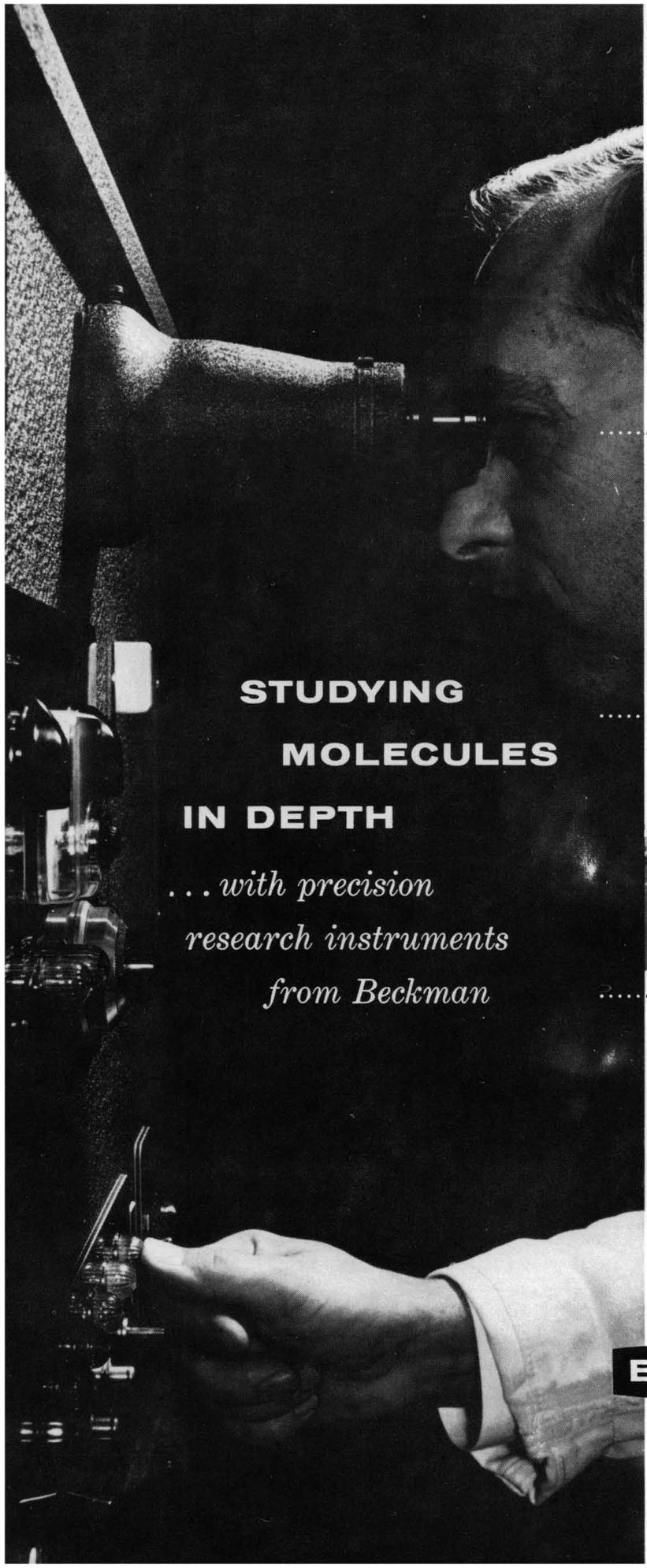
SCIENCE

9 March 1962
Vol. 135, No. 3506

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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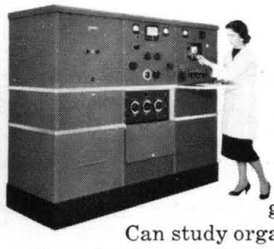

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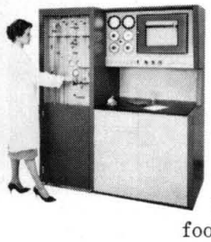

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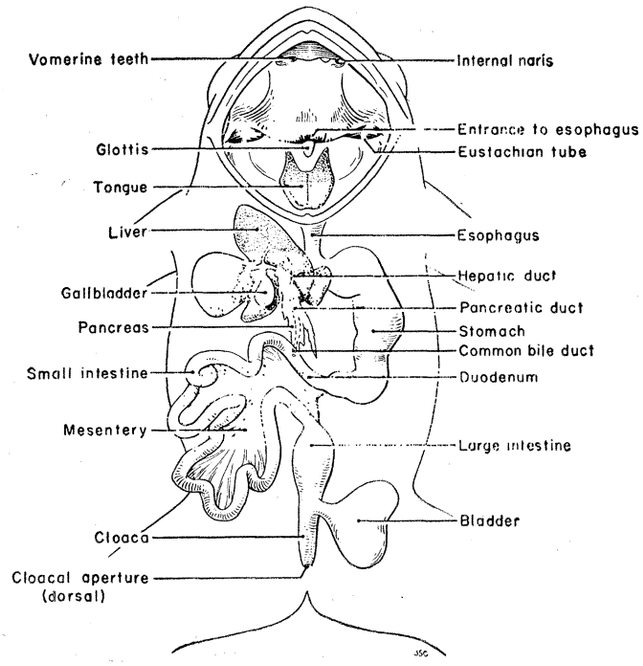

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Experiments Part I

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Microscope
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*Lower Invertebrates
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*The Chordate Line
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ADVANCED OPTICS AND ELECTRONICS . . . SERVING SCIENCE

9 March 1962, Volume 135, Number 3506

SCIENCE

Cover

Shell structure of *Globorotalia menardii*, a planktonic foraminiferan collected in the Atlantic Ocean. The two elongated objects, approximately vertical, are pores through which the organism extrudes its protoplasm. The parallel lines that extend across the picture are shell layers. The surface of the shell is at the bottom. [David Krinsley, Queens College, Flushing, N.Y.; Allen Be, Lamont Geological Observatory, Columbia University; Taro Takahashi; State University of New York College of Ceramics at Alfred University, Alfred, N.Y.]

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

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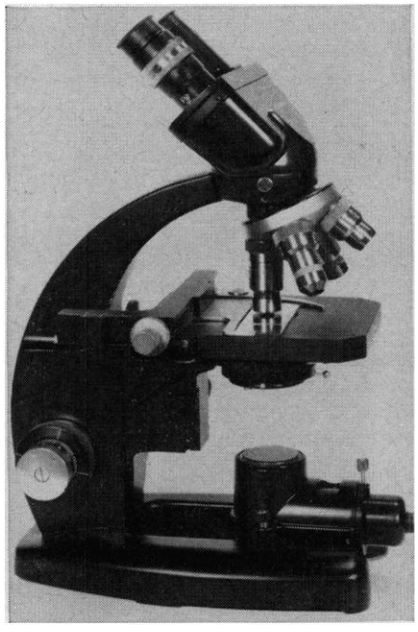
Instruments and Applications

An Inexpensive Flat Field High-dry Achromat

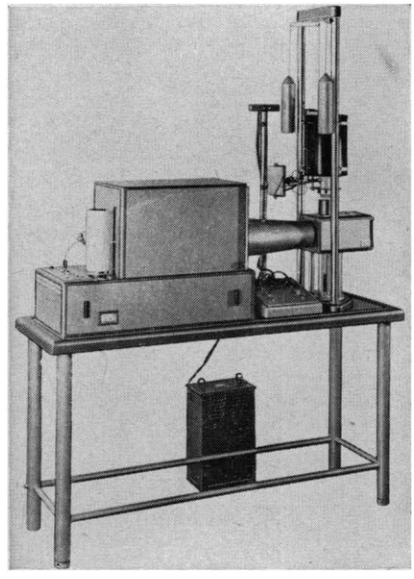
It is inevitable that conventional achromatic objectives have a certain amount of field curvature, if the best central definition is to be obtained. There is, however, a need for high-power dry objectives with flat fields, especially in the more routine laboratory uses of the microscope, and many makers compute their 40X objectives to give a flatter field while sacrificing something in resolution. In these past few years some elaborate designs have given flat fields without this compromise, but these objectives have not been generally adopted because of the very high cost involved.



A new basic approach to this design problem has been taken by Cooke resulting in the development of a new 40X achromatic objective. The Microplan 40 gives an extremely flat field of view, retains the maximum definition of the best N.A. 0.65 conventional achromatic objectives, and costs only slightly more. Because of tube length considerations the objective is most suitably used with the Cooke M15 Biological Microscopes.

Extension of Thermogravimetric Techniques

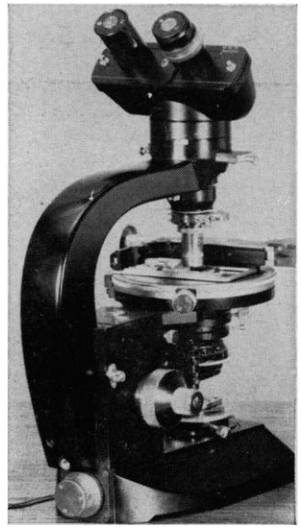
Many applications for the comparatively new techniques of thermogravimetry (measurement of weight change through a heat-time cycle) have been discovered in the fields of chemistry and metallurgy. In order to extend these studies into the critical areas where high temperatures and high vacuums are required, specialized apparatus has been needed.



The new Chevenard TH59 Thermobalance has been developed for routine and research studies in programmed temperature cycles up to 1500°C with specimens (up to 50 grams in weight) in a high vacuum or any desired controlled atmosphere. Recording is accomplished by a photoelectric spot-follower system of novel design. Very small weight changes can be shown as a function of time or of time and temperature.

A New Research Polarizing Microscope

The Cooke M75 series Universal Polarizing Microscope is designed for both quantitative and qualitative mineralogical techniques and, at the same time, provides for those having special requirements for observation in conventional transmitted and incident light microscopy.

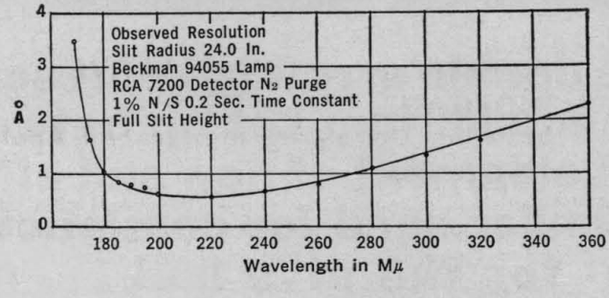


A large universal stand is supplied fitted for either built-in "solid source" illumination or an exterior higher-power source. Both stage and limb are mounted on robust dovetail slides and can be moved and clamped to provide up to 105mm of free space between objective and stage surface, allowing use of special set-ups and very large specimens. Different types of stage for a wide variety of special purposes can be instantly interchanged. There is a centerable aplanatic condenser suitable for both conoscopic and orthoscopic observation without the necessity for a trip-out front lens. A quartz compensator in the binocular body eliminates any partial polarization effects of the inclination prisms.

With this microscope all mineralogical techniques as well as regular transmitted and normal incident light studies in bright field, dark field and phase contrast can be carried out. Slotted objectives permitting insertion of compensators just above the objective back lens and a "Wright" slotted ocular can be supplied.

Beckman® DK-A

world's most versatile spectrophotometer...



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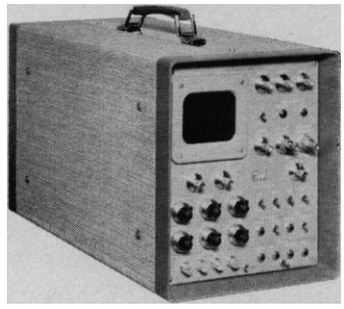
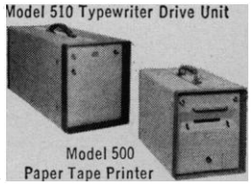
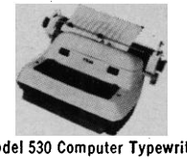
LARGE CAPACITY 4096-channel CN-440 time-of-flight analyzer.
Details of each analyzer series are listed below.



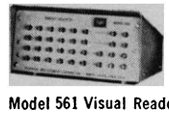
The 400-channel *"400 Series"* Pulse Height Analyzers occupy little over a cubic foot of space and weigh just 36 lbs. All circuits are board-mounted and easily accessible from the sides. *The Model 404* is a four-input unit; *Model 401* is an economical single input version. Both have low level linear amplifiers . . . memory grouping of 4 groups (100 channels each) 2 groups (200 each) and 1 group . . . automatic or manual data transfer from half to half and even quarter to quarter within one half. 400 series analyzers can also be used in multiscaler operation. Specifications such as average dead time of 60 μsec, and ½ channel per day stability are typical.



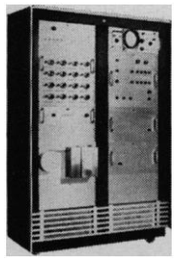
ACCESSORIES:
Model 500 Paper Tape Printer; Model 510 Typewriter Drive Unit. Model 530 IBM Computer Typewriter; Model 550 Paper Tape Reader plus various readout control units. Also, auxiliary equipment such as the Model 561 Visual Readout Indicator; Model 566 5" Oscilloscope Display Unit; X-Y plotters, null detectors, and character printers are all available as 400 series accessories.



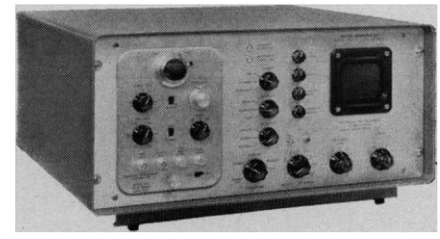
Model 530 Computer Typewriter



Model 561 Visual Readout Indicator

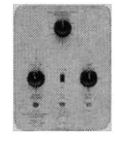


The *CN-440* — 4096-channel Time-of-flight Analyzer. Channels can be arranged in 16 groups of 256, each group with its own amplifier and integral discriminator. Memory cycle time fixed at 16 μsec . . . readout is by CRT display and punched tape built into the system as well as by auxiliary card punch, typewriter, printer and magnetic tape units.

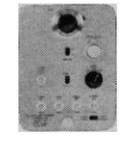


The *CN-110* — a 256-channel, all-transistor, digital computer with CRT display and switch-selected binary, decimal and analog readout. Simply change one logic unit for another of the seven interchangeable plug-ins and you change the system — in seconds. Types of logic available:

PULSE HEIGHT ANALYZER (#210) — built-in linear amplifier . . . coincidence gating . . . 5 x 10^4 cps . . . 42 μsec. ave. dead time.



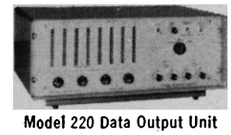
TIME-OF-FLIGHT ANALYZER (#211) 9 channel widths — 0.25 to 64 μsec. . . . dead time 16 μsec . . . 4 switch-selected types of delay.



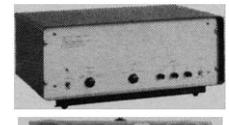
PULSE HEIGHT ANALYZER (#213) 4 inputs . . . coinc./anti-coinc. gating . . . 42 μsec. ave. dead time.

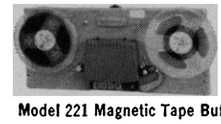
COINCIDENCE PAIR SPECTROMETER (#216) — 2 dimensional (16 x 16) analyses . . . dead time fixed, 100 μsec.

PULSED NEUTRON; MASS SPECTROMETER and MULTISCALER units are also available.



Model 220 Data Output Unit





Model 221 Magnetic Tape Buffer Storage Unit

ACCESSORIES:
The Model 200 Data Output Unit — handles digital output, serves as a live timer, true timer and analysis cycle counter. Model 221 Magnetic Tape Buffer Storage Unit — provides high-speed storage of data for later playback. Model 8276 Binary Information Indicator for visual indication of address and arithmetic information. Compatible Hewlett-Packard printer, Monroe Data-Log paper taper printers and tape printer and punch combinations are also available.

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9 March 1962, Volume 135, Number 3506 **SCIENCE**

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Pal Smurch Would Never Make It Today

James Thurber once wrote a story about a garage worker from Iowa, who, using special, floating auxiliary gas tanks, becomes the first man to fly nonstop around the world. The story is called "The Greatest Man in the World" and is set in 1937. In the story, Jack ("Pal") Smurch, for such is the aviator's name, is the kind of guy who is not hard to get to know. Emerging from the plane at the end of the flight with a now empty gallon of bootleg gin, Smurch is ready to tell the world that he has put one over on Lindbergh and is set for the parties and the big money. During the flight, however, a tremendous popular feeling has welled up for Smurch, and to preserve national decorum and international amity, he is hustled off to a special debriefing session with leading congressmen, selected members of the press, and the President of the United States. But as the session proceeds it becomes only more and more obvious that Smurch will never grasp the ethics of heroism. And so, when he strays over to an open window to listen to the newsboys shouting his name in the street far below, at a grim nod from the President, he is pushed out, falling to what is immediately mourned as a tragic, accidental death.

Less extreme measures for promoting national decorum and international amity are sufficing for the space age. We were lucky with Lindbergh, but we do not have to rely on luck any longer. Despite his undeniable daring, Thurber's Pal Smurch would never have made it as an astronaut. The space age has the advantage of picking its heroes and it is evident that this advantage is being put to good use. The natural ability of the astronauts in achieving laurels is matched only by their natural ability in accepting them gracefully. Lieutenant Colonel John Glenn, it is generally agreed, behaved as ably in his appearances before the nation, and before the world, as he did when operating the Friendship 7 spacecraft.

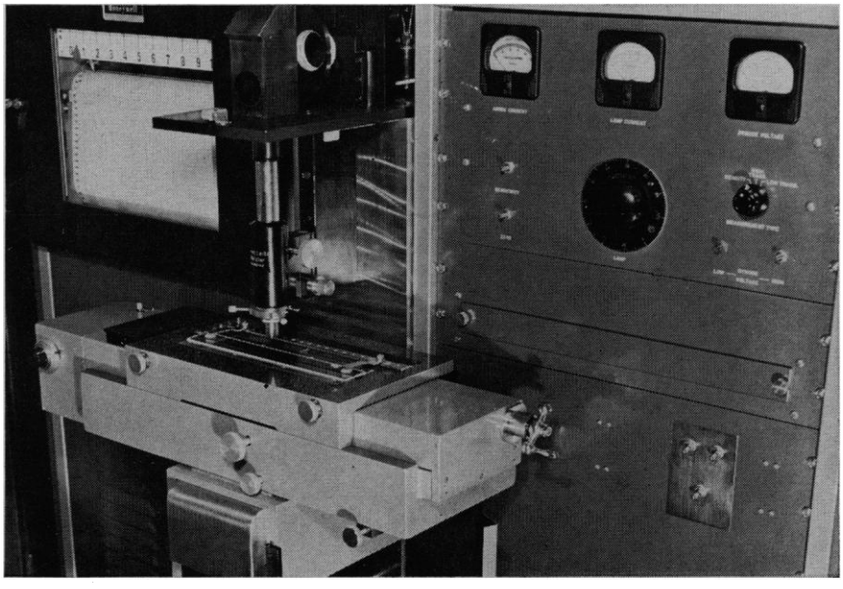
The space program is supposed to demonstrate something about the character and power of this country, and the virtues of the astronauts, of course, are not the whole of this demonstration. As Glenn pointed out in his address last week to the joint meeting of Congress, it is of more than passing interest that the information gained from these flights is available to all nations and that the launch was conducted openly with reporters from all over the world present. It would have been a bit difficult, of course, to conduct the launch secretly, but this does not mean that we are making the best of a bad situation but rather that we are dramatizing a good one.

If we now find ourselves sailing this new ocean, it is because we believe that our successes will hearten us and our friends and will give our foes second thoughts. To point this out is not to deny that these successes have something to do with the advancement of science. In his address to Congress, Glenn also touched on the scientific aspect of the space program and reminded us that knowledge begets knowledge. But if the funds for the space program had been allocated solely for the advancement of science, they might have been spent a bit differently. The way these funds are presently allocated it is as though the new Cultural Director at the White House were given a very generous sum for the support of music and spent it all on grand opera.—J.T.

Kodak reports on:

the trouble with thinking small . . . a triple-ply ether with nitrile prongs . . . a paper trick for instrument designers

Densitometry in Lilliput



The sharp minds now focussed on the information-storing function of photography always seem to wind up thinking very small. At the same time electronics is shrinking to microelectronics. This also requires thinking very, very small about photography.

We cannot be blamed for feeling a little wistful while we cheer photography's progress in Lilliput. A remarkably small number of dollars worth of Kodak High-Resolution plates are used up in producing a remarkably large number of micro-transistors.

Fear not for us. We'll make out.

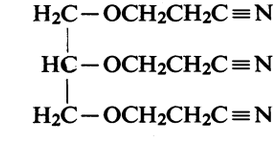
Nowhere will you catch us claiming that this "micro" business is as easy photographically as falling off a log. Indeed, an appreciation of the relationship between the logs of exposure and reciprocal transmittance makes scarcely more than a good beginning toward controlling them on a micro scale. Here the frequency response of a photographic emulsion must be cascaded with the frequency response of the other components in the total picture-handling system.

The game is widely believed to be worth the candle. To shed light on what is really going on, one needs to be able to measure density reliably over an area as little as ¼ micron wide, scanned in synchronism with a recorder so that hard-to-judge light sensations are logarithmically converted into easier-to-judge traces on a chart.

Shown above is such an instrument we built for our own work. Here also, perhaps, is some of the answer to the little economic problem we have hinted at. We can be paid for our work through sale not only of the cartoned products of our research but also through sale to others of the best available tools for such research. If we can line up orders for, say, half a dozen of these *Kodak Microdensitometers, Model 3*, we would be able to deliver them for about $38,000 apiece, more or less.

A note to Eastman Kodak Company, Special Products Sales, Apparatus and Optical Division, Rochester 4, N. Y., will bring enough details to approach the boss for authorization to come to Rochester for a look and a talk.

McNair's Stationary Phase



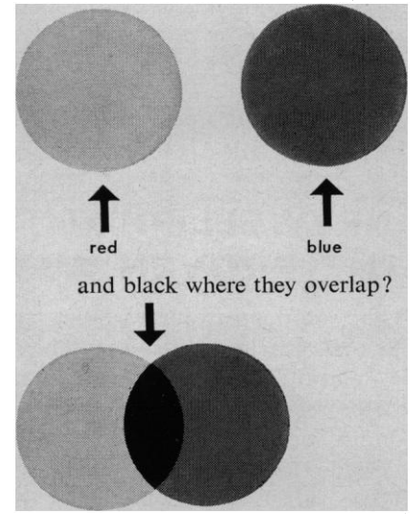
1,2,3-Tris(2-cyanoethoxy)propane (25 g. for $3.25) is a liquid which makes a good stationary phase for gas chromatographic columns. It has better selectivity for olefins, aromatics, naphthenes, alcohols, esters, ethers, and alkyl halides than can be expected of solvents like dinonyl phthalate. Its affinity for paraffins is small, but even these are separable at 55°C. One can see reasons why one might have expected that this triple-ply ether with nitrile prongs would exhibit a useful combination of phlegmatic character and polar attraction to various molecular species passing by.

Frankly, it had not occurred to us. It occurred instead to Mr. H. M. McNair. Mr. McNair was engaged at the time in earning the right to be addressed as Doctor McNair. This required that something new and decently significant be freely contributed to human knowledge. McNair undertook to fulfill the obligation by studying 17 solvents and 40 solutes for correlation between retention volumes and solvent-solute interaction forces. One of the fruits of the investigation was the knowledge (duly contributed to mankind in *Anal. Chem. 33*, 806) of the wide usefulness in gas chromatography of *1,2,3-Tris(2-cyanoethoxy)-propane*. While Doctor McNair has moved along to the research laboratories of a large corporation (not the one paying for this space, as it happens), we suggest the substance be remembered as McNair's Stationary Phase.

Alternatively, you can remember it as Eastman 8445, one of some 3900 Eastman Organic Chemicals sold by Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).

Overlap in black

What would you say to a photographic paper that comes out red or blue, depending on the color of the exposing light



If you would like to buy some for experimentation with photographic playback systems (or other purposes), we might be able to oblige. Write Eastman Kodak Company, Photorecording Methods Division, Rochester 4, N. Y.

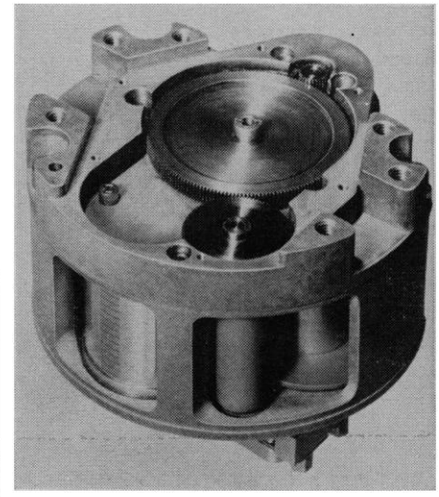
Prices subject to change without notice.

Kodak TRADE MARK

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science

New Products

The head and tape-transport assembly of a compact 26-ounce **magnetic tape recorder** (model MTR-362LT) are capable of operation at temperature extremes of −80° to +82°C. This device incorporates two new major features, a precision gear drive (see cut) and a silicon rubber capstan as mover for the tape. It is available with 7- or 14-channel heads and with ½- or 1-inch tape,



which moves at speeds of 3¾, 7½, 15, or 30 in./sec with conventional, FM, carrier erase, or digital modes of recording. This model holds 75 feet of 1-mil Mylar tape. Its working parts are protected by a rugged case of investment cast aluminum. A sister device of the recorder has been used to record physiological reactions to environmental extremes, for example, in the free falls of Joseph Kittinger.—R.L.B. (Leach Corp., Dept. S31, 717 N. Coney, Azusa, Calif.)

Resolver bridge (series 130 1R) features 2-second accuracy and 0.1-deg resolution of angular setting, according to the manufacturer. Settings are made digitally by means of front-panel knobs. The instrument is direct reading over the range from 0 to 360 deg without interpretation, interpolation, or quad-

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.

rant switching. Design of the four-arm resolver bridge is based upon the toroidal ratio-transformer divider. Instruments with operating frequency ranges from 20 to 3000 cy/sec are available, and resolutions as fine as 0.001 deg can be obtained on special order.—J.S. (Astrosystems, Inc., Dept. S36, 220 East 23 St., New York 10, N.Y.)

Multipurpose display console (model S-C 1090)—designed for monitoring digital computers—displays characters, symbols, and vectors on the 19-inch-diameter screen of the manufacturer's shaped-beam tube. Since the tube requires only a few microseconds to display a single character, more than 1000 characters can be displayed on the tube face in nonflickering presentation. Optional equipment such as an internal test routine, input register, level converters, internal storage of complete display frame, vector generator, expansion and off-centering, and category selection are available to adapt the instrument to specific data-system requirements. In addition to constant monitoring of computer outputs, the unit can display a significant block of stored information, as well as the contents of data registers in the computing section of the system. This quick-search capability makes possible rapid debugging of new programs without mechanical printing of information.—J.S. (General Dynamics/Electronics, Dept. S41, 1895 Hancock St., San Diego 12, Calif.)

Gamma irradiation unit, capable of dose rates greater than 10^6 r/hr when cobalt-60 is used, is self-contained and requires no additional shielding. Dose rates at the surface of the shield are said to be substantially less than minimum AEC requirements. Solid, liquid, or gaseous samples may be irradiated in the main chamber with complete monitoring during irradiation. Continuously flowing gases or liquids may be irradiated in a coil surrounding the source. Alternatively, the coil may be used to provide temperature control of the irradiation chamber. Controls permit automatically timed exposures.—J.S. (Ohio-Nuclear, Inc., Dept. S45, 27105 Knickerbocker Rd., Cleveland 40, Ohio)

Portable **standing-wave amplifier** (model B813T) is said to provide accuracy of ±0.05 db for the full-scale meter movement and for each 5-db step on the range switch. Calibrated range is 75 db. Normal, expanded, and com-

pressed meter scales are provided and can be used interchangeably without readjusting the gain control. Other features include controls and circuitry for bolometer protection and for selective meter damping, bandwidth and frequency selection, and peaking. The instrument is battery powered for field application, but it can be operated from the line.—J.S. (FXR Division of Amphenol-Borg Electronics Corp., Dept. S42, 25-26 50 St., Woodside 77, N.Y.)

An **electric furnace** intended for high temperature demonstrations in the classroom has unusual features that suggest its utility in other fields. Temperatures up to the melting point of tungsten (3370°C) are produced in a few seconds. This furnace heats a 1¼-inch square area in a piece of woven graphite cloth, which is strong and durable enough to support small samples. Solids can be melted directly on the cloth, and they remain in a ball after firing so that crucible losses and contamination are avoided. Glasses may be prepared by radiation heating by placing the powdered mix close under the heater element. A graphite planchette supports the mix and provides a noncontaminating sample holder. Small samples of special glasses for preparation of the alkali-metal electrodes could probably be prepared with this device. The graphite cloth heater is a remarkably strong woven fabric that is heated by an adjustable low-voltage power supply. It heats rapidly and will last several minutes. Cloth is discarded after each run at a cost of less than 20 cents per element. The furnace area is a platform on top of a cabinet about 20 inches square and 10 inches high; a bell jar is provided for controlling the atmosphere. Power consumption is 2000 watts, and a water connection is required for cooling the electrodes.—R.L.B. (Baird-Atomic, Inc., Dept. S33, 33 University Rd., Cambridge 38, Mass.)

Comparator and coordinate cathetometer makes linear measurements in a horizontal or vertical plane. Measurements are made by sighting through a 50× telescope-microscope onto calibrated scales reading directly to 0.0004 inch. By tilting the telescope to a vertical position and inserting an objective lens, the instrument is converted into a micrometer slide comparator. Horizontal range is 9.0 inches and vertical range is 7.0 inches.—J.S. (National Instrument Co., Inc., Dept. S35, 4119–4127 Fordleigh Rd., Baltimore 15, Md.)

Meetings

Esperantists

The 46th annual international congress of Esperantists was held from 6 to 12 August 1961 in Harrogate, England, with an attendance of 1700 members from 35 countries. Lord Boyd-Orr was the "Honora Protektanto." Hideo Yagi, president of Okayama University and dean of its medical school, opened the congress and presided over its formal sessions. Because this year a "festival of art" was to illustrate the wide capability of Esperanto, there was much less emphasis than usual on the interests of the technical and other organizations which regularly meet in conjunction with the congress. However, the Internacia Scienca Asocio Esperantista held one open session, on the popular subject "Why travel to other planets?" A relevant lecture on life in outer space was also given.

For the week of business sessions and recreation and for Catholic and Protestant services on Sunday, only Esperanto was used, with no translation into any other language.

The 47th annual international congress will be held in August 1962, in Copenhagen, Denmark.

IVY KELLERMAN REED
315 Westbourne Street,
La Jolla, California

Forthcoming Events

March

19–23. International Conf. on Equatorial Geophysics, Lima, Peru. (J. A. Broggi, Instituto Geofisico de Huancayo, Apdo. 46, Huancayo, Peru)

19–23. National Assoc. of Corrosion Engineers, Kansas City, Mo. (T. J. Hull, NACE, 1061 M&M Building, Houston, Tex.)

20–21. Hypervelocity Techniques, symp., Denver, Colo. (A. M. Krill, Mechanics Div., Univ. of Denver Research Inst., Denver 10)

20–23. American Assoc. of Anatomists, annual, Minneapolis, Minn. (C. B. Heggestad, Dept. of Anatomy, Univ. of Minnesota, Minneapolis 14)

20–23. High-Temperature Solution Chemistry, symp., Washington, D.C. (J. W. Cobble, Purdue Univ., Lafayette, Ind.)

20–23. Institute of Metals, London, England. (R. E. Moore, 17 Belgrave Sq., London, S.W.1)

20–29. American Chemical Soc., natl., Washington, D.C. (A. T. Winstead, ACS, 1155 16 St., NW, Washington 6)

21–23. Audio Engineering Soc., Los Angeles, Calif. (AES, P.O. Box 12, Old Chelsea Station, New York 11)

21–24. American Orthopsychiatric Assoc., annual, Los Angeles, Calif. (AOA, 1790 Broadway, New York 19)

21–24. Neurosurgical Soc. of America, Biloxi, Miss. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

22–24. Michigan Acad. of Science, Arts, and Letters, Ann Arbor. (F. C. Bald, 160 Rackham Bldg., Univ. of Michigan, Ann Arbor)

24–31. Symbolic Languages in Data Processing, symp., Rome, Italy. (Secretary, Provisional Intern. Computation Center, Palazzo degli Uffici, Zona dell'-EUR, Rome)

25. American Pharmaceutical Assoc., Las Vegas, Nev. (W. S. Apple, APA, 2215 Constitution Ave., NW, Washington, D.C.)

25–27. American Assoc. of Colleges of Pharmacy, Las Vegas, Nev. (C. W. Bliven, 2128 H St., NW, Washington 5)

25–30. American Soc. of Hospital Pharmacists, Las Vegas, Nev. (J. A. Oddis, ASHP, 2215 Constitution Ave., NW, Washington 7)

25–30. National Education Assoc., Dept. of Audio-Visual Education, Kansas City, Mo. (Chief of Information, Dept. of the Army, Washington 25)

26–27. High Energy Nuclear Physics, symp., London, England. (C. C. Butler, physics Dept., Imperial College, London, S.W.7)

26–29. Circum-Pacific Petroleum Exploration, Amer. Assoc. of Petroleum Geologists–Soc. of Economic Paleontologists and Mineralogists, annual, San Francisco, Calif. (G. B. Oakeshott, State Div. of Mines and Geology, Ferry Bldg., San Francisco 11)

26–29. Institute of Radio Engineers, intern., New York, N.Y. (E. K. Gannett, IRE, 1 E. 79 St., New York 21)

26–29. Recent Advances in Acarology, symp., Ithaca, N.Y. (J. Naegele, Dept. of Entomology, Cornell Univ., Ithaca)

26–20. World Meteorological Organization, Commission for Synoptic Meteorology, Washington, D.C. (WMO, 41, Avenue Giuseppe Motta, Geneva, Switzerland)

27–29. American Physical Soc., Div. of High-Polymer Physics, Baltimore, Md. (H. D. Keith, Bell Telephone Laboratories, Murray Hill, N.J.)

27–29. American Power Conf., American Soc. of Mechanical Engineers, Chicago, Ill. (A. B. Conlin, Jr., ASME, 29 W. 39 St., New York 18)

27–30. Cellular Basis and Aetiology of the Late Somatic Effects of Ionizing Radiations, symp., London, England. (P. Alexander, Chester Beatty Inst., Inst. of Cancer Research, Royal Cancer Hospital, Fulham Rd., London, S.W.3)

28–12. International Conf. on the Prevention of Pollution of the Sea by Oil, London, England (Intergovernmental Maritime Consultative Organization, Chancery House, Chancery Lane, London, W.C.2)

28–29. Engineering Aspects of Magnetohydrodynamics, symp., Rochester, N.Y. (G. W. Sutton, Massachusetts Inst. of Technology, Room 3-254, Cambridge 39)

29–30. Electron Beam Symp., annual, Boston, Mass. (Dr. Bakish, c/o Alloyd Electronics Corp., 35 Cambridge Pkwy., Cambridge 42, Mass.)

29–31. Kappa Delta Pi, Lafayette, Ind. (E. I. F. Williams, 238 E. Perry St., Tiffin, Ohio)

30–1. American Psychosomatic Soc., annual, Rochester, N.Y. (S. Wolf, APS, 265 Nassau Rd., Roosevelt, N.Y.)

30–1. American Soc. for the Study of Sterility, annual, Chicago, Ill. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

April

1–3. International College of Surgeons, Las Vegas, Nev. (Secretary, ICS, 1516 Lake Shore Dr., Chicago 10, Ill.)

1–4. American Radium Soc., annual, New York, N.Y. (C. G. Stetson, Dept. of Radiology, Englewood Hospital, Englewood, N.J.)

1–6. American Soc. of Abdominal Surgeons, clinical congr., Chicago, Ill. (B. F. Alfano, ASAS, 663 Main St., Melrose 76, Mass.)

2–5. American College of Obstetricians and Gynecologists, Chicago, Ill. (Chief of Information, Dept. of the Army, Washington 25)

2–5. Instrument Soc. of America, instrument-automation conf. and exhibit, Pittsburgh, Pa. (W. H. Kushnick, ISA, 313 Sixth Ave., Pittsburgh 22)

2–13. Photogrammetry Week, Munich, Germany. (H. Bischoff, Zeiss–Aerotopograph G.M.P.H., Ismaniger Str. 57, Munich 27)

3–5. Organic, Inorganic, and Physical Chemistry, symp., annual, Chemical Soc., Sheffield, England. (General Secretary, Burlington House, London, W.1, England)

3–5. Plasma Sheath, symp., Boston, Mass. (C. Ellis, Air Force Electronics Research Directorate (CRRD), L. G. Hanscom Field, Mass.)

3–6. Society of Automotive Engineers, natl. aeronautic, production forum and engineering display, New York, N.Y. (R. W. Crory, SAE, 485 Lexington Ave., New York 17)

3–7. Inter-American Nuclear Energy Commission, Mexico City, Mexico. (IANEC, Pan American Union, Washington 6)

4–6. Institute on Rehabilitation of the Mentally Ill, New York, N.Y. (B. J. Black, Altro Health and Rehabilitation Services, Inc., New York)

4–6. Physics of Graphite-Moderated Reactors, symp., Bournemouth, England. (Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

4–6. Short Run Production Techniques, intern. seminar, American Soc. of Tool and Manufacturing Engineers, Mexico City, Mexico. (Conf. Director, ASTME, 10700 Puritan Ave., Detroit 38, Mich.)

5–7. Pacific Sociological Assoc., annual, Sacramento, Calif. (R. Nisbet, Univ. of California, Riverside)

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 5e)

9–14. Nutritional Absorption in Vegetables, 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)

(See 16 February issue for comprehensive list)