philadelphia 44, Pa.)

Incremental gaussmeter (model 240) uses a single Hall-effect sensing element that can be inserted in gaps only 0.020 inch long. It can operate both as a conventional flux-measuring device and as an expanded-scale, suppressed-zero meter for observing small increments in flux density. It is said to be capable of magnifying small changes by a factor of 100. The field change can occur at any rate from 0 to 60 cy/sec, or to 400 cy/sec on special order. Incremental measurement resolution is said to be 1 part in 10,000, and accuracy ± 1 to ± 5 percent of full-scale range from 100 to 30,000 mgauss.—J.S. (F. W. Bell, Inc., Dept. S63, 1356 Norton Ave., Columbus 12, Ohio)

Electrodes and electrode jelly for noise-free electrophysiological recording are available in kits for electroencephalographic, electrocardiographic, and skin-conductance recording. Electrodes are of corrosion-resistant, flexible metal mesh in strap-on or stick-on form. The durable, nontoxic electrode bodies conform to body surface contours. Special low-noise shielded cables reduce self-generated cable noise by as much as 100 to 1 in comparison with untreated cables of the same type and length. The electrode jelly is said to be nontoxic and minimally absorbable; it is supplied in sealed containers for maximum shelf life. For extended periods of observation, a skin adhesive is used to secure the electrodes in place and seal in the conducting jelly.—R.L.B. (Decker Corp., Dept. S92, Bala-Cynwyd, Pa.)

Solid-state proportional alternating current controller provides exacting power control for temperature regulation. It utilizes a thermistor as the temperature sensor. The unit, called the Dynapac, has fast response to temperature change (within 16 msec on 60-cy/sec current) and controls temperature uniformity from a fractional point above ambient to extreme limits. It provides complete control of power from a fraction of a watt up to 4800 watts. This control of input power to the load device is performed by two, silicon-controlled rectifiers. Although specifically designed for temperature control of heating devices, the instrument is applicable wherever a transducer may be related to the control of alternating current power such as motor speed or light dimming. The unit measures 11½ (w) by 2½ (d) by 14 (l) inches and weighs 7 lbs. It has input and load terminals, and plug-ins for temperature meter, temperature control potentiometer, and thermistor sensor. The perforated metal case minimizes any heat rise. Two models are available: one with 2400-watt capacity, the other with 4800-watt capacity—R.L.B. (Dynatronic Instruments Corp., Dept. S86, 3070 W. Grand Ave., Chicago 22, Ill.)

Instrument mount will hold any measuring instrument, camera, or other device, weighing up to 7 lb and measuring 4 inches wide, and it will provide for movement of the instrument within a volume 24 by 19.5 by 3.5 inches. A component rack attachment will hold devices within an area of 24 by 22 inches and provide a back and forward

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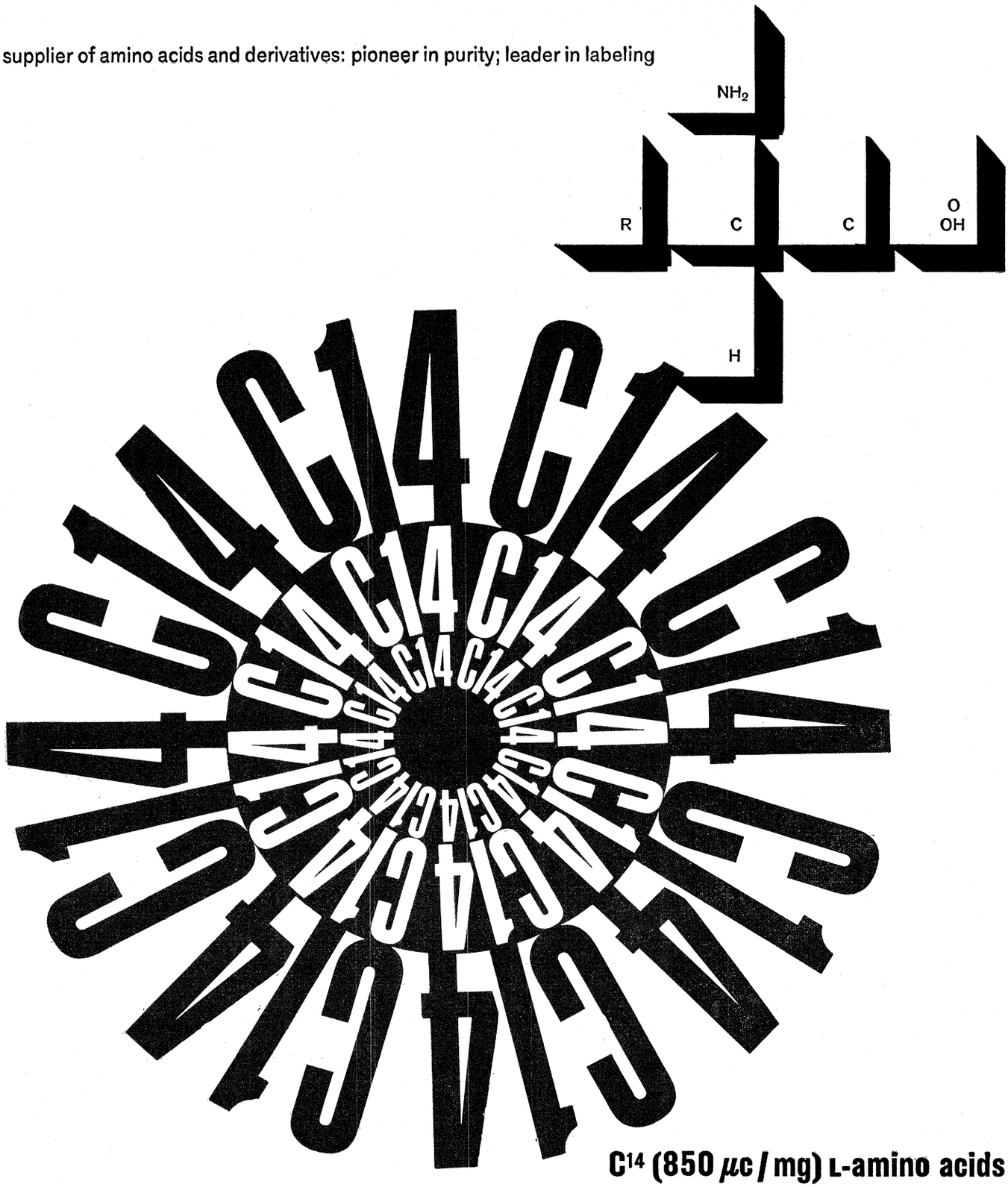

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movement of 14 inches. Additional component rails and supports are available to increase the horizontal movement to any width, and a special platform can be provided to accommodate greater weights. Precision of control of motion is said to be ±0.001 inch.—J.S. (Hoffman Engineering Corp., Dept. S95, Old Greenwich, Conn.)

Transistor-curve generator (model CG 200) will test both *n-p-n* and *p-n-p* transistors. Transistors can be tested in grounded-base or grounded-emitter configuration. The generator furnishes 10 amp of collector drive at 20 volts (peak) or 1 amp of collector drive at 200 volts (peak). The wave forms derived from the transistor under observation are fed to output terminals for connection to an oscilloscope. The instrument is said to operate properly with oscilloscopes having horizontal sensitivity of 0.5 v/div and vertical sensitivity of 0.1 v/div or greater.—J.S. (Galaxy Laboratories, Inc., Dept. S72, 3606 Midway Dr., San Diego 10, Calif.)

Subminiature high-vacuum indicator triode (type 6977) is designed for transistor circuits where its high input impedance will not load the transistors and its small drive requirements are suited to transistor circuit voltages. The tube can be operated from an a-c or d-c supply, and it draws 0.03 amp of heater current at 1.0 volt. With plate voltage of 50 volts and a series grid resistor of 10^5 ohms, full light output is obtained with zero grid supply voltage. Complete light cutoff is achieved at −3.0 volts. The glass bulb of the tube is 1.1 inches long and 0.22 inch wide. The illuminated area is approximately 0.4 inch long and 0.06 inch wide.—J.S. (Tung-Sol Electric Inc., Dept. S104, 1 Summer Ave., Newark 4, N.J.)

High-vacuum system is said to be capable of achieving an ultimate pressure as low as 10^{-10} mm-Hg and of maintaining this pressure over a period of several days without the use of liquid helium. A pressure of 10^{-9} mm-Hg can be reached within 4 hours of the start of pump-down operation, and the ultimate pressure within 8 hours. The system consists of a polished stainless-steel tank approximately 30 inches in diameter and 60 inches long. Completely removable hinged doors at both ends of the chamber allow access to any point in the chamber.—J.S. (Ilikon Corp., Dept. S102, Natick Industrial Center, Natick, Mass.)

Vidicon tube with fiber-optics faceplate (model Dev. No. C-74009) is a developmental tube with a diameter of 1 inch and a length of 6½ inches. The useful area of the face has more than 500,000 individual fibers that are each 0.0006 inch in diameter. The tube is said to have a resolving capability of about 600 TV lines and to be usable where light is sufficient to provide at least 0.5 ft-ca on the tube face. It is designed so that a flexible fiber bundle can be coupled to it by placing the end of the bundle in direct contact with the rigid fiber bundle extending through the faceplate of the tube.—J.S. (Radio Corporation of America, Dept. S93, 30 Rockefeller Plaza, New York 20, N.Y.)

Low-level gamma counting system for measuring radioactivity in bulk samples of liquids and solids is designed around a mercury shield. According to the manufacturer, the mercury shield reduces overall weight by two-thirds that of other shields with comparable characteristics. The counting chamber is designed to enable adaptation to annular, solid, or well configurations. An electrically powered door is interlocked to the sample port to provide safety to the operator.—J.S. (Delta Instrument Corp., Dept. S100, 250 Delawanna Ave., Clifton, N.J.)

Function generator makes available five different wave forms: square, triangular, sine, cosine, and ramp, with independent or simultaneous output of all five over a frequency range from 0.001 to 10,000 cy/sec. The instrument delivers 30 volts at 25 ma at the main output or 30 volts at 5 ma at auxiliary outputs. External triggering is provided in addition to manual triggering and continuous operation. Reference level is variable for above-ground or below-ground wave forms. Amplitude variation over the entire frequency range is said to be less than ±5 percent.—J.S. (Exact Electronics, Inc., Dept. S77, P.O. Box 234, Hillsboro, Ore.)

Measuring microscope no larger than a fountain pen magnifies 50 times and contains an etched glass reticle which represents 0.1 inch marked in 0.001-inch divisions. Readings are made direct from the reticle and estimates of 0.0005 inch are easily made. A chrome reflector at the base of the instrument reflects light on to the object to be measured. Sturdy construction assures long service.—R.L.B. (Edmund Scientific Co., Dept. S84, Barrington 82, N.J.)

Meetings

Forthcoming Events

April

6–8. American Soc. of Internal Medicine, annual, Philadelphia, Pa. (S. O. Krasnoff, ASIM, 3410 Geary Blvd., San Francisco 18, Calif.)

6–8. Association of Clinical Scientists, Chicago, Ill. (R. P. MacFate, 323 Northwood Rd., Riverside, Ill.)

6–8. Biological Photographic Assoc., midwestern sectional, Des Moines, Iowa. (BPA, 551 W. Grant Place, Chicago 14, Ill.)

7. New Jersey Acad. of Science, annual, West Long Branch. (H. L. Silverman, NJAS, 361 Highland Ave., Newark 4, N.J.)

7. New Mexico Acad. of Science, Socorro. (K. G. Melgaard, P.O. Box 546, Mesilla Park, N.M.)

7. Paleontological Research Institution, Ithaca, N.Y. (R. Harris, PRI, 109 Dearborn Pl., Ithaca)

7–9. Impact of Physical Metallurgy on Technology, symp., San Carlos de Bariloche, Argentina. (J. A. Sabato, National Atomic Energy Commission, Avda. Libertador General San Martin 8250, Buenos Aires, Argentina)

9–10. Chemical and Petroleum Instrumentation Symp., natl., Instrument Soc. of America, Wilmington, Del. (C. W. Sanders, E. I. du Pont de Nemours & Co., Louviers Bldg., Newark, Del.)

9–12. Aerospace Medical Assoc., annual, Atlantic City, N.J. (W. J. Kennard, c/o Washington National Airport, Washington, D.C.)

9–12. American Acad. of General Practice, annual, Las Vegas, Nev. (AAGP, Volker Blvd., Kansas City 12, Mo.)

9–12. International Feigl Symp. on Analytical Chemistry, Birmingham, England. (M. L. Richardson, c/o John & E. Sturge Ltd., Lifford Chemical Works, Kings Norton, Birmingham 30)

9–13. American College of Physicians, Philadelphia, Pa. (Chief of Information, Dept. of the Army, Washington 25)

9–13. American Welding Soc., annual, Cleveland, Ohio. (F. L. Plummer, AWS, 33 W. 39 St., New York 18)

9–13. Greater New York Safety Council, annual regional convention and exposition, New York, N.Y. (A. F. Fuller, Aetna Insurance Co., 161 Millburn Ave., Millburn, N.J.)

9–13. Inter-American Symp. on the Peaceful Application of Nuclear Energy, Mexico City, Mexico. (J. D. Perkinson, Jr., Inter-American Nuclear Energy Commission, c/o Pan American Union, Washington 6)

9–13. International Soc. for Fat Research, London, England. (Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1)

9–13. Physiology, Behavior, and Ecology of Orthoptera in Relation to Metamorphosis, intern. colloquium, Paris, France. (F. O. Albrecht, Laboratory of Natural Evolution, Natl. Scientific Research Center, 16 rue Pierre Curie, Paris)

9–14. Nutritional Absorption in Vege-

tables, intern. symp., Pisa, Italy. (Instituto di Chimica Agraria, Università degli Studi di Pisa, Via S. Michele degli Scalzi, 2, Pisa)

10–12. American Industrial Health Conf., Chicago, Ill. (M. E. Fairbank, Eastman Kodak Co., Rochester 4, N.Y.)

10–13. European Symp. on Size Reduction, European Federation of Chemical Engineering–Processing Technology Soc., Frankfurt am Main, Germany. (Verfahrentechnische Gesellschaft im V.D.I., Rheingau-Allee 25, Frankfurt am Main 7)

10–14. International Conf. on Stress Analysis, Paris, France. (Secretary, 10, rue Vauquelin, Paris 5°)

11–13. Institute of Environmental Sciences, annual meeting and equipment exposition, Chicago, Ill. (J. P. Monroe, Lear, Inc., Grand Rapids, Mich.)

11–13. Institute of Radio Engineers, southwest conf. and electronic show, Houston, Tex. (IRE, 1 E. 79 St., New York 21)

12. Symposium on Non-Conventional Nuclear-Engineering Lubricants and Bearing Materials, symp., London, England. (Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1)

12–13. Histochemical Soc., annual, Atlantic City, N.J. (M. Wachstein, St. Catherine's Hospital, Bushwick Ave., Brooklyn 6, N.Y.)

12–13. International Assoc. for Dental Research, British Div., annual, Sheffield, England. (C. H. Tonge, c/o Dept. of Anatomy, King's College Medical School, Newcastle-upon-Tyne, England)

12–14. Association of Southeastern Biologists, Wake Forest, N.C. (H. J. Bennett, Dept. of Zoology, Louisiana State Univ., Baton Rouge 3)

12–14. Experimental Arithmetic, symp., American Mathematical Soc., Chicago, Ill. (N. C. Metropolis, Inst. for Computer Research, Univ. of Chicago, Chicago)

13–14. American Soc. for Artificial Internal Organs, annual, Atlantic City, N.J. (E. C. Peirce, II, ASAIO, 514 W. Church Ave., Knoxville 1, Tenn.)

13–14. Iowa Acad. of Science, Waverly. (P. F. Romberg, Iowa State Univ., Ames)

13–14. Nebraska Acad. of Sciences, Lincoln. (C. B. Schultz, Univ. of Nebraska, Lincoln 8)

13–15. Alabama Acad. of Science, Inc., Troy. (W. B. DeVall, Forestry Dept., Auburn Univ., Auburn, Ala.)

13–15. American Assoc. for Cancer Research, annual, Atlantic City, N.J. (H. J. Creech, Inst. for Cancer Research, Fox Chase, Philadelphia 11, Pa.)

14–16. Kinetics, Equilibria, and Performance of High Temperature Systems, 2nd conf., Los Angeles, Calif. (G. S. Bahn, 16902 Bollinger Dr., Pacific Palisades, Calif.)

14–18. Federation of American Societies for Experimental Biology, Atlantic City, N.J. (M. O. Lee, 9650 Wisconsin Ave., Washington 14)

14–19. American Inst. of Nutrition, Atlantic City, N.J. (A. E. Schaefer, Bldg. 16-A, Natl. Institutes of Health, Bethesda 14, Md.)

14–19. American Soc. of Biological Chemists, Inc., Atlantic City, N.J. (F. W. Putnam, Dept. of Biochemistry, Univ. of Florida College of Medicine, Gainesville)

15–18. American College Personnel

Assoc., Chicago, Ill. (B. A. Kirk, Counseling Center, Univ. of California, Berkeley)

15–18. National Education Assoc., Council of Mathematics Teachers, San Francisco, Calif. (Chief of Information, Dept. of the Army, Washington 25)

16–18. Flight Test Instrument Symp., intern., Cranfield, England. (College of Aeronautics, Cranfield)

16–18. Spins and Phonons, conf., Bristol, England. (P. M. Llewellyn, H. H. Sills Physics Laboratory, Royal Fort, Bristol 8)

16–19. American Personnel and Guidance Assoc., annual, Chicago, Ill. (J. Fishbein, Science Research Associates, 259 E. Erie St., Chicago 11)

16–19. Interactions between Mathematical Research and High-Speed Computing, symp., American Mathematical Soc.–Assoc. for Computing Machinery, Atlantic City, N.J. (E. Pitcher, AMS, 190 Hope St., Providence 6, R.I.)

16–19. Paleoclimatology and Paleopedology, symp., International Soc. for Plant Geography and Ecology, Stolzenau, Germany. [R. Tüxen, Intern. Vereinigung für Vegetationskunde, Stolzenau (Weser)]

16–19. Vacuum Ultraviolet Radiation Physics, intern. conf., Los Angeles, Calif. (G. L. Weissler, Univ. of Southern California, Los Angeles 7)

16–20. American Physiological Soc., Atlantic City, N.J. (R. G. Daggs, APS, 9650 Wisconsin Ave., Washington 14)

16–20. American Soc. for Pharmacology and Experimental Therapeutics, Atlantic City, N.J. (H. G. Mandel, George Washington Univ. School of Medicine, 1337 H St., NW, Washington 5)

16–20. Reactor Safety and Hazards Evaluation Techniques, symp., Vienna, Austria. (Intern. Atomic Energy Agency, 11 Kaerntnerring, Vienna 1)

17–18. Conference on Permafrost, Ottawa, Ont., Canada. (R. J. E. Brown, Div. of Building Research, Natl. Research Council, Ottawa 2)

17–20. International Mineralogical Assoc., Washington, D.C. (D. J. Fisher, Dept. of Geology, Univ. of Chicago, Chicago 37, Ill.)

17–20. Sector-Focused Cyclotrons, conf., Los Angeles, Calif. (B. T. Wright, Dept. of Physics, Univ. of California, Los Angeles 24)

18–20. American Inst. of Electrical Engineers, Fort Wayne, Ind. (R. S. Gardner, AIEE, 33 W. 39 St., New York 18)

18–20. Information Retrieval in Action, conf., Cleveland, Ohio. (Center for Documentation and Communication, Western Reserve Univ., 10831 Magnolia Dr., Cleveland 6)

18–28. World Seed Congr., Rome, Italy. (Intern. Agency Liaison Branch, Office of the Director General, Food and Agriculture Organization of the U.N., Viale delle Terme di Caracalla, Rome)

19. Southern California Acad. of Sciences, Los Angeles. (G. Sibley, Los Angeles County Museum, 900 Exposition Blvd., Los Angeles 7)

19–20. Southern Municipal and Industrial Waste Conf., Chapel Hill, N.C. (Dept. of Sanitary Engineering, Univ. of North Carolina, Box 899, Chapel Hill)

19–21. Southern Soc. for Philosophy and Psychology, Memphis, Tenn. (D. R. Kenshalo, Dept. of Psychology, Florida State Univ., Tallahassee)

20–22. Czechoslovak Soc. of Arts and Sciences in America, 1st natl. congr., Washington, D.C. (M. Rechcigl, Jr., 1703 Mark Lane, Rockville, Md.)

21. Pennsylvania Acad. of Science, Pittsburgh. (K. B. Hoover, Messiah College, Grantham, Pa.)

21–21 Oct. World's Fair of Science, Century 21 Exposition, Seattle, Wash. (J. Rockey, c/o Seattle World's Fair, Seattle 9)

22–26. Association of American Geographers, Miami Beach, Fla. (M. F. Burrill, AAG, 1785 Massachusetts Ave., NW, Washington, D.C.)

23–25. Canadian Inst. of Mining and Metallurgy, annual, Ottawa, Ont. (C. Gerow, CIMM, 1117 St. Catherine St., W. Montreal 2, Quebec, Canada)

23–25. Meteorological Uses of Rockets and Satellites, symp., Washington, D.C. (World Meteorological Organization, 41, Avenue Giuseppe Motta, Geneva, Switzerland)

23–25. Pan American Congr. of Gastroenterology, New York, N.Y. (C. A. Flood, 180 Fort Washington Ave., New York 32)

23–26. American Physical Soc., Washington, D.C. (K. K. Darrow, APS, Columbia Univ., New York 27)

23–27. International Conf. on Palynology, Tucson, Ariz. (G. O. W. Kremp, Geochronology Laboratories, Univ. of Arizona, Tucson)

23–27. Problems in Education and Research in Tropical Biology, conf., San Jose, Costa Rica. (J. M. Savage, Dept. of Biology, Univ. of Southern Calif., Los Angeles 7)

23–5. Television Arts and Sciences, intern. symp. and festival, Montreux, Switzerland. (Intern. Television Symp., 8, Grand-Rue, Montreux)

24–25. Building Research Inst., spring conf., Washington, D.C. (M. C. Coon, Jr., BRI, 2101 Constitution Ave., NW, Washington 25)

24–25. Managing Petroleum and Petrochemical Operations, conf., San Antonio, Tex. (J. Harmon, Southwest Research Inst., 8500 Culebra Rd., San Antonio 6)

24–26. Mathematical Theory of Automata, intern. symp., New York, N.Y. (Symposium Committee, Polytechnic Inst. of Brooklyn, 55 Johnson St., Brooklyn 1, N. Y.)

25. Rocket Propulsion, symp., Cranfield, Bletchley, England. (Secretary, British Interplanetary Soc., 12 Bessborough Gardens, London, S.W.1, England)

25–27. International Federation of Associations of Textile Chemists and Colorists, annual, Amsterdam, Netherlands. (J. Boulton, Dean House, 19, Piccadilly, Bradford 1, Yorks, England)

25–27. Present Status and Future Prospects of Television and Motion Pictures as Media for Medical Education, intern. conf., Milan, Italy. (L. L. Leveridge, Medical Television Unit, New York Univ. Medical Center, 550 First Ave., New York 16)

25–27. Pulp and Paper Instrumentation Symp, natl., Jacksonville, Fla. (L. G. Good, Systems Service Corp., P.O. Box 952, Charlotte, N.C.)

27–28. Idaho Acad. of Science, annual, Moscow. (L. M. Stanford, College of Idaho, Caldwell)

27–29. Oklahoma Acad. of Science, Woodward. (A. D. Buck, Northern Oklahoma Junior College, Tonkawa)

27–29. West Virginia Acad. of Science, Bethany. (J. D. Draper, Dept. of Chemistry, West Virginia Univ., Morgantown)

28. Mississippi Acad. of Sciences, Inc., Jackson. (C. Q. Sheely, Mississippi State Univ., State College)

29–2. International Acad. of Pathology–American Assoc. of Pathologists and Bacteriologists, Montreal, Canada. (F. K. Mostofi, c/o Armed Forces Inst. of Pathology, Washington 25)

29–2. National Workshop on Aging, American Home Economics Assoc., Lafayette, Ind. (A. J. Bricker, AHEA, 1600 20th St., NW, Washington 9)

29–3. American Ceramic Soc., annual, New York, N.Y. (C. S. Pearce, ACS, 4055 N. High St., Columbus 14, Ohio)

29–4. Society of Motion Picture and Television Engineers, annual, Los Angeles, Calif. (H. Teitelbaum, SMPTE, 55 W. 42 St., New York 36)

30–1. International Acad. of Pathology, annual, Montreal, Canada. (M. Davis, Intersociety Committee on Pathology Information, 1785 Massachusetts Ave., NW, Washington 6)

30–1. International Acetylene Assoc., annual, Toronto, Canada. (L. Matthews, 30 E. 42 St., New York 17)

30–2. American Soc. of Mechanical Engineers, Design Engineering Div., Philadelphia, Pa. (A. B. Conlin, Jr., ASME, 29 W. 39 St., New York 18)

30–2. Association of Iron and Steel Engineers, Detroit, Mich. (T. J. Ess, AISE, 1010 Empire Bldg., Pittsburgh 22, Pa.)

30–2. Instrumental Methods of Analysis, natl. symp., Instrument Soc. of America, Pittsburgh, Pa. (E. E. Buckston, Works Engineering Dept., Union Carbide Chemicals Co., P.O. Box 8004, S. Charleston 3, W.Va.)

30–2. Role of Food in World Peace, intern. symp., Columbus, Ohio. (R. M. Kottman, College of Agriculture, Ohio State Univ., Columbus 10)

30–3. Mid-America Spectroscopy, annual symp., Soc. for Applied Spectroscopy, Chicago, Ill. (J. R. Ferraro, Argonne, Natl. Laboratory, 9700 S. Cass Ave., Argonne, Ill.)

30–4. Compressed Air and Hydraulics, intern. conf. and exhibition, London, England. (W. G. H. Chesher, c/o John Trundell and Partners Ltd., St. Richard's House, Eversholt St., London, N.W.1)

30–5. Automobile Technical Congr., intern., London, England. (Automobile Div., Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1)

May

1–3. Biologistics for Space Systems, symp. and workshop, Dayton, Ohio. (Col. A. I. Karstens, Aerospace Medical Research Laboratories, Aeronautical Systems Div., Wright-Patterson AFB, Ohio)

(See 16 March issue for comprehensive list)