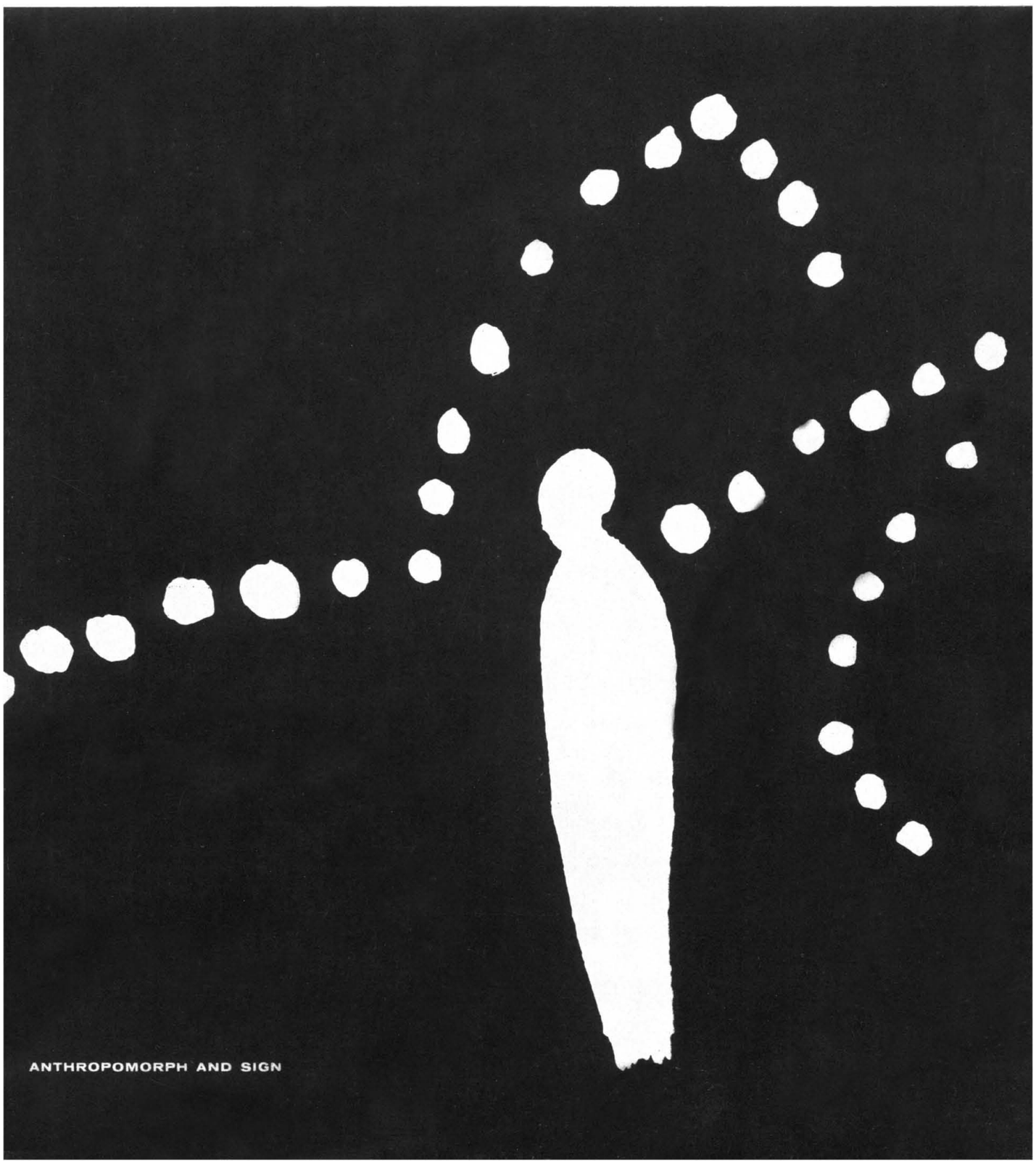
# SCIENCE

6 November 1964
Vol. 146, No. 3645

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ANTHROPOMORPH AND SIGN

# 162 ml
# 226,400 g's


This is the new Beckman Ti-50 preparative ultracentrifuge rotor. It may look familiar because it has the same configuration as our Type 40 rotor—and the same big capacity. But there the similarity ends. The new Ti-50 rotor is made of a special high-strength titanium alloy, and can centrifuge its 12-tube payload at 50,000 rpm, generating 226,400 g's—the highest combination yet of volume and force. A concomitant advantage: the Ti-50 rotor carries the unusually high warranty of 5,000 hours at top speed, or 5,000 runs, or 5 years, whichever occurs first . . . an indication of the metallurgical advance which this new rotor represents. The new rotor can be used in any Beckman Model L-2 Preparative Ultracentrifuge and in "certified" Model L's. For more information on this stride forward in ultracentrifuge rotors, write for Data File Ti-50-5.

Beckman INSTRUMENTS, INC.
SPINCO DIVISION
PALO ALTO, CALIFORNIA • 94304

INTERNATIONAL SUBSIDIARIES: GENEVA, SWITZERLAND; MUNICH, GERMANY; GLENROTHES, SCOTLAND; PARIS, FRANCE; TOKYO, JAPAN; CAPETOWN, SOUTH AFRICA

Linde Cryobiology NEWS

REPORT NO. 5 FROM UNION CARBIDE CORPORATION, LINDE DIVISION

# Recovery of microorganisms, viable platelets, and leukocytes using liquid nitrogen storage techniques.

Papers read at the 1964 meeting of the American Society for Microbiology and other recent reports indicate significant new advances in the science of cryogenic preservation of tissue and cells.

A paper by Sokolski et al. (1) discussed the preservation of *Lactobacillus leichmanii* in liquid nitrogen for direct inoculum in the vitamin $B_{12}$ assay. Complete recovery of viable cells was obtained when the suspensions were rapidly frozen by direct immersion in liquid nitrogen and then rapidly thawed by agitating in a 40°C water bath. Assay results on a number of test materials indicated good correlation between freshly prepared suspensions and frozen suspensions stored 3 months in basal medium.

Stapert et al. (2) reported on the preservation of *Sarcina lutea* in liquid nitrogen for direct inoculum in the bioassay for lincomycin. The dose-response slope of the liquid-nitrogen-preserved organism remained relatively constant over a 68-day period and the inhibition zone edges were sharp throughout. The authors further stated that the preparation and storage of one *S. lutea* suspension [in liquid nitrogen] would reduce day-to-day variation in the test organism for inoculum.

Rapid deterioration of viable platelets under ordinary conditions of storage led Djerassi and Roy (3) to experiment on rat platelets frozen in liquid nitrogen. After storage at −196°C, the platelets did not lose their morphologic integrity or their ability to circulate in thrombocytopenic recipient animals. The simultaneous presence of 5% dextrose and 5% dimethylsulfoxide in plasma was a key to a circulating yield of frozen platelets as high as 70% to 87% (compared to the numbers observed when fresh platelets were given).

Cohen and Rowe (4) reported on preservation of leukocytes taken from patients with lymphocytic leukemia. The cells were frozen in 10% to 15% dimethylsulfoxide at a controlled rate of 1°C per minute and stored in liquid nitrogen for 5 months at −196°C. During this time a total of 768 leukoagglutinin tests were performed. The experimenters concluded that cryogenic preservation appears practical for storage of leukocyte panels used for immunogenetic and routine leukoagglutinin testing.

## New Products from LINDE

Our new LR-10A-6 portable refrigerator is designed both for economical shipping and small quantity storage of biological specimens. It will hold six canisters with a capacity of 115 cu. in. and has a minimum holding time of 3 weeks at −196°C between refills of liquid nitrogen. Lightweight, rugged, vibration-and-shock resistant, the new LR-10A-6 features a bucket type handle for easy carrying and a special metal foot ring to provide a stable base.

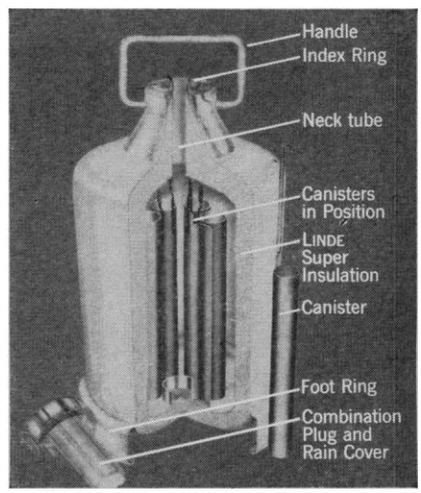
Another new product, the LINDE LD-4 Liquefied Gas Container, is particularly suitable for use in laboratories, classrooms and other locations requiring small portable cryogenic containers. Weighing only 11½ lb. when full, it can hold up to 4 liters of liquid nitrogen or liquid argon. A large pitcher-type handle makes it easy to pour and lift.

## Complete Liquid Nitrogen Capabilities

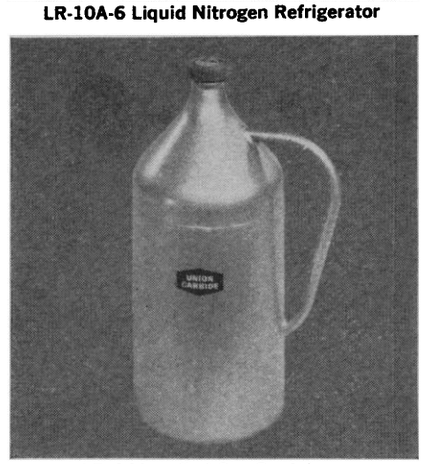
The full line of LINDE liquid nitrogen equipment includes storage tanks, refrigerators, controlled-rate freezer units, biological transports, and auxiliary equipment.

We also provide technical service from knowledge gained over years of leadership in cryogenics, backed up by nationwide delivery of liquid nitrogen.

For data, write to Union Carbide Corporation, Linde Division, Dept. SC-11, 270 Park Avenue, New York, N. Y. 10017.




LR-10A-6 Liquid Nitrogen Refrigerator



LD-4 Liquefied Gas Container

(1) Sokolski, W. T., Stapert, E. M., Ferrer, E. B., and Hanka, L. J., *Bact. Proc.*, RT4, 1964. (2) Stapert, E. M., Sokolski, W. T., Kaneshiro, W. M., and Cole, R. J., *Bact. Proc.* RT5, 1964. (3) Djerassi, I. and Roy, A., *Blood XXII*, 703-717, 1963. (4) Cohen, H. and Rowe, A. W., *Transfusion 3*, 427, 1963.

6 November 1964
Vol. 146, No. 3645

# SCIENCE





SCIENCE is published weekly by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with T **Scientific Monthly**®. Second-class postage paid at Washington, D.C.  Annual subscriptio $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢. School year subscriptions: 9 months, $7; 10 months, $7.50. Provide 4 weeks' notice for chan of address, giving new and old address and zip numbers. Send a recent address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature.**

# AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



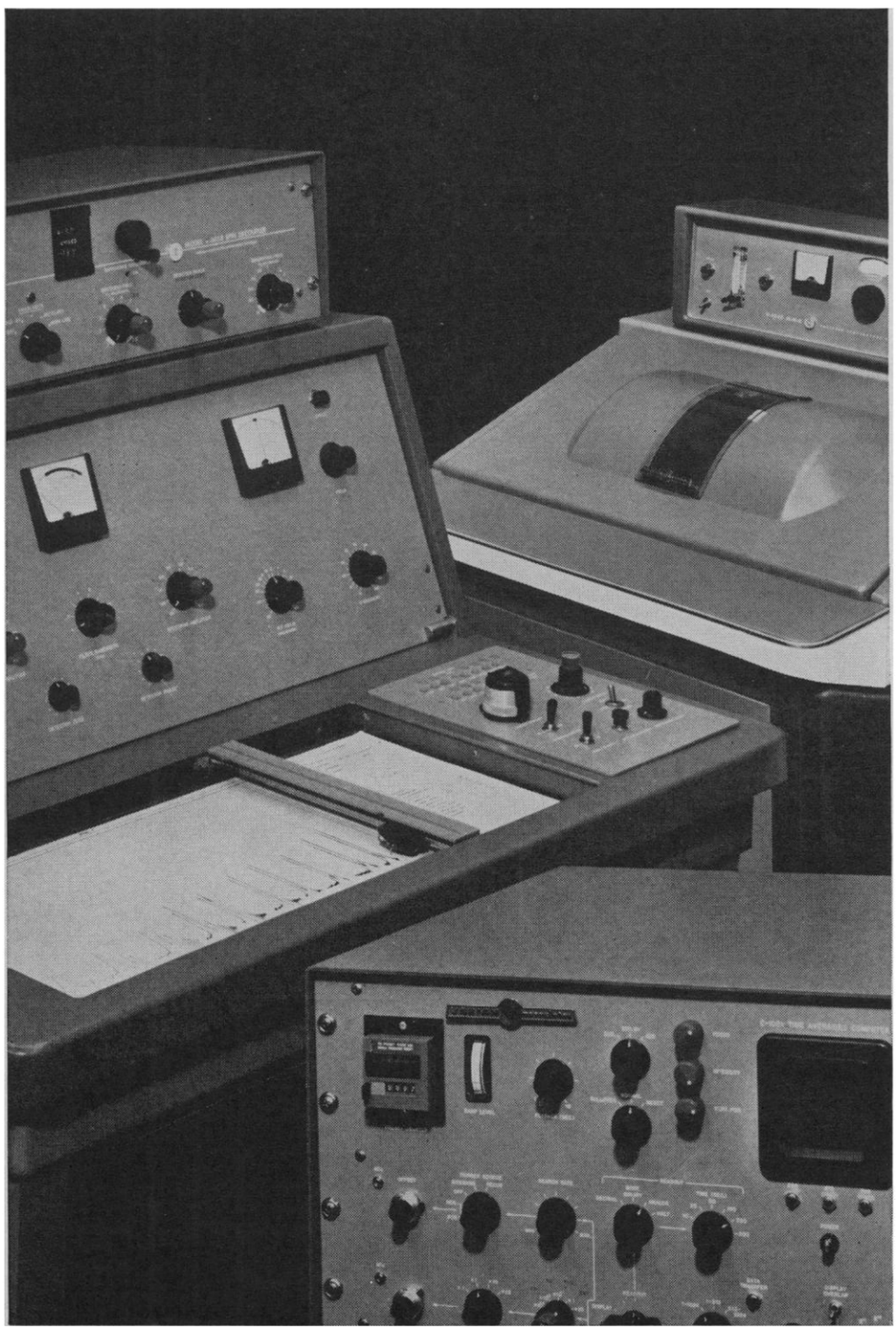


**COVER**

Red-painted figure on rock wall at Abri de las Veñas in southwestern Spain (Badajoz). The date of the composition is uncertain but it is thought to be post-Ice Age Mesolithic and related to the art and "signs" of the Ice Age Magdalenian. Spanish rock art varies widely in complexity, style, meaning, and chronology. This composition has been analyzed as lunar. See page 743. [From Henri Breuil, courtesy Trianon Press, Paris, France]

# Because becomes

## NOW'S THE TIME TO RECONSIDER NMR



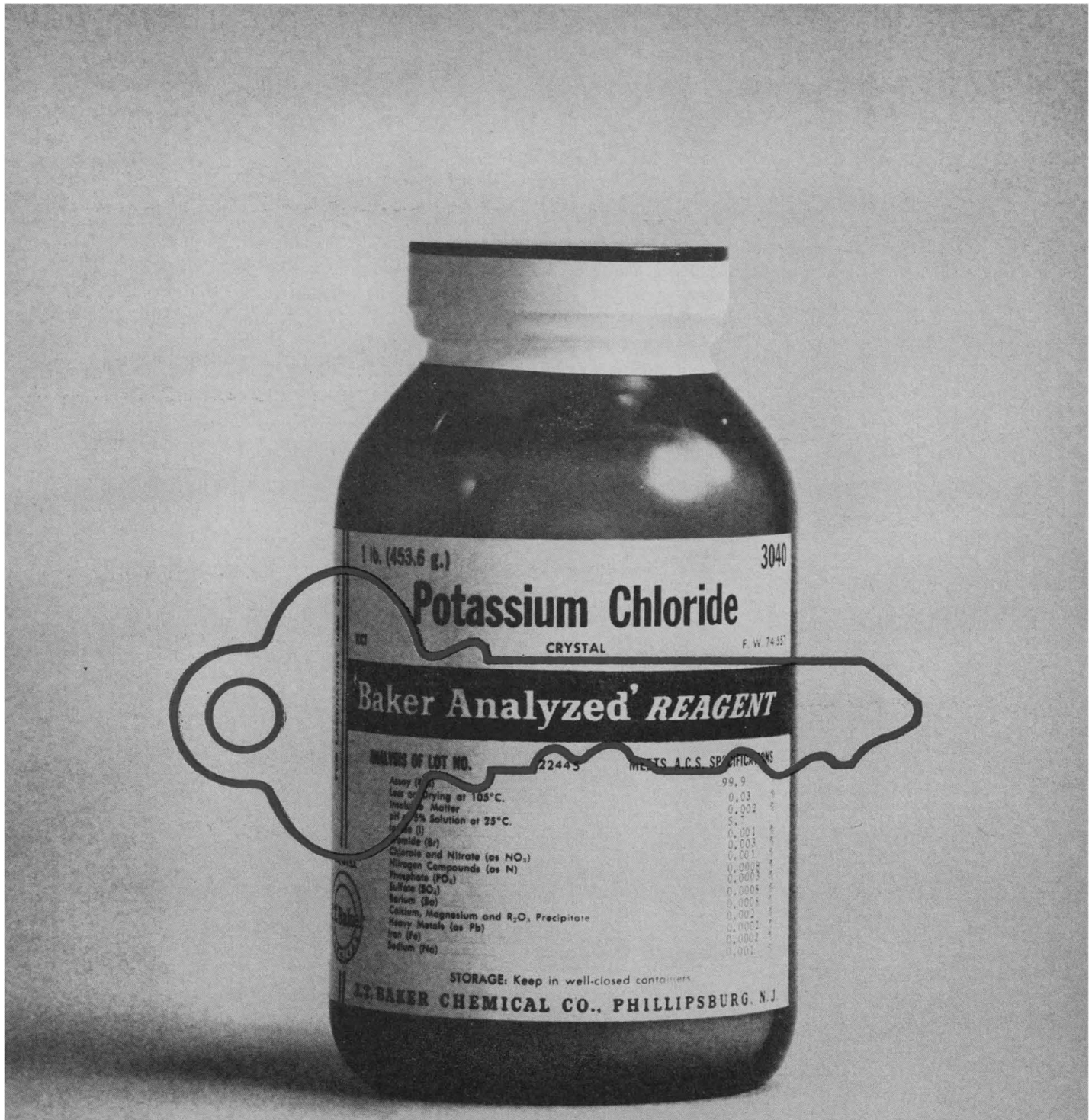
☐ That first A-60 spectrum of a 0.10% ethyl benzene solution is so noisy that it is almost worthless. So we reran the sample a hundred times, using an A-60 spectrometer equipped with our new C-1024 time averaging computer. The second spectrum shows the result: a clear, readable, useful signal which has improved the signal-to-noise ratio by a factor of *10*.

☐ Just one example, but we could give you plenty of others. Why couldn't *you* use NMR before? Samples too minute? Working with biological specimens? Solubility-limited compounds? Or what? Anyhow, now's the time to take another look at what our A-60 —coupled with the C-1024— can do for you.

☐ The Varian A-60 offers a fast, non-destructive method of identifying compounds, functional groups, isotopic substitution sites, and components of mixtures. Now, with the time averaging computer accessory, it allows studies which were not previously feasible. Sensitivity is essentially limited only by the time you want to invest. Write our Analytical Instrument Division for details.

☐ P.S. Just in case you haven't heard, we now have spin decoupler and variable temperature accessories for our A-60 Spectrometers. They open up brand new paths to explore. Ask us about them sometime.

**VARIAN ASSOCIATES**
ANALYTICAL INSTRUMENT DIVISION
PALO ALTO, CALIF. · ZUG, SWITZERLAND



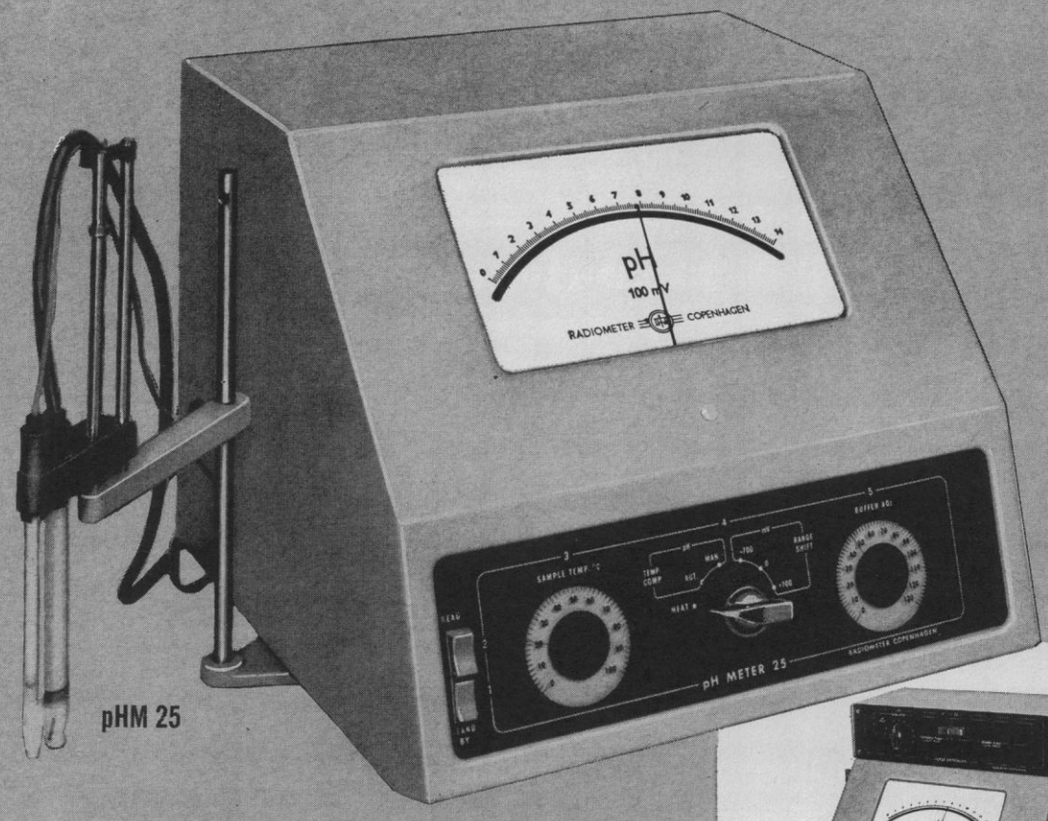

## Fits the needs of any laboratory

'Baker Analyzed' reagent chemicals are versatile. Equally suited for research, analytical or developmental work. Because every 'Baker Analyzed' reagent is manufactured and controlled to the highest standards of purity. Select from our complete lines of inorganic and organic chemicals and consolidate your purchases for added economy. J. T. Baker's service-in-depth includes the latest in functional package design—in the sizes you need. Fast delivery too.

**J. T. Baker Chemical Co.** J.T.Baker CHEMICAL **Phillipsburg, N. J.**

# pH new!

**RADIOMETER** of Copenhagen offers a laboratory type, direct reading pH Meter setting NEW standards of accuracy, reliability, stability and convenience, featuring: AC line operation—**zero** drift. • Ruggedized specially selected components and 10,000 hour military type tubes. • A radically new approach for special applications with provision for **external** recorders, temperature compensators, buffer controls, standby switches, and a variety of special control accessories. • Available with an integral scale expander accessory, changing the scale from 0-14 pH, to 1.4 full scale pH bands over entire range. • Reproducibility of 0.02 pH; or 0.002 pH with the scale expander. • Ultra convenient electrode holder, and a complete range of standard and specialized electrodes for every application.




pHM 25

If you require complete reliability of service and measuring accuracy, **you now can't afford to consider any other instrument.**

Also available as Model pHM 27 with a built-in expanded range of 6.8 to 8.2 pH for use with Ultra Micro Blood pH electrode and accessories for acid-base measurement. Write for further details.

pHM 25 with Scale Expander

SOLD AND SERVICED IN U.S.A. BY

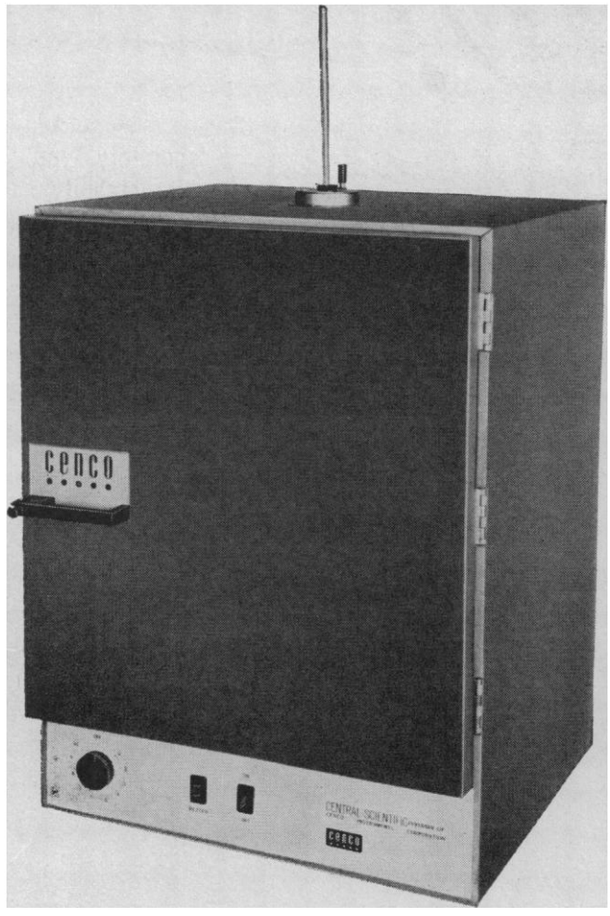
**THE LONDON COMPANY**

811 Sharon Drive WESTLAKE, OHIO

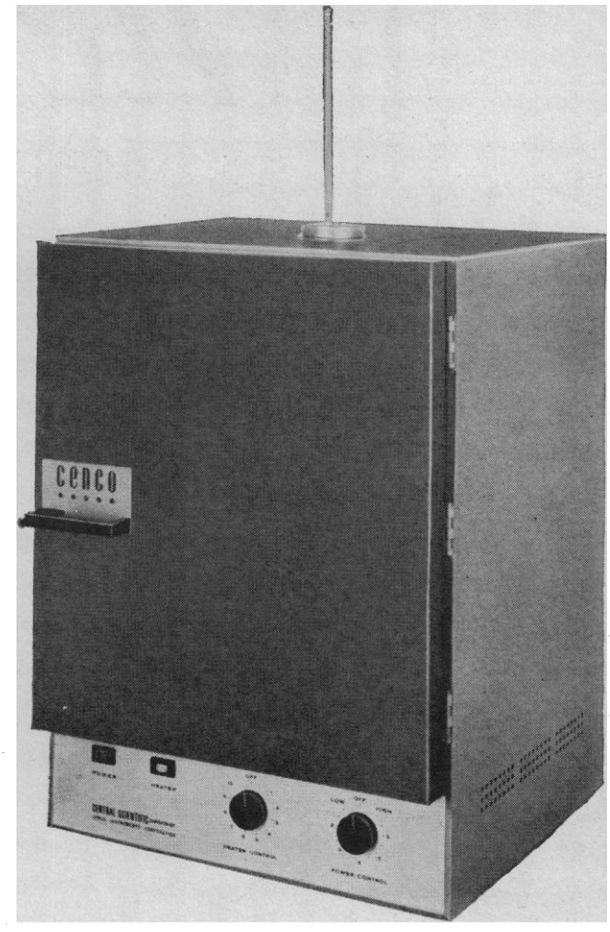
**RADIOMETER**

72 Emdrupvej COPENHAGEN, DENMARK

In Canada: Factory representatives Bach-Simpson Limited; sold and serviced by Canadian Laboratory Supplies Limited




**CENCO SERIES 16 STANDARD LABORATORY OVENS**
**$184.00 TO $395.00**




**CENCO SERIES 8 LINEAR CONTROL OVENS**
**$225.00 TO $377.50**

# CENCO STOCKS 42 MODELS OF OVENS FOR IMMEDIATE DELIVERY. HERE ARE TWO OF THEM.

**CENCO SERIES 16 DOUBLE WALL OVENS** handle such constant temperature tasks as aging, baking, curing, molding, batch processing, and glassware drying.

These ovens offer features found only in more expensive ovens: safety-type heaters, uniform heat distribution — gravity convection or forced draft, and sensitive control to 200°C. Units are fully insulated; are of finest construction. Each has easy-to-read control panel, door-mounted record card holder, and snap-action handle.

Three sizes, 14″ x 13½″ x 14″, 19″ x 16½″ x 20″, and 25″ x 19½″ x 20″ (inside dimensions) are available with aluminum or lacquered steel interiors and 115- or 230-volt operation.

**CENCO SERIES 8 DOUBLE WALL OVENS** offer precise control for such tests as the non-volatile matter in asphalt emulsions, moisture determination of fatty acids, and the performance of electronic components at specific temperatures.

Cenco's separate heater and power controls establish a linear response at temperatures to 260°C.

Other Cenco features include safety-type heaters and uniform heat distribution — gravity convection or forced draft. Full insulation; finest construction. Easy-to-read control panel and snap-action door handle.

Two basic sizes with stainless steel interiors and 115- or 230-volt operation.

CEN-4-221

**FREE OVEN CATALOG AVAILABLE**

**CENTRAL SCIENTIFIC**
*a division of Cenco Instruments Corporation*
**1724 Irving Park Road**
**Chicago, Illinois 60613**
*offices in principal cities*

I'd like to know more about Cenco's line of ovens. Please send the new CONSTANT TEMPERATURE EQUIPMENT catalog.

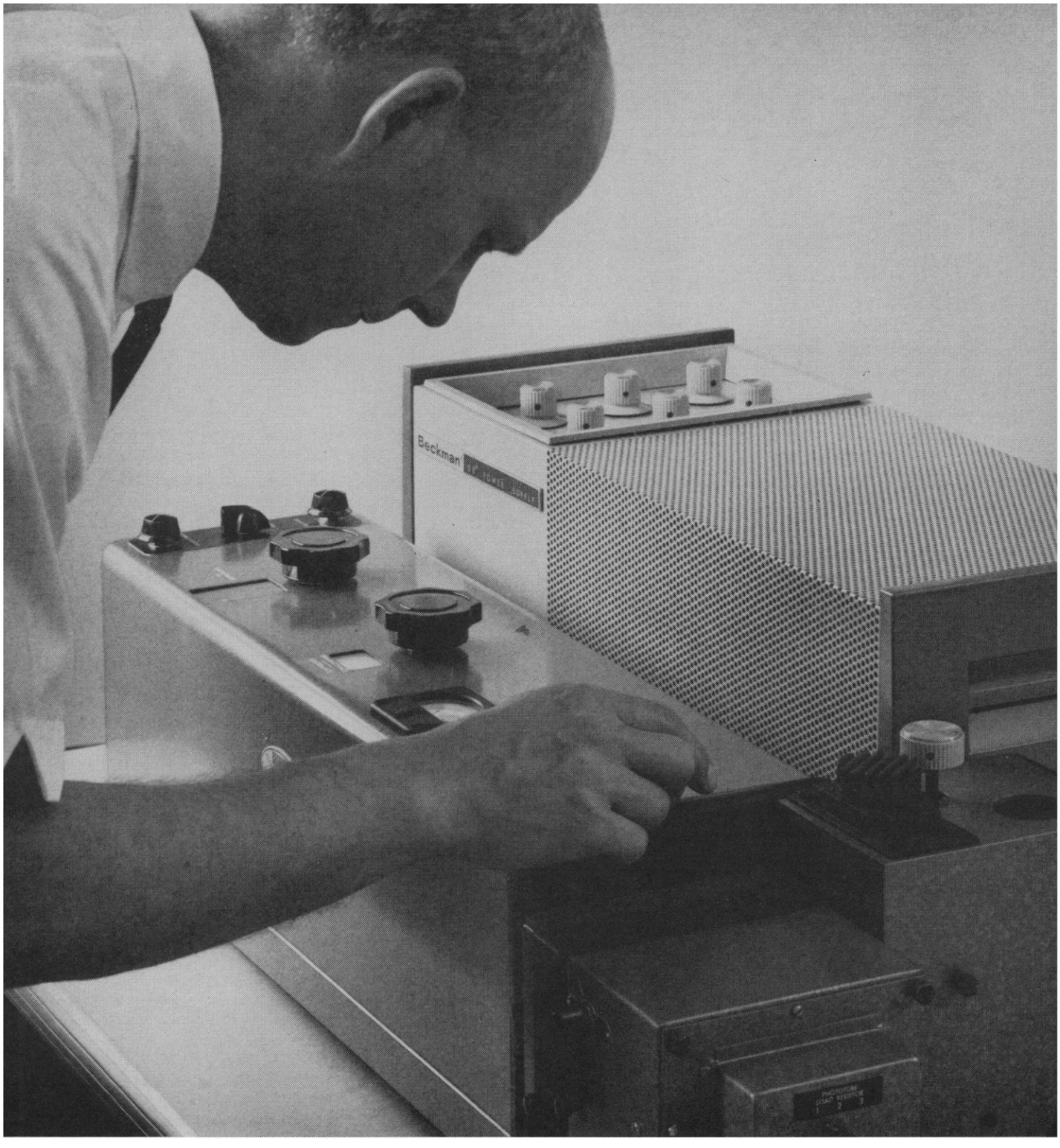
NAME _____ TITLE _____

COMPANY OR INSTITUTION _____

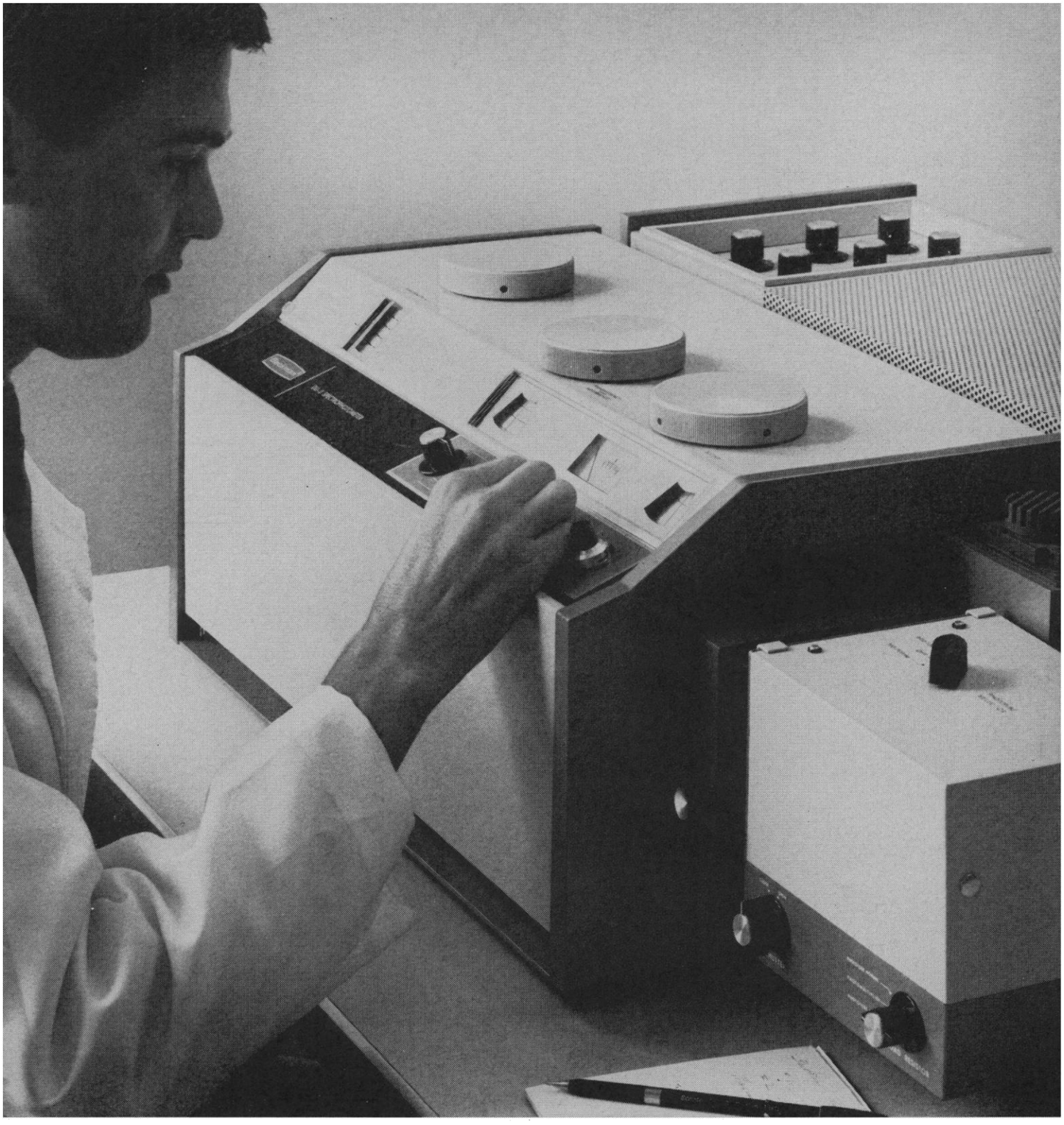
STREET _____

CITY _____ STATE _____ ZIP CODE _____

*CENCO: YOUR CONVENIENT SINGLE SOURCE FOR LABORATORY INSTRUMENTATION AND SUPPLIES*




**The Beckman DU® Spectrophotometer** is the standard throughout the world for reliable and accurate photometric measurements in the ultraviolet range. Over 25,000 of these durable instruments are presently in use. Its null-balance precision, its optical and electrical qualities, and its flexibility are well known and trusted in analytical and research laboratories in almost every field.

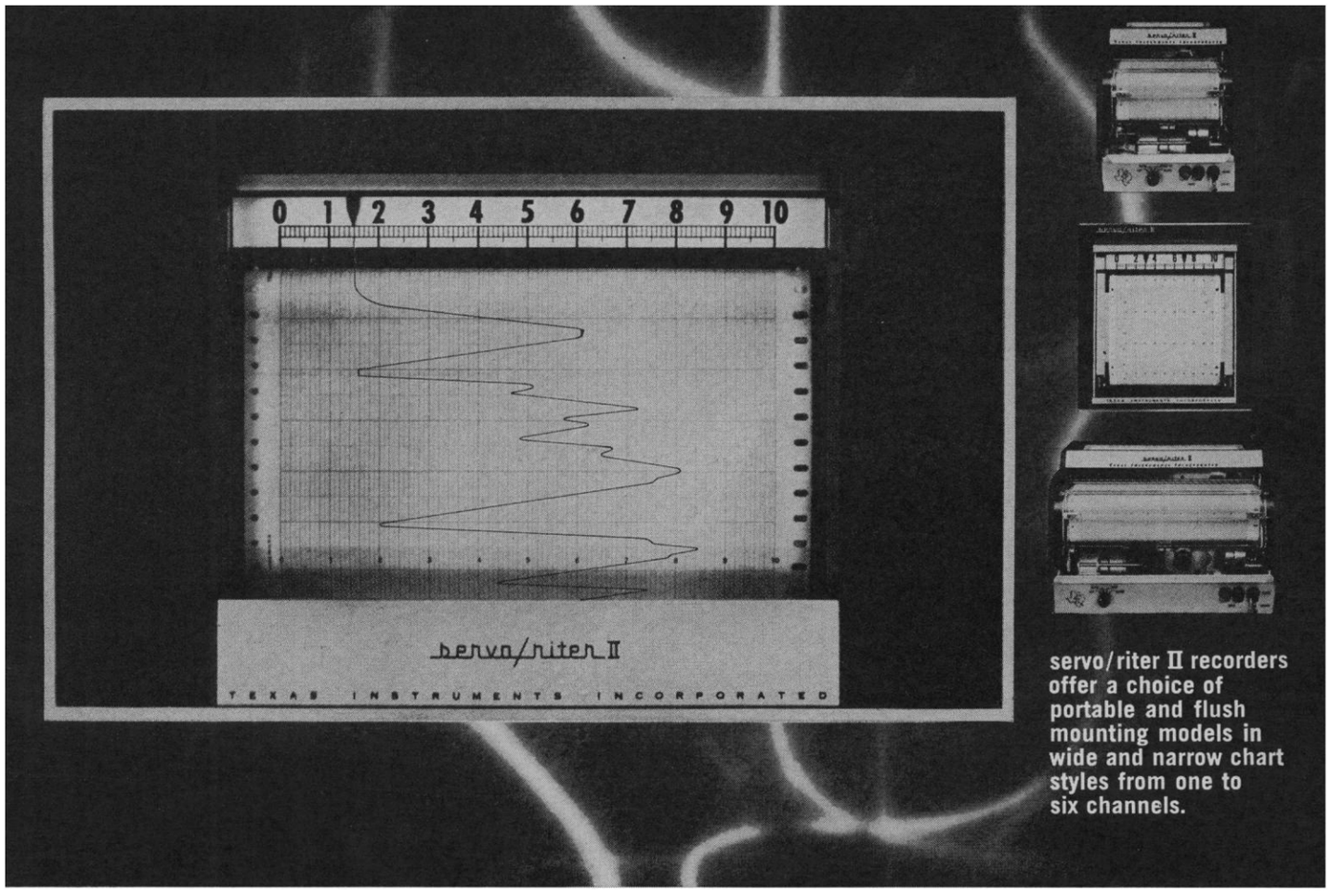


**The New Beckman DU®-2 Spectrophotometer** is the successor to the renowned Beckman DU. The new, more convenient DU-2 has a sloped front panel and large easy-to-read controls. It has increased range: 190 to 1000 mμ. Its photometric scale is expanded at both ends. It uses micro cells without attachments. It retains all the reliable DU principles, and it uses every time-tested DU accessory.

***It's available at the same low DU price.***
*Ask your local Beckman Sales Engineer about the new DU-2 or write for Data File LUV-* **38-265.**

Beckman® INSTRUMENTS, INC.
**SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION**
FULLERTON, CALIFORNIA • 92634

INTERNATIONAL SUBSIDIARIES: GENEVA, SWITZERLAND; MUNICH, GERMANY; GLENROTHES, SCOTLAND; PARIS, FRANCE; TOKYO, JAPAN; CAPETOWN, SOUTH AFRICA




servo/riter II recorders offer a choice of portable and flush mounting models in wide and narrow chart styles from one to six channels.

# servo/riter II* is all new...

## new electronics! new servo system! newest strip-chart recorder!

**Outstanding performance** distinguishes the all new **servo/riter II**... you can discriminate 1/10% steps... you can't detect deadband but we guarantee it to be no more than 1/10% ... the pen speed is 0.4 second with a dynamic response in excess of 5 cps at 10% of full scale... external circuit resistance rating is 25,000 ohms... and up to 100 times span of a-c longitudinal noise pickup will not offset the pen by even 1/10%. We guarantee an accuracy of ¼%... and that's not all!

**Reliability** — you couldn't ask for more! An all new solid state design utilizes long-life components... an infinite resolution slidewire needs only the contacts changed after millions of cycles of operation... an all new non-mechanical, photoconductive chopper... all this combined in a rugged printed circuit board design. Bearing and wear surfaces are long-life and quiet-running acetal. Quality design throughout assures the reliability and performance of the all new **servo/riter II**... and that's not all!

**New convenience features** — and more of them! Front panel access to all operating controls for span switching, zero positioning and suppression, chart speed selection, pen lifters... easily removable door... chart advance... interchangeable chart drive motors... chart supply indicator... chart tear-off... writing platen. Chart loading is faster... filling the removable inkwells is easier... installation is simpler using direct rack mounting with front and rear terminal access... and that's not all!

**More versatility** — tailor the all new **servo/riter II** to your needs! Choose the desired input form — d-c potentiometer, thermocouple, universal range, etc. — and plug it into the amplifier... change span and zero position with plug-in circuit cards, too. Marker pens, control contacts, retransmitting slidewires, pen lifter, internal lighting are available options.

Ask for a demonstration of the newest strip-chart recorder ... the all new **servo/riter II.**

* Trademark of Texas Instruments

INDUSTRIAL PRODUCTS GROUP

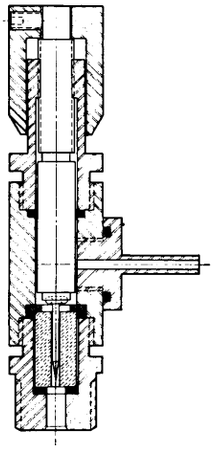
TEXAS INSTRUMENTS
INCORPORATED
P. O. BOX 66027 HOUSTON, TEXAS 77006
7 RUE VERSONNEX GENEVA, SWITZERLAND

# New Equipment from Matheson

## 1. New Lab-Stat

This is a compact laboratory proportional controller which is designed for accurate, automatic control and recording of temperature, pressure, vacuum or liquid level. Equipped with a unique sensor, the system "senses" the position or level of any conductive liquid. It is designed specifically for laboratory use.

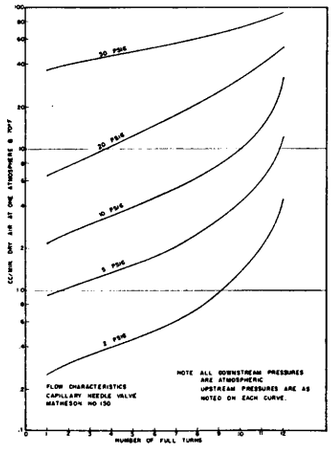
The Lab-Stat is a proportional controller, free from the cycling experienced with standard thermostats and on-off controllers. It has a transistorized circuit, stabilized against supply voltage fluctuation and ambient temperature changes. The Lab-Stat can also be used as an on-off controller, or a high limit shut off. Applications: 1. Unattended control of temperature for distillations, heat up for melting point determinations, control of reaction temperatures and general heating and cooling. 2. Control of vacuum for vacuum distillation, vacuum drying or any vacuum system. 3. Control of reaction feed streams by control of system pressure, or liquid level. For full information, send for our 4 page bulletin.



## 2. New Micro-Flow Control Valve

A unique valve. This valve is free from the type of flow surges that usually accompany the use of standard needle valves. Accurate flow settings can be reproduced with little or no flow hysteresis. See the accompanying graph showing flow vs. turns of the handwheel.

Our new valve works by combining a precision bore glass capillary and a closely-fitting, precision-ground stainless steel rod. Thus, laminar flow through a capillary annulus is achieved. At a pressure differential of 1 p.s.i., a minimum flow as low as 10 cc/hr. of air can be controlled. The end of the precision rod is a needle point so that the valve can also be used as a conventional needle valve over the last few turns. Maximum use temperature is 100°C.; it is suitable for pressures up to 2000 p.s.i.g. This valve is equipped with a ¼″ NPT inlet and ⅛″ tubing outlet. Available in brass or stainless steel, this valve is recommended for use in mass spectrometry, gas chromatography and high vacuum systems or wherever low flows must be accurately controlled and reproduced. Full information and prices can be obtained from our bulletin. Send for a copy.




## 3. New Low Flow Flowmeter

This is an accurately machined rotameter style flowmeter capable of metering low flows never before capable of accurate measurement with this style of flowmeter. This high precision permits accurate coverage of a large flow range.

Air: 0.33 to 100.00 cc/minute
Water: 0.003 to 1.4 cc/minute

All meters separately calibrated for air and water and provided with individual calibration curves. This flowmeter is ideal for highly corrosive gases as well as for the more common gases.

A data sheet describing how this rotameter can be used and more about its construction and price is available from us. Use the coupon below.

Mail Coupon Now!

The Matheson Company, Inc., P.O. Box 85, East Rutherford, N.J.
Please send the following:

☐ 4 page Lab-Stat Bulletin ☐ Micro-Flow Needle Valve Bulletin ☐ Low Flow Flowmeter Bulletin

Name_____

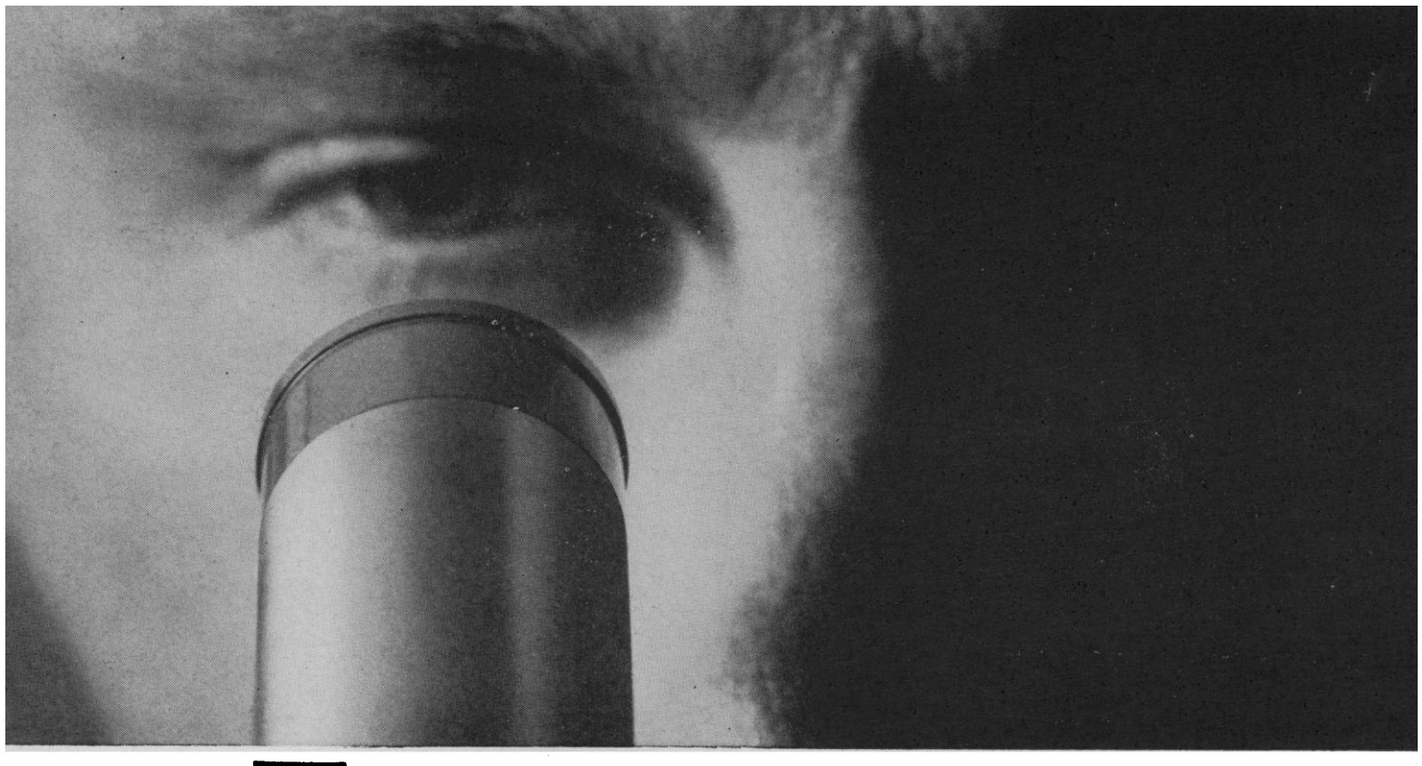
Firm_____

Address_____

City_____ State_____

**MATHESON**

P.O. Box 85, East Rutherford, N.J.
Plants in Forest Park, Ga., Joliet, Ill., LaPorte, Tex., Newark, Calif.
Matheson of Canada, Ltd., Whitby, Ont.



# Focus on the finest


## GOLD SEAL® SLIDES and COVER GLASSES

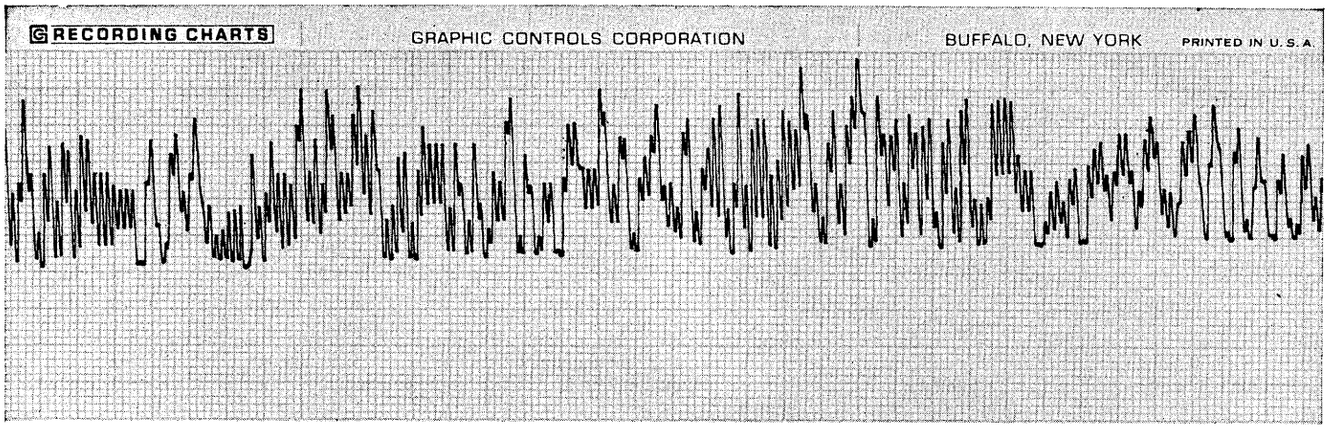
Synonymous with quality for almost half a century, microslides and cover glasses with the familiar GOLD SEAL label are guaranteed as perfect as highest quality raw materials and skilled precision manufacturing can make them. *Continual research assures you of the best possible product for the best possible results in all applications.*

Gold Seal Slides come to you pre-cleaned, ready to use, in the *new* lint-free box. This box has an inner cellophane wrap as well as a sealed outer wrapper. The box also contains plastic inserts which readily convert the empty box into a Slide File convenient for transporting, filing and storing prepared slides. The special Stand-Rite tabs keep the slides upright in the box during dispensing, permitting fingertip removal without smearing.

Gold Seal Cover Glasses are manufactured to the same exacting standards as Gold Seal Slides. Made of a special, non-corrosive, non-fogging glass of uniform thinness, each is individually selected and guaranteed perfect. Available in every convenient size and thinness, Gold Seal Cover Glasses are dispensed clean from lint-free plastic boxes.

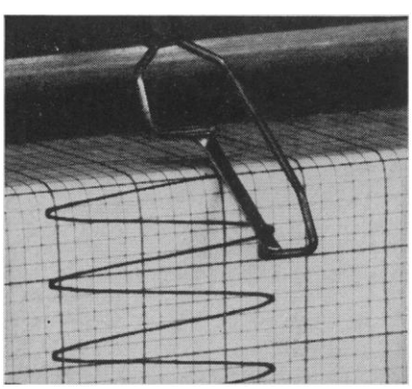
Your dealer carries Gold Seal Microslides and Cover Glasses plus a large selection of Clay-Adams microslide boxes, cabinets, and other accessories.

Clay-Adams
New York 10, N. Y.




# Just a few lines...

## about the SHARPER, MORE PRECISE traces you get in critical areas with Graphic Controls' thermal recording oscillograph charts.

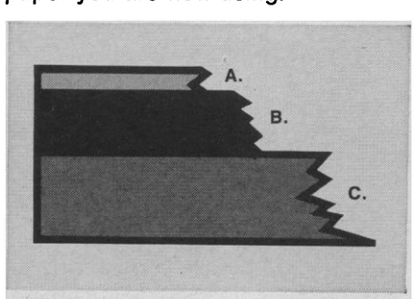


Consistently gives you distinct... black... clearly legible trace lines.

The reason is our unique paper construction. We start with a specially-processed, high-density undercoating that provides the blackest possible black. To this we add an unusually sensitive, completely compatible surface coating that lets the stylus glide evenly and smoothly. Many critical areas that are blurred or indistinct on other papers become clear and precise with GC's paper.

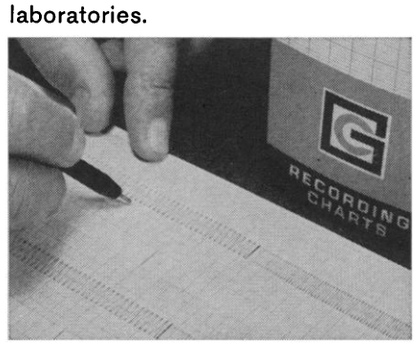
You can record even the most complex functions and inputs.

Because the surface coating is applied by a unique, new process, there's no variance in thickness from edge-to-edge. The caliper of the paper is constant. Creep is eliminated and uniform paper flow is assured. And at the same cost as the paper you are now using.




A. Thermal-reactant coating
B. Contrast undercoat
C. Substrate

In addition, GC's paper is water resistant, durable, yet extremely lightweight. Its consistent performance has been proved in major aerospace, industrial, and scientific research laboratories.




Check the performance of GC's paper for yourself... and compare it with your present paper. Complete information will be sent on request. Contact:

**RECORDING CHART DIVISION**
**GRAPHIC CONTROLS CORPORATION**
189 VAN RENSSELAER STREET, BUFFALO, NEW YORK 14210

**FREEZE DRY SYSTEMS** Models for Laboratory, Pilot Plant and Mass Production. Amsco Freeze Dryers feature precision control throughout the cycle. IC-612.

**DEIONIZERS**
Capacities range from 2 to 300 gal./hr. MC-595.

# AMSCO

# Microbiological Equipment

## *For Industry and Science*

If you are looking for technical microbiological equipment, look first to Amsco. Virtually every university research laboratory, pharmaceutical, and industrial plant looks to American Sterilizer's Industrial Dynamics Division when they require sterilization equipment. Yet Amsco researches, designs and manufactures a *wide variety* of technical apparatus and systems.

Today Amsco is a major producer of high quality Freeze Drying equipment ranging from laboratory models, to pilot plant models, to complex mass production equipment . . . all featuring precision control.

Another area of extensive growth is in batch or continuous fermentation pilot plant systems. Here Amsco designs a completely steam sterilizable system consisting of such items as media mix kettle, continuous flow sterilizer, raw media holding tank, feeding pumps, Biogen apparatus for controlled fermentation, harvest pump, cooling bath, harvest holding tank, centrifuge system and freeze dry equipment. The system is literally a complete laboratory designed and built by Amsco to suit your needs.

These are typical apparatus and systems produced at Amsco Industrial Dynamics. You will have other requirements. *Call Amsco first.* Let us share *your* confidential equipment and process problems.

Write for literature of interest to you. The catalog number is listed after each classification. If you have special problems please call or write . . .

AMSCO
INDUSTRIAL DYNAMICS
DIV. OF AMERICAN STERILIZER CO., ERIE, PA.

*Designers and developers of systems and equipment for Life Science and Industrial Technology*

**WATER STILLS**
Still capacities range from 1 to 150 gal./hr. Steam or Electric heat. Automatic or Manual Controls. IC-603.

**BATCH-CONTINUOUS FERMENTATION SYSTEMS**
Amsco produces complete range of precision-controlled batch or continuous fermentation apparatus. Biogen shown above. IC-605

AMSCO 1894 1964 FROM DEEDS . . . MATURITY

70 years of SERVICE

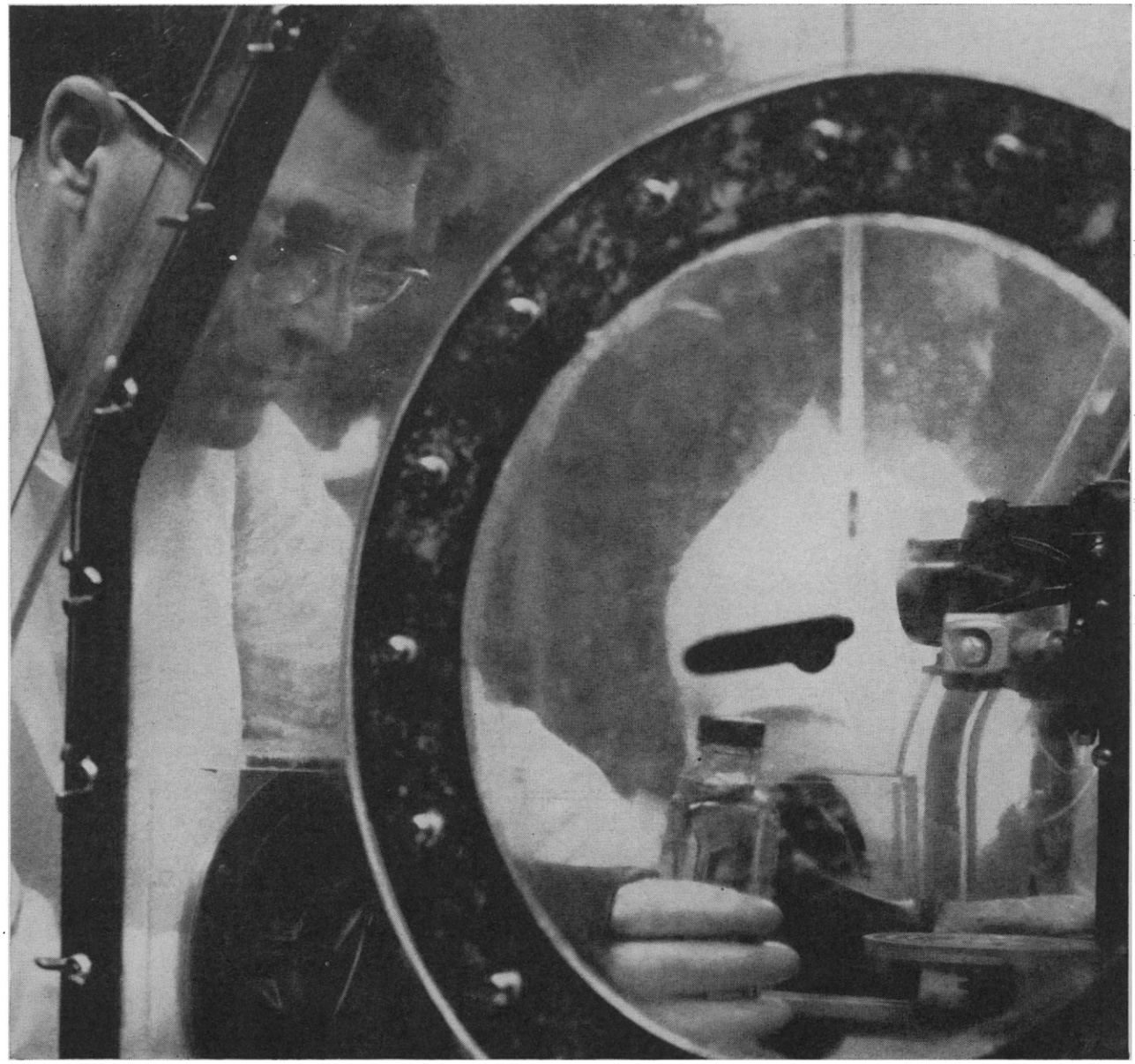
**GERM-FREE LIFE ISOLATORS**
New, low cost isolators of strong, flexible film design. Optional accessories include sterile dip tank, egg transfer tank, portable cart. IC-609.

**DRY BOXES**
Flexible film chamber. Economical and easy to use. Designed for laboratory or production use. IC-607.

**CASEWORK**
Complete casework needs. Planning, installing and maintenance. Base, wall storage cabinets in stainless or enameled steel. Counter and work table tops in a variety of materials. MC-503.

**STERILIZERS**
Pressure Steam, Ethylene Oxide and Combination Gas-Steam Systems. Chambers 16" x 16" x 24" to 80" x 108" x 360" and larger. SC-318.

# Why Do Big Ideas Keep Coming From Castle?



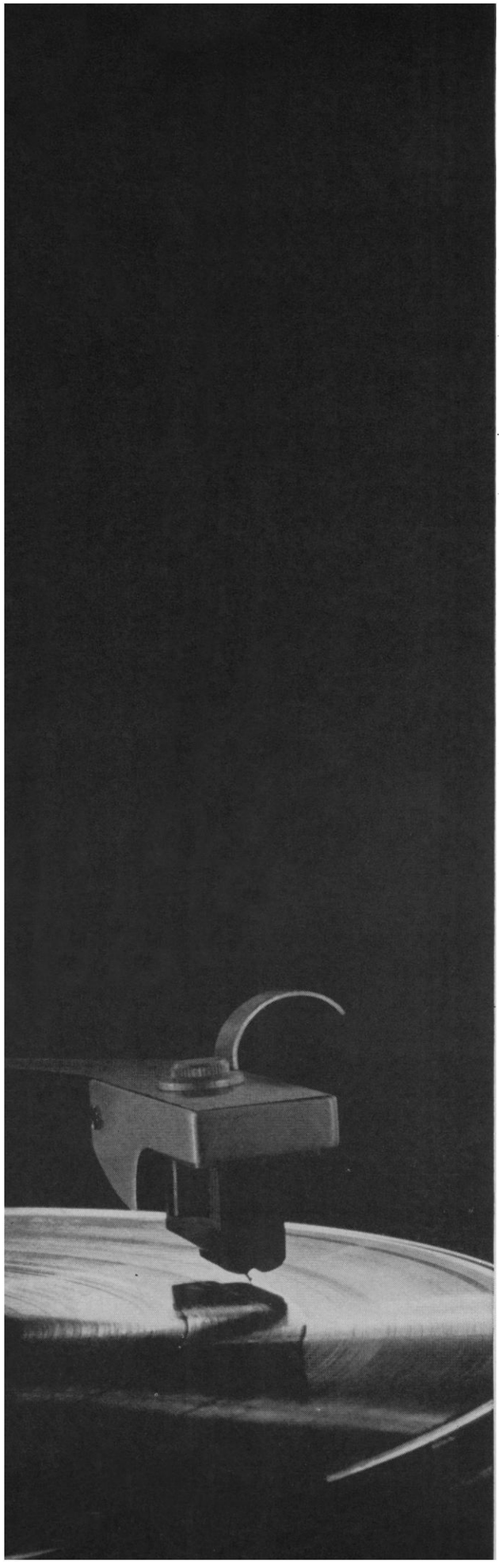
**BECAUSE WE PLAN IT THAT WAY**

We think in terms of being first—in theory and design. That's why we have a brand new research center—why we spent thousands of dollars last year on research—why we pay engineers to do nothing but think big.

All this pays off in big ideas . . . in high vacuum and ethylene oxide sterilization . . . in modern surgical lights . . . in operating table design . . . in advanced sterilization techniques.

Next time you look over the field, notice who's in first place with the big ideas. We planned it that way . . . we're working hard to keep it that way. Wilmot Castle Company, 1747 East Henrietta Rd., Rochester, N. Y. 14602.

Castle
SUBSIDIARY OF RITTER COMPANY INC.



*One of a series briefly describing GM's research in depth*

# When will it wear out?

Most things we know about—and this includes biological systems—begin to wear out as soon as they go into service. Survival rates do not follow a Gaussian distribution. Life is not symmetrical. For the person concerned with reliability, the problem is to find a realistic mathematical representation of the wear-out phase of components.

In a break from classical reliability statistics, GM Research mathematicians were among the first to use the relatively little known Weibull distribution function . . . a remarkable generalized way of handling skewed distributions by one family of straight lines. To demonstrate its appropriateness, they've developed a number of easy-to-use graphical techniques for planning and interpreting life tests, fatigue experiments, and even incomplete field service data. Among their pioneering contributions:

A new method using median ranks for graphically describing experimental main effects and interactions;

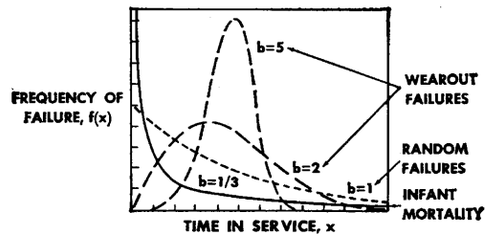
New ways of slashing test times and optimizing experimental designs;

A new method (theory of suspended items) for analyzing endurance data in which some items have failed and some are still running.

Now an accepted standard in the bearing industry, their graphic Weibull techniques have filled numerous papers and two books now on press. It's one of the ways GM researchers and engineers are working to bring improved reliability to both space and earth-bound hardware.

## General Motors Research Laboratories

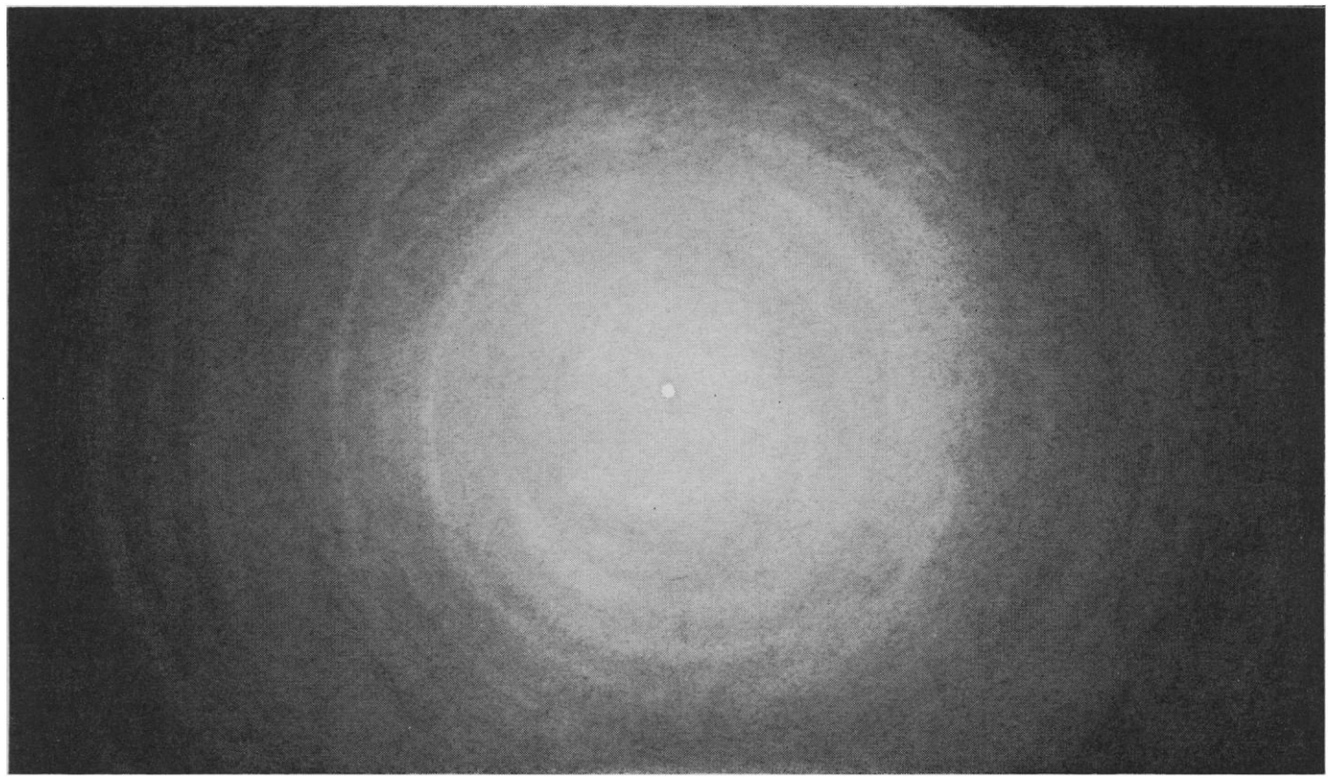
Warren, Michigan

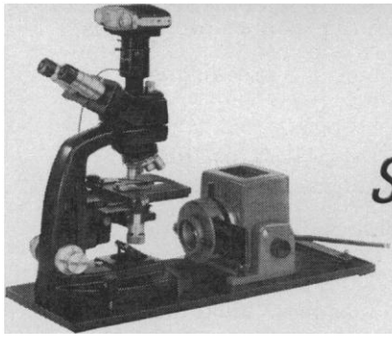



Varying one parameter (b) in the Weibull distribution function allows the characterization of many types of reliability phenomena.

# BAUSCH & LOMB

(on the light side)

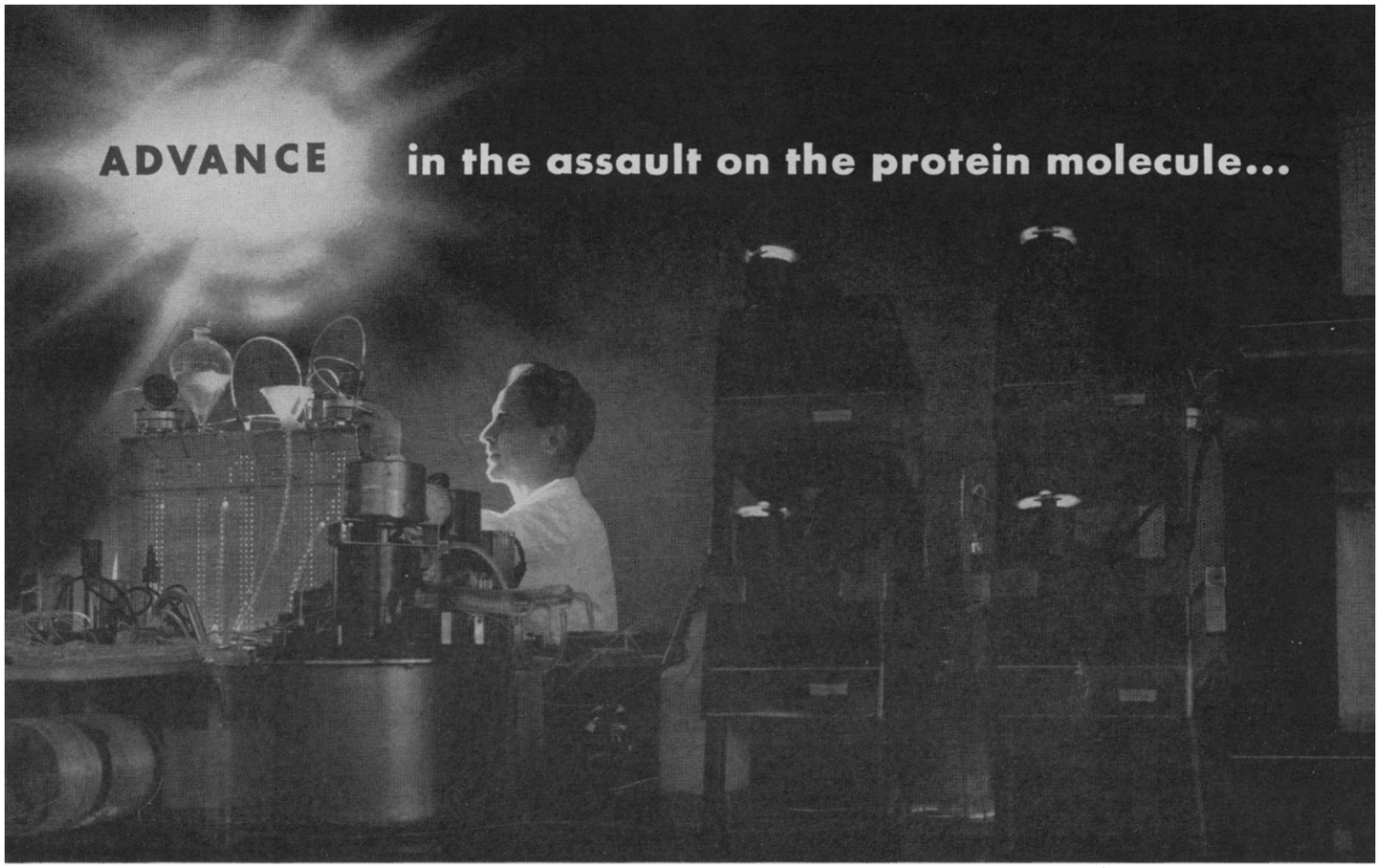




## Six different kinds of light, that is.

Only Advanced DynaZoom® lets you choose the exact magnification you want—seen by the illumination you need. The incomparable zoom optical system offers continuously variable magnification from 1× to 2× through the entire range. (Monocular series available with and without zoom.) You select the lighting equipment that's right for your work. ***For bright field*** . . . new Hi-Intensity illuminator with adjustable field iris for Koehler illumination, is just right for visual and photomicrographic work. Opti-lume illumination or mirror for visual bright field applications. ***For dark field*** . . . paraboloid and cardioid condensers for hard-to-see subjects from lesion exudates to flocculents. ***For ultra-violet*** . . . the most extensive line of grating monochromators, UV objectives, condensers and image converters, to reveal differential absorption of biological materials at high N.A. ***For phase contrast*** . . . turret and long-working distance condensers and objectives, with phase altering patterns in the rear focal plane, for selective differentiation of specimens without staining. ***For polarized light*** . . . analyzers, polarizers and retardation plates, for birefringence studies. ***For fluorescence*** . . . a Mercury arc lamp, exciter and barrier filters, non-fluorescing optics for all primary and secondary fluorescence and antibody testing. Ask for a demonstration or send for our new Advanced DynaZoom catalog, D-185, also our "Model Maker—Cost Finder," D-1142 and mention the illumination you're interested in. Write Bausch & Lomb Incorporated, 64211 Bausch Street, Rochester, New York 14602.

***For the inquiring mind searching for better microvision... Advanced Dyna Zoom***



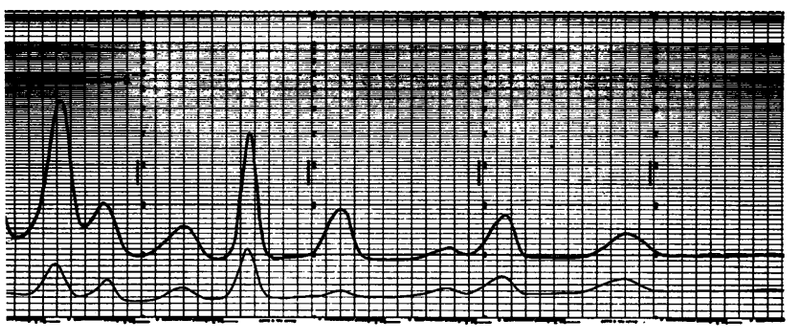

***new automated technic provides rapid preparative and quantitative information on peptides ... their size, occurrence and distribution ... and assures detection.***

The Technicon AutoAnalyzer system you see above may well make history in protein research. By an ingenious extension of multiple-analysis chromatography, it not only separates peptides for preparative purposes, but at the same time gives quantitative information.

The column effluent is split into many streams. One stream is subjected to a system of continuous hydrolysis. Another stream, unhydrolyzed, is used as control. Both are reacted with Ninhydrin. Comparison of these gives information about the size of the peptide. Other parallel streams can be used simultaneously for specific amino acid reactions. Thus, the basic AutoAnalyzer® train can be augmented and shaped at will to provide more and more analytic information.

In doing this, the system takes up where paper chromatography, electrophoresis and UV monitoring leave off. These methods are generally adequate enough for limited qualitative findings only.

The Technicon® peptide system is automated from beginning to end with thoroughgoing AutoAnalyzer efficiency, rapidity, and reliability. This versatile AutoAnalyzer reduces to *hours* the *days* now conscripted to the tedious task of peptide analysis.

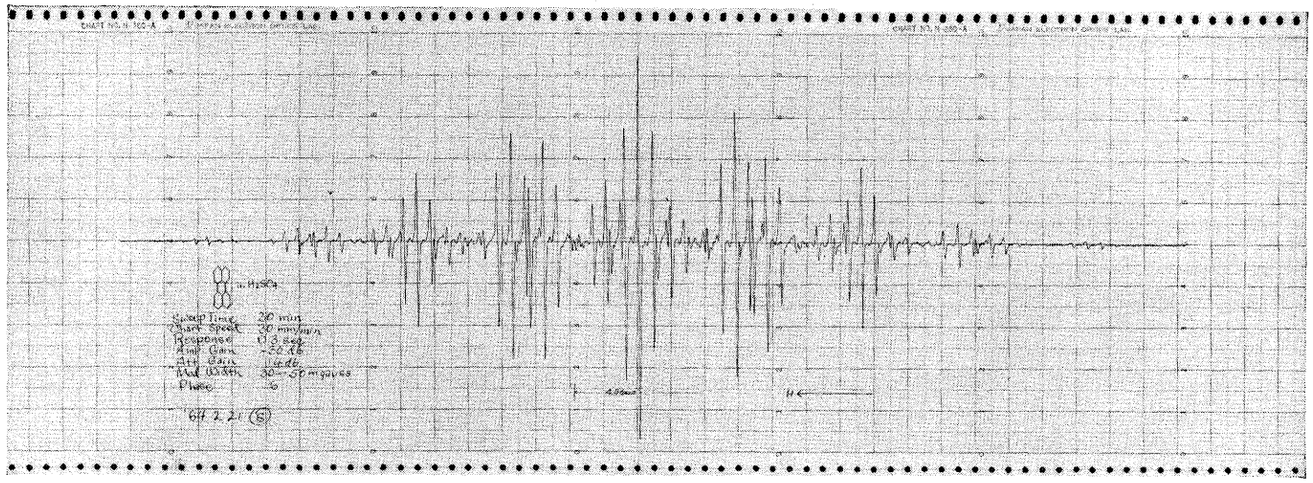



*Section of a chromatogram showing tryptic hydrolyzate of performic acid oxidized bovine pancreatic Ribonuclease before and after alkaline hydrolysis.*

TECHNICON
CHROMATOGRAPHY CORP.
Research Park • Chauncey, N.Y.

Technicon International of Canada, Ltd., Montreal; Technicon Instruments Company, Ltd., London; Compagnie Technicon, Paris; Technicon GmbH, Frankfurt/M.; Technicon AB, Stockholm; Technicon, Basle; Technicon Italiana S.r.L., Rome; Technicon Equipment Pty., Ltd., Sydney; Compagnie Belge Technicon, Brussels; Conitech A/S, Copenhagen

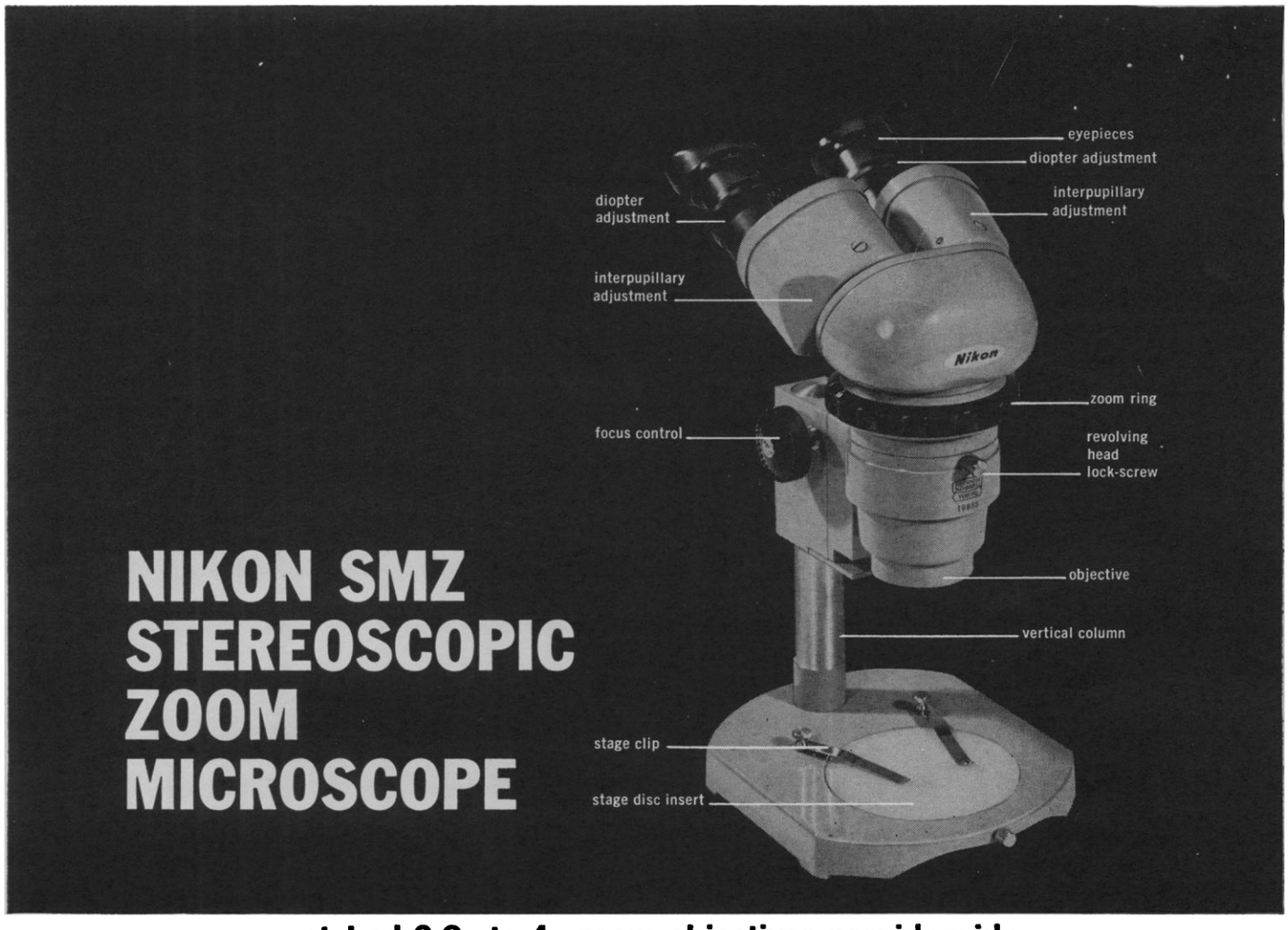
# ESR



*ESR spectrum of perylene positive ion in sulphuric acid showing highly resolved hyperfine structure due to interaction with proton spins.*

## SENSITIVITIES TO $1 \times 10^{11}$ SPINS/GAUSS, RESOLUTION $1 \times 10^{-5}$

A complete line of versatile Electron Spin Resonance equipment and accessories is now available from Japan Electron Optics Laboratory Co., Ltd. Unusually high sensitivity to $1 \times 10^{11}$ spins/gauss and $1 \times 10^{-5}$ resolution with broad operational flexibility make them important research tools for a wide variety of applications. Units for K and Q-band operation with sensitivity of $1 \times 10^{10}$ spins/gauss are also available. ■ Feeble ESR spectra produced by free radicals of organic compounds and aqueous solution samples used in biochemical research can be clearly recorded and analyzed. Unlike conventional instruments, JEOL's equipment can record second derivative curves for more precise analysis. Samples can be measured under varying conditions of mixture, temperature and rotation as well as under UV radiation. ■ Japan Electron Optics Laboratory Co., Ltd. has established a complete domestic servicing network to provide technical assistance and assure continuous trouble-free service. Complete technical data and sales information on ESR equipment can be obtained by contacting JEOLCO (U.S.A.), Inc., 461 Riverside Avenue, Medford 55, Mass., telephone 396-6241, area code 617.




# NIKON SMZ STEREOSCOPIC ZOOM MICROSCOPE

## matched 0.8x to 4x zoom objectives provide wide magnification range with precise parfocality

The Nikon SMZ is equipped with matched 5-to-1 zoom objectives. Used with a pair of 10x oculars it provides a continuously variable range of magnifications from 8x to 40x without any change in focus or working distance. Magnification ranges from 4x to 120x are also obtainable with other eyepieces and by adding supplementary meniscus objective lenses. The following table gives complete details:

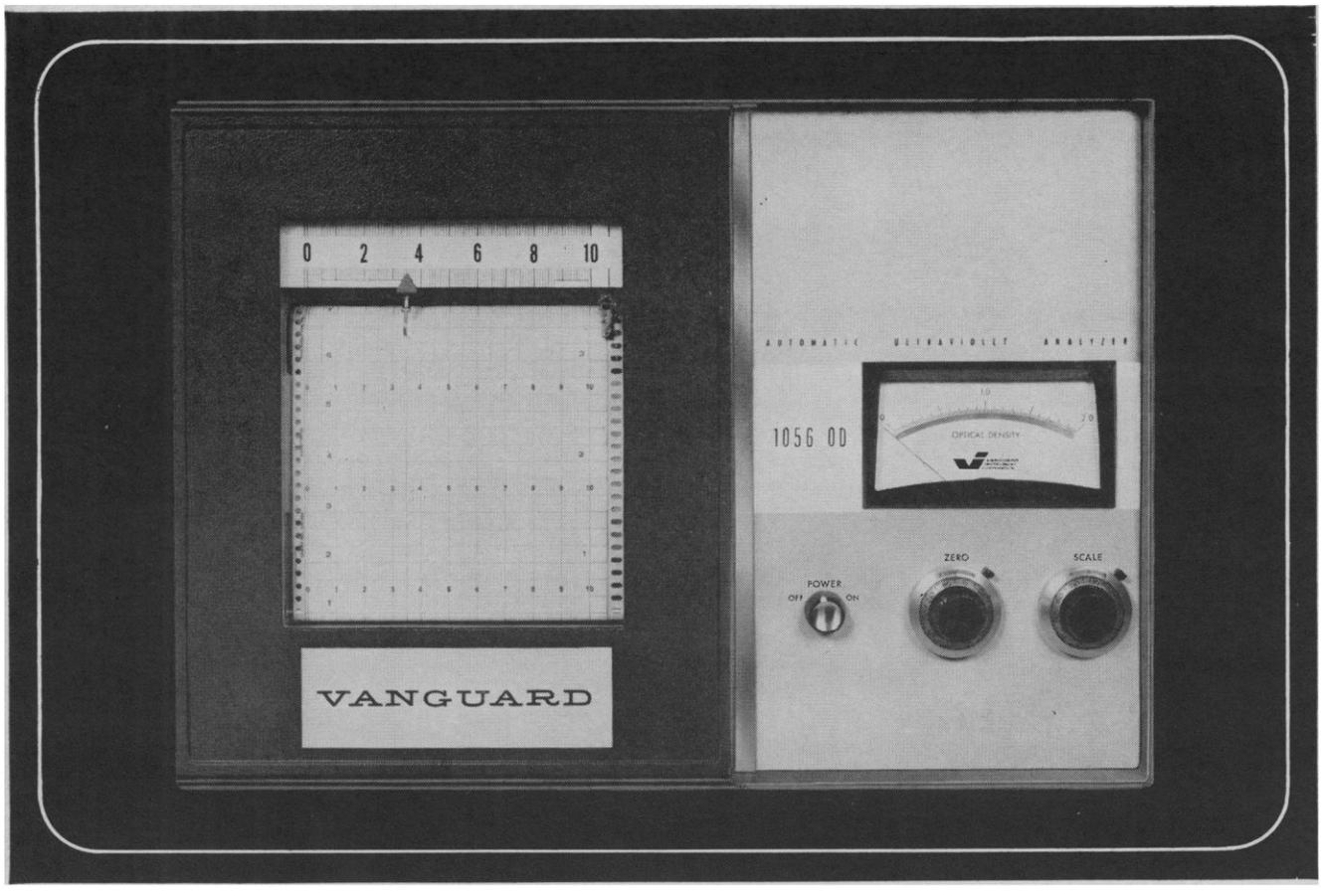
| OBJECTIVES | SUPPLEMENTARY OBJECTIVE LENSES | EYEPIECES 10X mag. | 10X field dia. | 15X mag. | 15X field dia. | 20X mag. | 20X field dia. | WORKING DISTANCE |
|---|---|---|---|---|---|---|---|---|
| 0.8X to 4X zoom | none | 8X to 40X | 29.7mm to 5.6mm 1.17 in. to .22 in. | 12X to 60X | 15.3mm to 2.9mm .60 in. to .11 in. | 16X to 80X | 14.2mm to 2.7mm .56 in. to .11 in. | 77.5mm 3.05 in. |
| | 0.5X | 4X to 20X | 45.5mm to 9.4mm 1.79 in. to .37 in. | 6X to 30X | 24.8mm to 5.1mm .98 in. to .2 in. | 8X to 40X | 22.2mm to 4.5mm .87 in. to .18 in. | 103mm 4.06 in. |
| | 0.7X | 5.6X to 28X | 38.0mm to 7.3mm 1.50 in. to .29 in. | 8.4X to 42X | 19.8mm to 3.9mm .78 in. to .15 in. | 11.2X to 56X | 18.2mm to 3.5mm .72 in. to .14 in. | 95.5mm 3.76 in. |
| | 1.5X | 12X to 60X | 21.0mm to 4.1mm .83 in. to .16 in. | 18X to 90X | 11.0mm to 2.1mm .43 in. to .08 in. | 24X to 120X | 9.0mm to 1.8mm .35 in. to .07 in. | 45mm 1.77 in. |

One of the advantages of the SMZ is the precise in-focus tracking of the right and left images over the entire zoom range. This is due to meticulously matched optics, and to the fact that the eyepiece tubes are both adjustable for dioptric power. There is a distinct sense of visual ease and comfort even with prolonged use.

Equally evident is the pronounced 3-dimensional effect, brightness of field, and almost incredible image definition. These, too, are traceable to the quality of the optics, their precise collimation and alignment, and to the use of high quality, coated prisms rather than mirrors. In fact, all glass-to-air optical surfaces are anti-reflection hard-coated for increased light transmission and reduced glare.

Standard equipment supplied with the Nikon SMZ includes stand, base, reversible white-and-black disc insert and clips, as shown in illustration. Optional equipment includes: substage base for transmitted light observation, illuminators, micrometer stages, reticles, polarizing attachment, half-reflecting mirror attachment for on-axis surface illumination, and a variety of other accessories for numerous applications. Free demonstration provided on request. For detailed catalog, write Dept. S-11

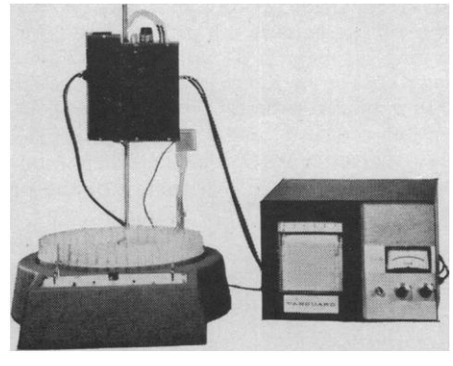
NIKON INCORPORATED INSTRUMENT DIVISION 111 FIFTH AVENUE NEW YORK 3, N.Y.
Subsidiary of Ehrenreich Photo-Optical Industries, Inc., In Canada: Anglophoto Ltd. Instrument Division Rexdale, Ontario




# new automatic optical density ultra-violet analyzer

Vanguard Model 1056-OD Automatic Ultra-Violet Analyzer provides the investigator with unequaled reliability and versatility. Through the use of two independent logarithmic converters, this instrument provides a chart recording of the optical density of the effluent from a chromatographic column—the ordinate of which is linear with optical density. In addition, a plain diffraction grating monochromator enables the operator to select any wave length from 200 millimicrons into the visible spectrum.

■ Dual beam operation utilizing sample and reference cuvettes provides continuous base line compensation for gradient elutions or other applications where the optical density of the eluent may change ■ Automatic chart recorder marking system speeds location and identification of test tubes containing ultra-violet absorbing fractions ■ Completely transistorized for dependable, maintenance-free operation ■ Detection system completely self-contained and light-shielded.



For complete specifications on the Model 1056-OD Automatic Ultra-Violet Analyzer, send for new informative literature. For immediate information, call or write to the address below.

**Model 1056-OD Automatic Ultra-Violet Analyzer shown with Model 1000 Fraction Collector. Model 1056-OD is compatible with all Fraction Collectors.**

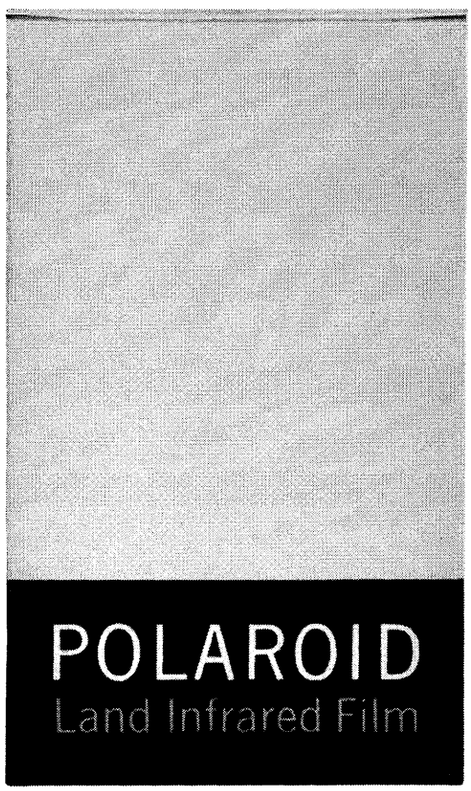
VANGUARD INSTRUMENT CORPORATION subsidiary of TECHNICAL MEASUREMENT CORPORATION

**Designers and Manufacturers of Precision Instrumentation for Research**

441 Washington Avenue, North Haven, Connecticut 06743 Area Code: 203 239-2501

**Offices in Principal Cities throughout the Country**

# Polaroid announces infrared film. Development time: 15 seconds.




You may know we've been field testing it for the past several months. Well, we're ready with it now. And it's available in unlimited quantity.

It's called Polaroid Type 413 Land Infrared Film. Its sensitivity to radiation extends from the visible region of the spectrum to beyond 9000 Å in the infrared, peaking at about 8400 Å. It is a high-contrast material. H & D reflection gamma is 2.1. It comes as a roll film with 8 exposures to the roll. It fits all standard Polaroid Land cameras and camera backs using series 40 film (except the J-66). And it's as easy to use as any other Polaroid Land film.

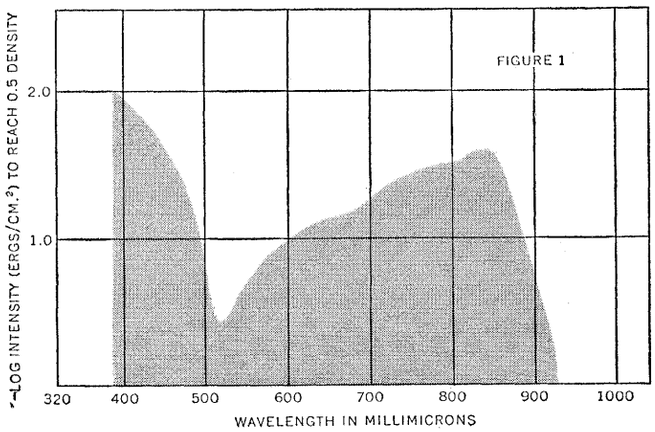
This new film has two important advantages over conventional infrared film. Most important, of course, is instant development. You get a finished print 15 seconds after you snap it. You know, on-the-spot, if you got the picture you wanted. And if it's not perfect you can take another while everything is still set up.

The other advantage is its high speed. Type 413 infrared film is more than three times as sensitive as conventional infrared film. ASA equivalent is 800 without filtration.

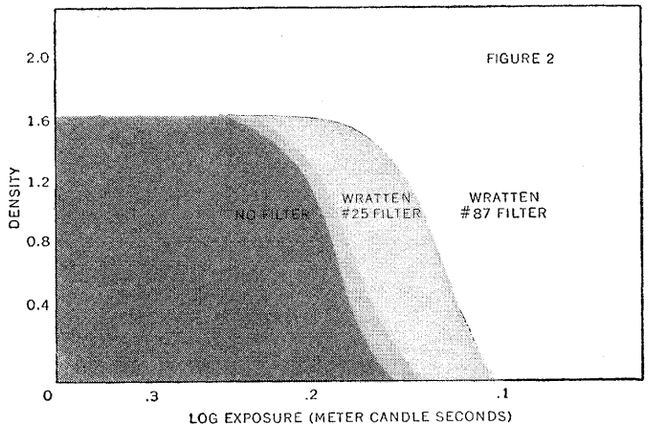
We expect this remarkable film to find wide use in just about every area of industrial and scientific photography. In laser research, spectrographic analysis, plant pathology, general medical research, and specialized industrial photography where heat is a factor. If you have a need for infrared recording we expect you'll be using it soon. For further information, write Sales Department, Polaroid Corporation, Cambridge, Massachusetts 02139.

"POLAROID"®

**SPECTRAL SENSITIVITY.** This graph illustrates the spectral response of Type 413 film.




**CHARACTERISTIC CURVES.** This graph illustrates average H & D characteristics of Type 413 film. (Tungsten light source, 3000°K.)



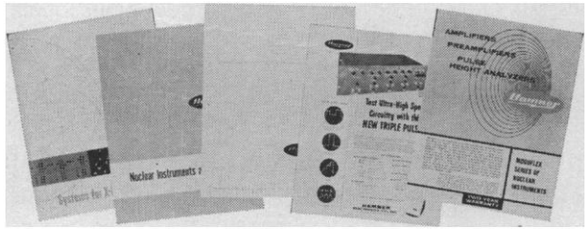
# Complete Nuclear Capability Through

Hamner

## SYSTEMS AND INSTRUMENTS

### All Solid State • Two Year Warranty

For over a decade the finest nuclear instruments and systems have borne the Hamner trademark and in each year Hamner has introduced techniques that have advanced the capabilities of research physicists all over the world. Again in 1964 Hamner advances the state of the art with its Moduflex line . . . a complete research series that brings new precision, versatility, compactness, reliability and accuracy to the accumulation and display of nuclear data. Now, experiments from the most routine to the most sophisticated can be handled easily. All configurations have been subjected to severe "worst case studies" assuring dependability under a wide range of critical conditions.



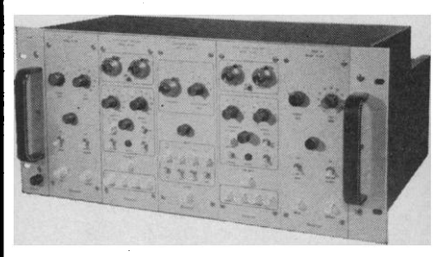
**Brochures are available on individual Hamner instruments and systems.**

**Send today or ask our representative to call.**


**HAMNER ELECTRONICS CO., INC.**

A Subsidiary of The Harshaw Chemical Company

P. O. Box 531, Princeton, N. J. • Telephone 609-737-3400

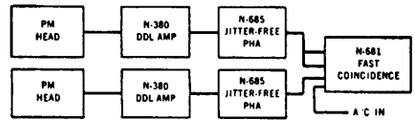



### NUCLEAR PHYSICS FAST COINCIDENCE AND SPECTROMETRY SYSTEM

This new system eliminates the old two stage method of coincidence measurement involving fast measurement for all energies and a secondary slow measurement for energy criteria . . . a technique resulting from the fact that standard single channel analyzers do not preserve time data. Special timing circuitry in the Hamner single channel analyzer requires measurement of fast coincidence only.

RESULTS — Simplicity . . . plus a big reduction in higher order accidental coincidences at high singles rates, and better "pile-up" characteristics.

The system includes Hamner's N-655 Jitter-Free PHA; N-380 DDL Amplifier; and N-681 Coincidence Module. Each amplifier can drive many single channel analyzers. Each analyzer can drive 3 fast coincidence units and a scaler. The fast coincidence unit can perform 3-fold coincidence plus fast anticoincidence.




### OTHER HAMNER SYSTEMS

**Low Noise Amplifying Systems**

**Tunnel Diode Logic Systems for High Energy Physics**

**Routine G.M., Proportional & Scintillation Counting**

**Research Proportional & Scintillation Counting**

**High Speed Counting**

**Manual Scintillation Spectrometers**

**Automatic Recording Spectrometers**

**Automatic Data Handling Options**

6 November 1964, Volume 146, Number 3645

SCIENCE



EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

# Conventional versus Nuclear Power

The intense economic competition presently existing between conventional and nuclear power is bringing benefits to this nation on a scale that in the next decade may exceed a billion dollars a year. The pace of technological advance in power generation has been especially fast during the past 2 years. In this period the cost of generating nuclear power has been cut drastically and the cost of producing conventional power has also diminished.

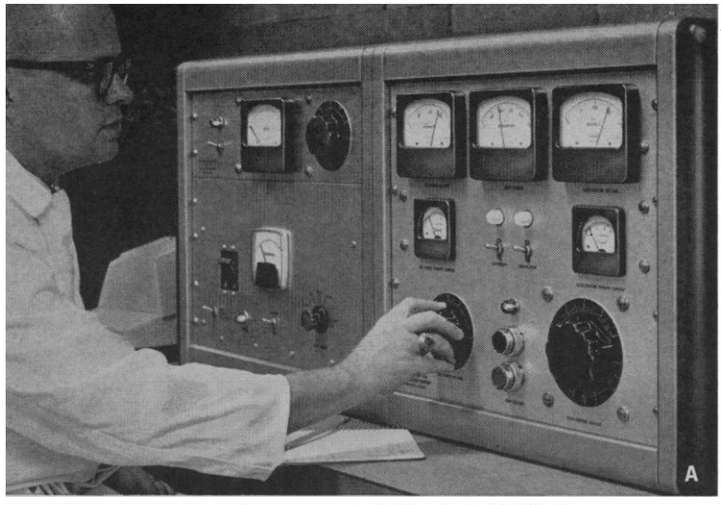
It is instructive to analyze statements on the matter by Philip Sporn, a leading spokesman of the electrical industry. In 1962, when Sporn estimated future costs of nuclear and conventional power, he flatly stated that nuclear power was not competitive with conventional energy. He also estimated that in the period 1973–78 nuclear power would cost between 6.17 and 6.89 mills per kilowatt-hour, whereas costs of conventional power would vary from 3.9 mills in favorable areas to 5.6 mills in high-cost fuel zones. Thus, in 1962 a leading expert considered that even after 15 more years nuclear power would not be competitive.

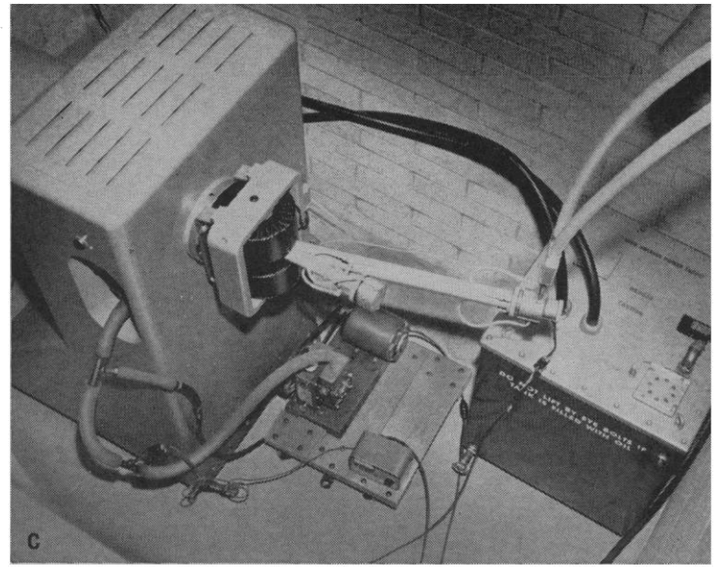
In 2 years the outlook has changed surprisingly. The General Electric Company has entered into a contract to build a nuclear installation at Oyster Creek in New Jersey. This plant, to be completed in 1967–68, is expected to deliver power at a cost as low as 3.66 mill/kw hr. Sporn has prepared a new analysis of the competitive status of conventional and nuclear power, and his views are different from those of 2 years ago. He is unwilling to accept the Oyster Creek plant costs as typical, contending that the General Electric Company has priced its plant too low, for competitive reasons, and perhaps has been too bold in guaranteeing performance. Even so, he concedes that there has been "an impressive . . . reduction in total energy costs" for nuclear power during the past 2 years.

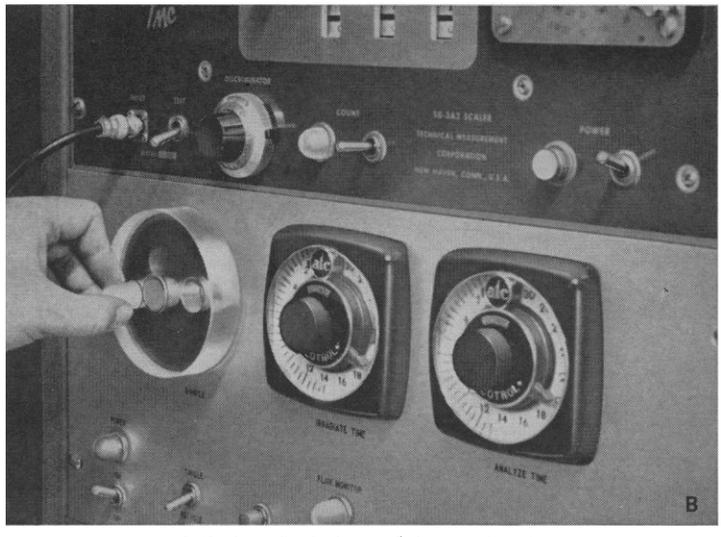
In his report Sporn also emphasizes the continuing improvements in the conventional approach to power, and he credits these, at least in part, to the competition between the two major sources of energy. In his own company, a plant using low-priced coal, to be completed in 1967, is expected to deliver power at 3.59 mill/kw hr, a cost below his earlier estimate of what might be achieved in the period 1973–78.

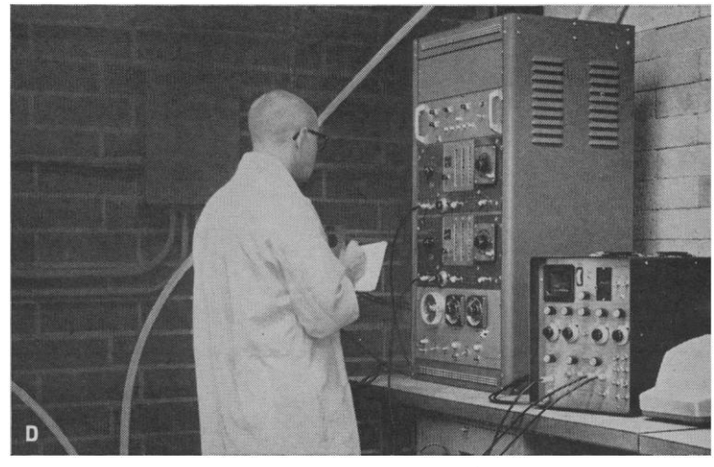
Perhaps the most impressive feature of Sporn's analysis is the change in his view of the energy competition. He now believes that this competition has reached the stage where nuclear power "is capable of joining this battle armed only with its own remarkable record of achievement and the promise of advancing further the established record of cost and performance without justification for, or need of, Federal assistance."

It appears that another federal review of the energy situation is inevitable and may occur during the next session of Congress. Up to the last year or so, subsidies have been necessary to enable nuclear energy to compete. In the light-water reactor field that need is no longer clear, since the Oyster Creek plant will be constructed without direct government support. Nevertheless, it is to be hoped that Congress will move cautiously in changing the rules of the game. We are witnessing a beneficial competition which should not lightly be interfered with. In addition, development of breeder or advanced converter reactors should be given high priority. Success in this effort would have tremendous long-term significance. Our nuclear scientists and engineers should be given every encouragement and incentive to maintain their record of superlative achievement.—PHILIP H. ABELSON









a. Activatron Controls are Set b. Loading the Sample Transfer System c. The Sample is Irradiated by the Activatron
d. The Sample's Nuclear Spectrum is Analyzed by the Pulse Height Analyzer

# Activation Analysis:

## a practical laboratory procedure with this complete TMC system

TMC has developed a complete laboratory activation analysis system that will fit well within the budget and space limitations of most analytical laboratories. A high yield ($10^{11}$ neutrons per sec.) neutron generator, single or dual sample transfer system, multi-channel pulse height analysis system and a choice of scintillation detectors are the basic elements. These may be supplemented by neutron flux monitoring, data storage and reduction units, and readout devices in several types — all designed and built by TMC.

***The neutron generator—the Ellison Activatron 111***— has a high atomic-to-molecular ratio Penning ion source with an ultrastable 1 ma. beam current and a neutron yield of $10^{11}$ neutrons/sec., making it equal to virtually every sample activation requirement. Safety of the operator is increased by the total immersion of the high voltage supply, accelerator section and ion source in oil baths. This also provides cooling of these units. The target is cooled by an integral recirculating water system. *Activatron control units* may be housed in individual cabinets, in a desk-type console, or they may be mounted with other equipment in custom cabinets.

***The Sample Transfer System*** (single and dual units available) is completely automatic. The sample "rabbit" is inserted in the receptacle on the control unit and transferred by compressed air to the Activatron target holder. After irradiation, the sample is automatically transferred to a scintillation detector for a preset counting period. The complete system includes the control unit, irradiate and counting stations, conveyor tubing and compressor.

***The Pulse Height Analysis Systems*** — the 100-channel Gammascope and the 400-channel 400 Series offer the choice of an economical, single input system or a more versatile, higher capacity system. The Gammascope provides one input, a variable single-channel "window" selector, built-in CRT display and a digital tape printer. The 400 Series has two independent detector inputs, memory sub-grouping and multi-scaling capabilities, built-in CRT display and a wide selection of accessory units for data reduction and readout.

TMC activation analysis systems are backed by broad experience in designing, building, installing and servicing equipment tailored to meet the precise needs of many laboratories. For complete information on a system for your requirements, contact any TMC office or write Technical Measurement Corporation, Ellison Division, 441 Washington Avenue, North Haven, Connecticut.

TMC

**TECHNICAL MEASUREMENT CORPORATION**

**SEE US AT THE ATOM FAIR, BOOTH 113-115, IN SAN FRANCISCO, DECEMBER 1-3. OR SEE US AT THE EASTERN ANALYTICAL SYMPOSIUM, STATLER-HILTON HOTEL, NEW YORK, NOVEMBER 11-13.**


# HITACHI PERKIN-ELMER ULTRAVIOLET VISIBLE GRATING SPECTRO-PHOTOMETER

The Model 139 Grating Spectrophotometer, a compact, precise modern instrument, out performs similar spectrophotometers costing significantly more.

Check these features: High resolution grating Monochromator — gives exceptional radiation purity in transmittance / absorbance measurement from 205 to 800 millimicrons; Direct reading meter — presents measurements in both transmittance and absorbance quickly and accurately; Single wide-range phototube — covers the entire range from 205 to 800 millimicrons, eliminates need to change even at wavelength extremes; Dual Hydrogen/Tungsten lamp source assembly — has high energy output, gives instant switching from one source to the other; Direct line-operated power supply — is stable, fully transistorized, eliminating batteries and drift problems; Low cost — brings the advantages of modern instrumentation to any laboratory with unmatched economy and superior performance.

The five basic functional units, in combination, provide the analyst with a fully integrated instrument for the rapid and precise analysis of any sample by absorption measurement.

For details see your Aloe Scientific representative or write Aloe Scientific, B Division of Brunswick, 1831 Olive Street, St. Louis 3, Mo.

*Serving the Sciences that Serve Mankind*

ALOE SCIENTIFIC

an initially very blue color. The denser protogalaxies reddened most rapidly, becoming the elliptical galaxies and stellar objects that we see today; the less dense ones have evolved more slowly to Irr I and Sc types, and the least dense ones are probably unobservable. He points out that the lack of scattered points on this plot (no blue galaxies of high density, for instance) implies a single age for all galaxies—possible evidence against the steady-state cosmology.

It was pointed out that a volume change in collapsing gas clouds would increase log $\rho$ by 3 or more during the life of a galaxy, in which case the evolutionary tracks could well be *along* the sequence from Irr I through Sc, Sb, Sa, SO, and Irr II to E. Moreover, other types such as dwarf ellipticals are not yet represented, and may not fall along the narrow sequence.

Page reported calculations which showed that evolving stars would not have the observed values of $M/L = 50$ to 100 after lifetimes of $10^{10}$ years unless a large proportion of the newly formed stars were of very low mass (0.01 sun) and said that this could not be corrected by changing $n$, the power of $\sigma_R$ in Schmidt's formula for the rate of star formation. He expects that the size of smallest star formed depends on turbulence in the protogalaxy gas cloud, and notes that the angular momentum (roughly estimated from inclinations of lines in spectra of galaxies) shows a trend from low values for E galaxies to higher values for Sc types. There is a possibility that some of the mass in E galaxies with low angular momentum has collapsed to densities exceeding the Schwarzschild limit, in which case it would be invisible in all electromagnetic radiation, but would still influence the gravitational potential in its vicinity.

Although Bondi and McVittie disagreed with this possibility, G. Burbidge and Fowler upheld it, and Zwicky reported observations of "compact galaxies" that support it. He and Herzog have discovered on Palomar photographs 300 fuzzy images, forming a sequence from 10 seconds of arc to less than 1 second of arc, in such numbers that he expects that there is an average of one brighter than the 17th magnitude for every 2 square degrees all over the sky. Spectra of 16 of them show broad lines indicating large mass and red shifts from 1,000 to 30,000 km/sec. Quasars are probably one extreme of this sequence, and clus-

ters of galaxies like the Coma Cluster may form the other extreme.

Other reports and comments confirm the general impression that the study of evolution of galaxies is now in an early stage of development comparable to that of the study of stellar evolution in 1935. There is an evolutionary pattern evident in the various correlations and sequences, and possibly in the variety of peculiar galaxies. More observations are needed to fill in the gaps indicated by theoretical studies, and new instruments were discussed for such purposes. Three new spectrographs have been built for the larger telescopes in the southern hemisphere (at Pretoria, South Africa, Cordoba, Argentina, and Mt. Stromlo, Australia). Leo Goldberg described far ultraviolet spectra down to x-ray wavelengths obtained by rockets fired above the earth's atmosphere. The Canadian "Alouette" satellite will carry a radio telescope above the ionosphere for measurements at frequencies down to 1 Mcy/sec, and the NASA Orbiting Astronomical Observatory program may have a 100-inch optical telescope in space by 1975.

THORNTON PAGE
*Van Vleck Observatory, Wesleyan University, Middletown, Connecticut*

**References**

1. Proceedings of the congress will be published by Academic Press in 1965 in *Transactions of the International Astronomical Union*, vol. 12.
2. "QSO's, the brightest things in the universe," *Astron. Soc. Pacific, Leaflet 421* (1964); *Proceedings of the Symposium on Gravitational Collapse*, E. L. Schucking, Ed. (Univ. of Chicago Press, Chicago, 1964).
3. "Proceedings of the Conference on Instability of Systems of Galaxies," *Astron. J.* **66**, 533 (1961).
4. E. Holmberg, *Arkiv Astron.* **3**, 387 (1964).
5. T. Page, *Astrophys. J.* **136**, 685 (1962).

## High-Energy Physics

At the 12th International Conference on High-Energy Physics which was held in Dubna, Russia, 5–12 August, a most exciting report was presented by J. Cronin and V. Fitch (Princeton) giving evidence for the apparent nonconservation of CP (C, charge reflection; P, parity or spatial reflection) in $K_2^0$ decays. The experiment was carried out in a simple and elegant manner at the alternating-gradient syncrotron accelerator at Brookhaven National Laboratory and consisted in observing that $K_2^0$'s (the long-lived particle mixture of $K^0$ and $\bar{K}^0$ mesons) decay into $\pi^+$ and $\pi^-$ mesons with a charged-particle branching ratio of $2.0 \pm 0.4 \times 10^{-3}$. Earlier

experiments had established an upper limit for this decay mode, which is forbidden by CP invariance, of approximately 1/300. Since the invariance of all known interactions under the transformation TCP (T, time reversal) has not been challenged (TCP invariance predicts equal mass and lifetime for particle and antiparticle), the violation of CP invariance also implies the violation of time reversal invariance for the weak interactions. This result will surely trigger a new round of difficult experiments in the search for time reversal noninvariance in other weak decay interactions. No theoretical papers on this subject were presented, but there was much speculation during informal discussions concerning the incorporation of terms that will allow for time reversal noninvariance into existing weak-interaction theory. These ideas included weak-interaction terms of the types (i) $\Delta S = -\Delta Q$ (Sachs), (ii) $\Delta I = 3/2$ (Amati) ($S$ being strangeness, $Q$ being charge, and $I$ being isotopic spin), or (iii) "currents of the second kind" (Cabibbo). Since the meeting, several theorists have offered explanations for this new result which suppose a new type of long-range interaction coupled to hypercharge (+1 and −1 for $K^0$ and $\bar{K}^0$, respectively), much weaker than the $\beta$-decay interaction and even weaker than gravitation. Such a new force would have little impact on other elementary particle behavior but could have cosmological significance.

Detailed talks on experimental aspects of the weak interactions were presented by A. K. Mukhin (Dubna) on nonstrange particles and by I. V. Chuvilo (Dubna) on strange particles. All data presented on other aspects of weak interactions were consistent with current theoretical ideas which include: universality of the coupling of muons and electrons, lepton conservation, conserved vector current, the strangeness-changing leptonic decays satisfying the $\Delta S + \Delta Q$ and the $\Delta I = \frac{1}{2}$ rules, and finally nonleptonic decays satisfying the $\Delta I = \frac{1}{2}$ rule. The Cabibbo theory of weak interactions that relates the neutron $\beta$-decay to the hyperon $\beta$-decays by way of the $SU_3$ symmetry of strong interactions is consistent with the data. A special report on neutrino physics was presented by G. Bernardini (Centre Européen de la Recherche Nucléaire). The beautiful experiment on high energy neutrino interactions conducted at CERN for the past 2 years has confirmed the existence of two neutrinos, $\nu_e$ and $\nu_\mu$, which couple to

electrons and muons, respectively. The search for a charged intermediate vector meson that decays into $(\mu^+, \nu_\mu)$ or $(e^+, \nu_e)$ has been unsuccessful. A lower limit for the mass of 1.8 Gev has been set for this theoretically conjectured particle that is supposed to transmit the weak interaction between pairs of spin ½ particles.

The review by N. Ramsay (Harvard) of electromagnetic interactions revealed no violation of quantum electrodynamics up to momentum transfers $\sim$ 1 Gev/c. The mysterious muon continues to behave exactly as an electron in all observed electromagnetic interactions [including $\mu^-$, $\mu^+$ pair production (Friedman) and $\mu^- + p \rightarrow \mu^- + p$ scattering (Tinlot)]. No theoretical ideas exist that explain the large mass ratio $(m_\mu/m_e) = 207$. Electron scattering cross section experiments on protons at the Cambridge Electron Accelerator continue to display a smooth fall off with increasing momentum transfer, $\leq$ (7 Gev/c)$^2$ (Wilson, Harvard).

A myriad of experimental results on strong interactions of $p$, $n$, $\pi^\pm$, $K^\pm$, $\bar{p}$, $\Lambda$ and $\Sigma^\pm$ particles on protons were presented. Talks by Yu. M. Kazarinov (Dubna) and S. J. Lindenbaum (Brookhaven) on $\pi - n$ interactions (up to and above 1 Gev), S. Ya. Nikitin (Moscow) on pion resonances, R. Armenteros (CERN) on strange-particle resonances and D. Miller (Berkeley) on strange-particle physics, could hardly do justice to the material. The hope that the analytic properties of the $S$ matrix coupled with simple Regge trajectory hypotheses could explain cross sections in the region of 10 to 30 Gev is not borne out by experiment. New experiments at CERN, Harwell, and Brookhaven confirm the existence of a substantial real part in the $p - p$ scattering amplitude at high energies (first found by a Russian group at approximately 8 Gev a few years ago). A similar real part is also found in $(\pi,p)$ elastic scattering (Lindenbaum) and allows for the possibility of testing dispersion relations (based on microscopic causality) in the energy regime of 10 to 20 Gev. Several new $N^*$ resonances at energies ranging up to 2825 Mev have been discovered (Kycia), and the properties of many other $N^*$ resonances have been elucidated. Among the meson resonances, the existence of a ninth pseudoscalar meson, $X^0$, of mass 960 Mev has been well established [Samios (Brookhaven), Kalbfleisch (Berkeley), and Ticho (U.C.L.A.)]. Other new resonances include $B$(1215

Mev) → $\omega$ $\pi$; $A_2$(1310 Mev) → $\rho$ $\pi$, $K\bar{K}$ with spin and parity $2^+$, and many more controversial objects, called $A_1$, $C$, $E$, $H$, $\kappa$, etc., whose existence as well as spin, parity, and decay modes are not well established. As for hyperon resonances, the existence of $\Xi^*$ (1810 Mev) has been confirmed, and the $Y^*_1$ (1660) has had its parity changed from plus to minus. It is clear that the world of elementary particles and resonant states is richer than most physicists had imagined, and much more work is needed.

The idea of M. Gell-Mann and Y. Neeman that the strong interactions obey an approximate symmetry called $SU_3$ has brought some order into the picture. The crowning point of the success of this theory was the prediction of the $\Omega^-$, a hyperon with hypercharge $Y = -2$. Two examples were found a few months ago by a team at Brookhaven, and these were reviewed in a convincing fashion by Samios. The success of this theory has led to many new theoretical extensions ($SU_4$, $SU_3 \times SU_3$, . . .) and exciting speculations, most of which were reviewed by Salam (Imperial College). The low mass, strongly interacting particles, have been assigned to $SU_3$ group representations of dimension 1, 8, and 10. However, as the name suggests, this theory also allows for fundamental triplet representations. Many theorists, including Gell-Mann (California Institute of Technology), Schwinger (Harvard), Van Hove (CERN), and others not at this meeting have conjectured that these triplets are the fundamental building blocks out of which matter, as we know it in the form of nucleons and pions, is composed. These speculations have triggered a new experimental search for such triplets (either of fractional charge or integral charge). To date, this search at existing accelerators has been unsuccessful, but the idea is sufficiently attractive to last a long time. The heavier the mass, of course, the higher the energy needed to produce these objects. The answer to the crucial question concerning the order of magnitude of the mass expected varies among the "experts" from about several Gev to very heavy (≈ 100 Gev). In the latter case, even the next generation of high-energy accelerators will not suffice as a source, but there remain cosmic rays.

The Russian physicists were wonderful hosts at this meeting, and their energetic efforts to get revised manuscripts promptly into the hands of the

translators (Russian and English were the official languages) suggest that the proceedings will also be published without too much delay. A 13-hour boat trip down the Volga and a 4½-hour evening entertainment were also provided. The length of these entertainments were well matched to the length of the physics sessions.


GEORGE SNOW
*Department of Physics and Astronomy, University of Maryland, College Park*


## Forthcoming Events

### November

*12–14.* **Paleomagnetism**, 2nd U.S.–Japan seminar, U.S.–Japan Cooperative Science Program, Univ. of California, Berkeley. (J. Verhoogen, Dept. of Geology and Geophysics, Univ. of California, Berkeley)

*13–15.* American Inst. of **Professional Geologists**, 1st annual, Denver, Colo. (AIPG, W. A. Newton, Public Information Committee, P.O. Box 836, Golden, Colo. 80402)

*13–15.* **Clinical Scientists** Assoc., annual, Washington, D.C. (ACS, F. W. Sunderman, Jr., Univ. of Florida, College of Medicine, Gainesville 32603)

*14–19.* American Acad. of **Ophthalmology and Otolaryngology**, Chicago, Ill. (W. L. Benedict, 15 Second St., SW, Rochester, Minn. 55901)

*14–21.* Pan American **Medical Women's** Alliance, 9th congr., Los Angeles, Calif. (E. M. Hohl, 1234 N. Vermont Ave., Hollywood, Calif.)

*15–17.* Water in the **Arid Zones** of the Old World, symp., Halle an der Saale, East Germany. (Deutsche Akademie der Naturforscher Leopoldina, August-Bebel Str. 50 a, Halle an der Saale)

*15–19.* American Soc. of **Agronomy**, Crop Science Soc. of America, Soil Science Soc. of America, annual, Kansas City, Mo. (L. A. Richards, Amer. Soc. of Agronomy, 677 S. Segoe, Madison, Wis.)

*15–19.* Society of **Exploration Geophysicists**, Los Angeles, Calif. (C. G. Ferris, E. V. McCollum & Co., 515 Thompson Bldg., Tulsa, Okla.)

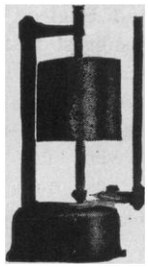
*16.* **Ammonia Metabolism**, symp., Brooklyn, N.Y. (D. M. Kirschenbaum, Dept. of Biochemistry, State Univ. of New York, Downstate Medical Center, 450 Clarkson Ave., Brooklyn 3)

*16–17.* **Basic Sciences**, 3rd annual conf., New York, N.Y. (A. Gelbart, Yeshiva Univ., Amsterdam Ave. and 186th St., New York)

*16–19.* Gulf and Caribbean **Fisheries** Inst., conf., Ocho Rios, Jamaica. (Executive Secretary, Gulf and Caribbean Fisheries Inst., 1 Rickenbacker Causeway, Miami, Fla. 33149)

*16–19.* **Magnetism and Magnetic Materials**, Minneapolis, Minn. (J. B. Goodenough, Lincoln Laboratory C182, Lexington, Mass. 02173)

*16–20.* Interagency **Chemical Rocket Propulsion** Group, Mechanical Behavior Working Group, 3rd annual, Redstone Arsenal, Ala. (T. H. Duerr, AMSMI-RKP, Redstone Arsenal, Ala. 35809)



## BIRD model KYMOGRAPH

Very Suitable for student and general work

Presenting a motor driven recording drum that is very suitable for student experiments and general experimental work.

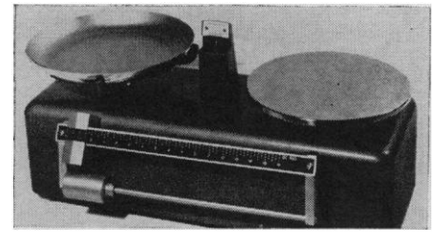
The driving mechanism, consisting of an induction motor and gear box, is housed in the aluminum base. Five speeds are provided—0.44, 2.2, 11, 54 and 270 centimeters per minute. Care has been exercised to provide speeds that will be suitable for all student experiments. Any one of the five speeds may be selected at will. Simply rotate the speed control knob to the desired position while the motor is running. The chart drum (aluminum) is 15 cm. high and 50 cm. in circumference.

A special feature of this kymograph is the convenient drilled and tapped base for attaching the long paper extension (No. 70-128). Extension is attached by removing the two acorn nuts and attaching the drilled end plate to the base. Paper records 225 cm. in length may be made.

**No. 70-060-Kymograph-Bird complete as illustrated.**

**PHIPPS & BIRD, INC.**
Manufacturers & Distributors of Scientific Equipment
6th & Byrd Streets — Richmond, Virginia

# HEAVY-DUTY PRECISION BALANCES



- Capacity 3 kg or 6 kg; sensitivity as fine as 100 mg.
- Beams graduated in milligrams, grams, or ounces.
- Heavy blue-gray aluminum case. Stainless steel pans, plates, or scoops for every weighing requirement.
- All models available with or without graduated beams; priced from $105.
- Illustration shows Model 195-B, 3-kg capacity, with one 8-in. pan and one 6-in. plate. Dimensions 17½" W, 8½" D, 9½" H. Price $115.
- Locking tare weight on all models with beam.
- Ask your lab-supply dealer or write for complete information.

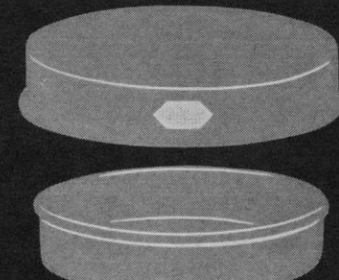
**Henry TROEMNER, Inc.**
6825 Greenway Ave., Philadelphia, Pa. 19142
Phone (215) 724-0800

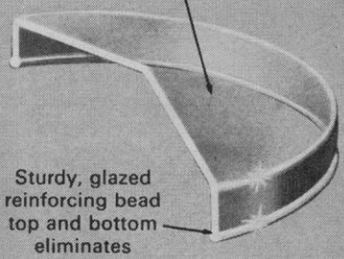
STANDARD OF EXCELLENCE

You get more of the better things first from **KIMBLE**

*FOR EXAMPLE, BETTER*

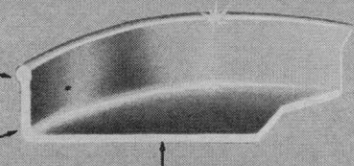
## Kimax® Culture Dishes






Tops and bottoms color-coded

Markings stand up under repeated autoclaving




Better because . . . "hard" glass assures the economy of long service life. Provides a dish with inert surfaces for optimum culture growth. Color-coded for easy, sure sorting.

OWENS-ILLINOIS
maker of Kimble Products
Toledo 1, Ohio

*16–20.* **Soil Science** Soc. of America, annual, Kansas City, Mo. (W. E. Jeske, 7515 N.E. Ankeny Rd., Ankeny, Iowa)

*17–18.* **Allied Air Force Medical** Conf., 10th annual, Fontainbleau, France. (Officier Administratif, Division Médicale d'Aircent, Camp Guynemer, Fontainbleau)

*18–20.* **Navy Research and Development**, Philadelphia, Pa. (*clearance*). (H. G. Sparks, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

*18–20.* Northeastern States **Navy Research and Development** Clinic, Philadelphia, Pa. (N. R. Droulard, Franklin Inst. Laboratories, 20th and Parkway, Philadelphia 19103)

*18–21.* **Neurological Surgeons**, 14th congr., Bal Harbour, Fla. (J. R. Russell, 1815 N. Capitol Ave., Indianapolis, Ind.)

*19–21.* **Geological** Soc. of America, Miami Beach, Fla. (J. W. Peoples, 10 Wesleyan Place, Middletown, Conn.)

*19–21.* **Paleontological** Soc., Miami Beach, Fla. (R. L. Langenheim, Jr., Dept. of Geology, Univ. of Illinois, Urbana)

*19–21.* National Council of **Teachers of Mathematics**, Atlanta, Ga. (J. D. Gates, 1201 16th St., NW, Washington, D.C.)

*19–22.* American **Anthropological** Assoc., 63rd annual, Detroit, Mich. (E. R. Service, Dept. of Anthropology, Univ. of Michigan, Ann Arbor)

*21–22.* American **Geological** Inst., Miami Beach, Fla. (L. Hoover, 1444 N St., NW, Washington, D.C. 20005)

*21–24.* American **Speech and Hearing** Assoc., San Francisco, Calif. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington, D.C.)

*23–24.* **Water** for Texas, 9th annual, Texas A&M Univ., College Station. (E. T. Smerdon, Water Resources Inst., Texas A&M Univ., College Station)

*23–25.* American Physical Soc., **Fluid Dynamics** Div., Pasadena, Calif. (R. J. Emrich, Dept. of Physics, Lehigh Univ., Bethlehem, Pa.)

*23–27.* **Dosimetry of Irradiations from External Sources**, intern. symp., Health Physics Soc., French section, Paris, France. (M. Gras, 5, rue Armand, Gauthier, Paris 18e)

*23–27.* Use of **Radioisotopes** in Animal Nutrition and Physiology, symp., Intern. Atomic Energy Agency, Food and Agriculture Organization of the UN, Prague, Czechoslovakia. (Symp. Secretariat, Kärntnerring 11, Vienna 1, Austria)

*23–28.* **Internal Medicine**, 8th intern. congr., Buenos Aires, Argentina. (Secretariat, Melo 2081, Buenos Aires)

*24.* **Manufacturing Chemists'** Assoc., 14th conf., New York, N.Y. (Manufacturing Chemists' Assoc., 1825 Connecticut Ave., NW, Washington, D.C.)

*26–28.* Central Assoc. of **Science and Mathematics Teachers**, 64th annual, Detroit, Mich. (Sister Mary Ambrosia, Gesu Convent, 17180 Oak Drive, Detroit 48221)

*27–28.* National Council for **Geographic Education**, Minneapolis, Minn. (L. Kennamer, Univ. of Texas, Austin)

*29–1.* Applications of **Fundamental Thermodynamics** to **Metallurgical Processes**, conf., Pittsburgh, Pa. (G. R. Fitterer, Engineering Research Div., Schools of Engineering and Mines, 405 Engineering Hall, Univ. of Pittsburgh, Pittsburgh)

*29–1.* Association for Research in **Ophthalmology**, Minneapolis, Minn. (H. Kaufman, J. Hillis Miller Health Center, Univ. of Florida, Gainesville)

*29–4.* American Soc. **Mechanical Engineers**, annual, New York, N.Y. (D. J. Sengstaken, ASME Nuclear Engineering Div., Long Island Lighting Co., 175 Old Country Rd., Hicksville, L.I., N.Y.)

*29–4.* **Radiological** Soc. of North America, Chicago, Ill. (M. D. Frazer, 1744 S. 58 St., Lincoln, Neb.)

*30.* **Food and Drug Administration and Law** Inst., 8th annual conf., Washington, D.C. (S. T. Grey, Bureau of Education and Voluntary Compliance, FDA, Washington 25, D.C.)

*30–1.* **Mechanisms of Dental Caries**, New York Acad. of Sciences, New York, N.Y. (J. F. Fredrick, New York Research Laboratories, 3425 Boston Post Rd., Bronx, N.Y. 10469)

*30–2.* New Horizons in **Solid State Electronics**, seminar, Rochester, N.Y. (A. DeWinter, Rochester Inst. of Technology, Extended Services Division, Rochester 8)

*30–2.* **Pacific Air Force Medical** conf., Fuchu Air Station, Tokyo, Japan. (Lt. Col. R. J. Carter, 14th PACAF Medical Conf., USAF Hospital Tachikawa, APO 323, San Francisco, Calif.)

*30–2.* **Thalamic Regulation of Sensorimotor Activities**, symp., New York, N.Y. (M. D. Yahr, New York Neurological Inst., 710 W. 168 St., New York 10032)

*30–3.* **Atomic Industrial Forum**, annual, San Francisco, Calif. (Atomic Industrial Forum, 850 Third Ave., New York, N.Y.)

*30–3.* **Entomological** Soc. of America, annual, Philadelphia, Pa. (ES, 4603 Calvert Rd., College Park, Md.)

*30–3.* American **Nuclear** Soc., winter meeting, San Francisco, Calif. (W. H. Nutting, Pacific Gas and Electric Co., 245 Market St., San Francisco)

### December

*1.* **Food Standards**, symp., Washington, D.C. (Food Law Inst., Inc., 205 E. 42 St., New York 10017)

*1.* **New Polyolefin Copolymer Plastics**, regional technical conf., Philadelphia, Pa. (E. A. Jeffreys, Registration Chairman, c/o Allied Chemical Corp., 901 Catalapa Rd., Warminster, Pa.)

*2–4.* **Communication Wires and Cables**, 13th annual symp., Atlantic City, N.J. (J. Spergel, WCS, U.S. Army Electronics R&D Laboratories, Fort Monmouth, N.J. 07703, Attn: SELRA/PEE)

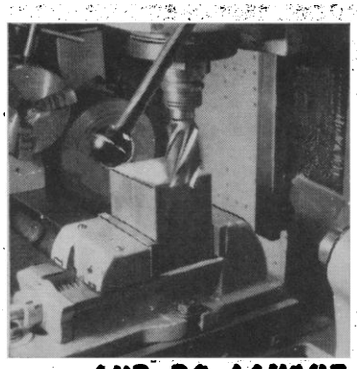
*2–5.* **Crystalline Lens**, symp., Minneapolis, Minn. (J. E. Harris, Dept. of Ophthalmology, Univ. of Minnesota Medical School, Minneapolis 55455)

*3–5.* **American Chemical Soc.**, 20th annual southwestern regional meeting, Shreveport, La. (ACS, 1155 16th St, NW, Washington, D.C. 20036)

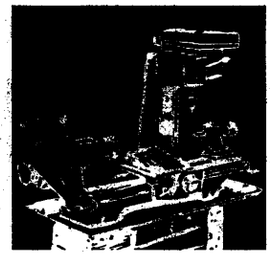
*3–5.* **Sociological Questions Pertaining to the Medical Field**, East German Hygiene Soc., symp., Berlin, East Germany. (German Acad. of Sciences, Mohrenstrasse 39, Berlin W.8.)

*3–5.* **Texas Acad. of Science**, annual, Dallas. (S. O. Brown, Texas A&M Univ., Box 33, College Station)

*4.* Central States Society of **Industrial**



## You can machine a steel block dead square on this lathe!



## AND DO LAYOUT DRILLING TOO!

Ordinarily these are jobs that can't be done on a conventional lathe, unless you've managed to rig up some very unusual features. Lathes for the past 150 years have been built to do *just* one *basic job,* metal turning.

But you can mill, do layout drilling, indexing, surfacing and dozens of other *impossible* jobs on a Maximat. Maximat was not designed as a lathe with attachments, but as a complete multi-functional machine tool that marries the common elements of the lathe and vertical mill to create a highly practical tool, that has greatly enhanced abilities to machine metals.

In many laboratories and maintenance facilities, you'll find Maximats doing a job that ordinarily takes three or four separate machines. Yet the cost of a Maximat is comparable with single-purpose lathes.

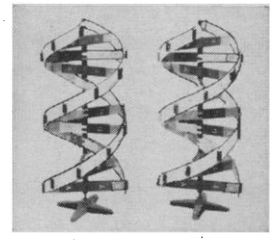
Before you decide to buy a lathe, mill or a drilling machine, you owe it to yourself to investigate Maximat. A new brochure illustrates many unusual time-saving setups possible with Maximat. Free. Write today to:

**AMERICAN EDELSTAAL INC.** (or) **CANADIAN EDELSTAAL**

Dept. B-K4, 350 Broadway
New York 10013

47 Granger Ave.
Scarborough,
Ontario, Canada

## MAKE MOLECULES ON A UNIMAT?



Even though Unimat can turn, drill, mill and saw parts so small you need tweezers to handle them, making a molecule, actual size, is quite impossible. But molecule models *are made* in prototype by Science Teaching Aids Co., of Pell Lake, Wisconsin, who are famous for their DNA "working molecule model".

Paul Dziulak, biologist (in photo) says, "Our work is very unusual. Our biological cell models are made of metals, hard plastics, epoxies. Nature seldom makes anything in true round, square or flat shapes. That's why we use Unimat in our design shop . . . because of its ability to tackle so many unusual jobs in machining, cutting, polishing *impossible* shapes."

**Isn't it time to put Unimat to work for you too?**

A special bulletin describing the Science Teaching Aids Co. shop, unusual Unimat applications and latest tech literature will be sent free on request.

Write toaay to

**AMERICAN EDELSTAAL INC.** (or) **CANADIAN EDELSTAAL**

Dept. BB-K4, 350 Broadway
New York 10013

47 Granger Ave.
Scarborough,
Ontario, Canada

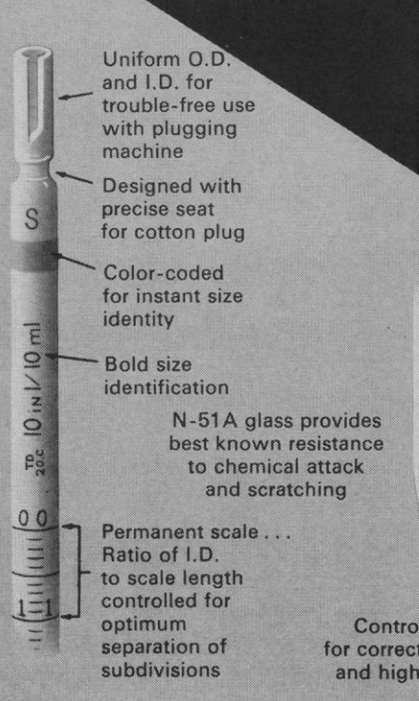
---

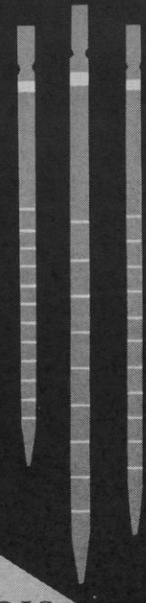
You get more of the better things first from **KIMBLE**

*FOR EXAMPLE, BETTER*

# SAFE-GARD Pipets

Better because . . . you get color coding for rapid, errorless sorting, plus SAFE-GARD® tip for protection and long life — all at no extra cost. Pipets also resist fogging and etching.



OWENS-ILLINOIS
maker of Kimble Products
Toledo 1, Ohio

**Medicine and Surgery**, Iowa City, Iowa. (Dean, State Univ. of Iowa College of Medicine, Iowa City 52241)

*4–5.* **American Rheumatism Assoc.**, annual, Washington, D.C. (J. A. Coss, Jr., 20 E. 76 St., New York 10021)

*4–5.* **American Rheumatism Assoc.**, 11th interim scientific session, National Institutes of Health, Bethesda, Md. (G. W. Speyer, ARA, 10 Columbus Circle, New York 10019)

*4–5.* Association for Research in **Nervous and Mental Diseases**, New York, N.Y. (R. J. Masselink, ARNMD, 700 W. 168 St., New York 10022)

*4–5.* **Oxygen in Biosystems**, basic science symp., New York, N.Y. (Miss J. Newkirk, New York Heart Assoc., 10 Columbus Circle, New York 10019)

*4–5.* **Oxygen**, symp., New York, N.Y. (A. P. Fishman, New York Heart Assoc., 10 Columbus Circle, New York 10019)

*4–5.* Southern Soc. for **Pediatric Research**, Houston, Tex. (F. K. Edwards, Emory Univ. School of Medicine, Thomas K. Glenn Memorial Bldg., 69 Butler St., Atlanta, Ga. 30303)

*4–6.* American **Psychoanalytic** Assoc., fall meeting, New York, N.Y. (APA, 1 E. 57 St., New York 10022)

*4–9.* American Acad. of **Dermatology**, Chicago, Ill. (S. E. Huff, AAD, 636 Church St., Evanston, Ill.)

*5–6.* Academy of **Psychoanalysis**, mid-winter meeting, New York, N.Y. (A. H. Rifkin, AP, 125 E. 65 St., New York 10021)

*6.* American Acad. of **Dental Medicine**, mid-annual meeting, New York, N.Y. (S. C. Conrad, 133-28 228th Street, Laurelton, L.I.)

*6–10.* American Inst. of **Chemical Engineers**, annual, Boston, Mass. (J. Henry, AIChE, 345 E. 47 St., New York 10017)

*6–12.* Latin American Congr. on **Microbiology**, 3rd, Bogota, Columbia. (O. Juliao, Instituto Nacional de Salud, Aptdo, Aereo 3495, Bogota)

*7.* American Institute of **Mining, Metallurgical and Petroleum Engineers**, annual, Tucson, Ariz. (H. N. Appleton, AIME, 345 E. 47 St., New York 10017)

*7–9.* Performance of **High Temperature Systems**, Pasadena, Calif. (G. S. Bahn, 16902 Bollinger Dr., Pacific Palisades, Calif. 90272)

*7–9.* Southern **Surgical** Assoc., meeting, Hot Springs, Va. (G. H. Yeager, University Hospital, Baltimore 1, Md.)

*7–11.* Chemical Effects Associated with **Nuclear Reactions and Radioactive Transformations**, symp., Vienna, Austria. (P. Ghelardoni, Div. of Scientific and Technical Information, International Atomic Energy Agency, Karntnerring 11, Vienna 1)

*8–9.* Ciba Foundation Guest Symposium on **Measurement of Oxygen Tension**, London, England. (Ciba, 41 Portland Pl., London, W.1)

*8–11.* American Soc. of **Agricultural Engineers**, New Orleans, La. (J. L. Butt, ASAE, 420 Main St., St. Joseph, Mich.)

*9–11.* **Antiviral Substances**, conf., New York Acad. of Sciences, New York, N.Y. (B. K. Forscher, Publications Section, Mayo Clinic, Rochester, Minn.)

*12–15.* American Acad. of **Optometry**, annual, Columbus, Ohio. (C. C. Koch,

AAO, 1506-08 Foshay Tower, Minneapolis 2, Minn.)

*14–16.* **Hahnemann Medical College**, 13th symp., Philadelphia, Pa. (J. H. Moyer, Dept. of Medicine, Hahnemann Medical College, Philadelphia)

*14–16.* **Reticuloendothelial** Soc., meeting, New York, N.Y. (N. R. Di Luzio, Univ. of Tennessee Medical Units, Memphis)

*14–17.* **Adipose Tissue Metabolism and Obesity**, conf., New York, N.Y. (B. N. Brodoff, New York Acad. of Sciences, 2 E. 63 St., New York)

*14–18.* Conference on **Nuclear Electronics**, Bombay, India. (International Atomic Energy Agency, Karntnerring 11, Vienna 1, Austria)

*14–22.* **International Geological Congr.**, 22nd, New Delhi, India. (Secretary-General of the Congress, c/o Geological Survey of India, 27, Chowringhee, Calcutta 13)

*14–22.* International **Mineralogical** Assoc., 4th general, New Delhi, India. (J. V. Smith, c/o Dept. of Geophysical Sciences, University of Chicago, Chicago, Ill.)

*15–16.* **Periodic Functions in Live Matter**, Czechoslovak Meteorological Soc., conf., Prague. (J. Novak, First "Prof. Konopik" Dermatology Clinic, Prague 2, Apolinarska 4)

*15–18.* **High Energy Astronomy**, symp., Univ. of Texas, Austin. (Office of Aerospace Research, 4th and Independence Avenue, SW, Washington, D.C. 20233)

*15-18.* **Relativistic Astrophysics**, symp., Univ. of Texas and Southwestern Center for Advanced Studies, Austin. (Mrs. J. Wardlaw, Dept. of Physics, Physics Bldg. 438, Univ. of Texas, Austin 78712)

*16–21.* Inter-American Congr. of **Psychology**, 9th annual, Miami, Fla. (V. D. Sanua, Yeshiva Univ., 110 W. 57 St., New York 10019)

*20–24.* **Theoretical and Applied Mechanics**, congr., Kanpur, India. (M. K. Jain, Indian Inst. of Technology, Kharagpur, India)

*21–23.* American **Physical** Soc., Berkeley, Calif. (W. Whaling, California Inst. of Technology, 1201 East California St., Pasadena)

*21–23.* **Biology of Marine Microorganisms**, conf., Univ. of California, Berkeley. (R. Newton, Letters and Science Extension, Univ. of California, Berkeley 94720)

*26–29.* Society of **Systematic Zoology**/ American Soc. Zoologists/Herpetologists' League, annual, Univ. of Tennessee,, Knoxville. (J. G. Rozen, Jr., Dept. of Entomology, SSZ, American Museum Natural History, Central Park West and 79th St., New York, N.Y.; A. G. Richards, ASZ, Dept. of Entomology, Univ. of Minnesota, St. Paul 55101; J. M. Legler, HL, Dept. of Zoology, Univ. of Utah, Salt Lake City)

*26–31.* **American Assoc. for the Advancement of Science**, annual, Montreal, Canada. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

---

The following 45 organizations will meet in conjunction with the AAAS annual meeting in Montreal, Canada, 26–31 December:

**Academy Conference** (J. T. Self, Dept.

of Zoology, Univ. of Montreal, Montreal)

**Academy of Psychoanalysis** (M. Ullman, Maimonides Hospital, 4802 Tenth Ave., Brooklyn 19, N.Y.)

**Alpha Epsilon Delta** (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y. 10708)

**AAAS Commission on Science Education** (J. R. Mayor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

**American Astronautical Soc.** (E. van Dreist, Director, Space Science Laboratory, North American Aviation, Downy, Calif.)

**American Astronomical Soc.** (G. C. McVittie, Univ. of Illinois Observatory, Urbana)

**American Economic Association** (H. E. English, Private Planning Assoc., 712 Sun Life Bldg., Montreal 2)

**American Meteorological Soc.** (K. C. Spengler, AMS, 45 Beacon St., Boston, Mass.)

**American Nature Study Soc.** (V. Rockcastle, Cornell Univ., Ithaca, N.Y.)

**American Soc. of Naturalists** (S. Granick, Rockefeller Inst., 66th St. and York Ave., New York 10021)

**American Political Science Assoc.** (E. B. Skolnikoff, Massachusetts Inst. of Technology, Cambridge)

**American Soc. of Criminology** (W. C. Reckless, Dept. of Sociology, Ohio State Univ., Columbus)

**American Soc. for Microbiology** (S. J. Ajl, Director of Research, Albert Einstein Medical Center, York and Tabor Rds., Philadelphia 41, Pa.)

**American Soc. of Zoologists**, Animal Behavior and Sociobiology Div. (G. W. Barlow, Vivarium Bldg., Wright and Healey Sts., Univ. of Illinois, Champaign)

**American Sociological Assoc.** (W. E. Moore, Russell Sage Foundation, 230 Park Ave., New York, N.Y.)

**Animal Behavior Soc.** (J. P. Scott, Jackson Laboratory, Hamilton Station, Bar Harbor, Maine)

**Association canadienne-française pour l'Avancement des Sciences** (M. J. Beauregard, ACFAS, C.P. 6128, Univ. of Montreal, Montreal)

**Association for Computing Machinery** (M. Woodbury, New York Univ. Medical Center, New York, N.Y.)

**Biometric Soc.** (D. S. Robson, Cornell Univ., Ithaca, N.Y.)

**Canadian Aeronautics & Space Inst.** (H. C. Luttman, CASI, 77 Metcalf St., Ottawa 4)

**Canadian Assoc. of Geographers** (J. T. Parry, Morrice Hall, McGill Univ., Montreal)

**Canadian Assoc. of Physicists** (A. C. H. Hallett, Dept. of Physics, Univ. of Toronto, Toronto 5)

**Canadian Science Fairs Council** (H. I. Bolker, Pulp & Paper Research Inst. of Canada, 3420 University St., Montreal 2)

**Ecological Soc. of America** (G. M. Woodwell, Brookhaven Natl. Laboratory, Upton, L.I., N.Y.)

**Engineering Institute of Canada** (G. T. Page, EIC, 2050 Mansfield St., Montreal 2)

**Entomological Soc. of Canada** (I. S. Lindsay, Defence Research Board, 125 Elgin St., Ottawa)

**General Systems Knowledge** (O. Wing,

Columbia Univ., Dept. of Electrical Engineering, New York 10027)

**History of Science Soc.** (J. E. Murdoch, Harvard Univ., Cambridge, Mass.)

**Institute of Management Sciences** (B. V. Dean, Dept. of Management, Case Inst. of Technology, Cleveland, Ohio)

**Medical Geology and Geography** (H. V. Warren, Dept. of Geology, Univ. of British Columbia, Vancouver 8, B.C.)

**Metric Assoc.** (R. P. Fischelis, Ohio Northern Univ., Ada)

**National Assoc. of Biology Teachers** (R. Beidleman, Colorado College, Colorado Springs)

**National Assoc. of Science Writers** (L. S. Zahn, Hill & Knowlton, Inc., 150 E. 42 St., New York, N.Y.)

**National Council of Teachers of Mathematics** (J. Gates, NCTM, 1201 16th St, NW, Washington, D.C.)

**National Geographic Soc.** (R. W. Gray, NGS, 16th and M Sts., NW, Washington, D.C.)

**National Inst. of Social and Behavioral Science** (D. P. Ray, NISBS, 863 Benjamin Franklin Station, Washington, D.C.)

**National Science Teachers Assoc.** (A. F. Eiss, NSTA, 1201 16th St., NW, Washington, D.C. 20006)

**Pharmacological Soc. of Canada** (C. W. Nash, Dept. of Pharmacology, Univ. of Alberta, Edmonton)

**Sigma Delta Epsilon** (S. C. Stevens, VA Hospital, Lincoln, Neb.)

**Society for Computer Programs in Biology and Medicine** (R. S. Ledley, Natl. Biomedical Research Foundation, 8600 16th St, NW, Silver Spring, Md.)

**Society for Economic Botany** (Q. Jones, New Crops Research Branch, Plant Industry Station, Beltsville, Md.)

**Society for General Systems Research** (J. H. Milsum, Dept. of Electrical Engineering, McGill Univ., Montreal)

**Society for the History of Technology** (J. J. Beer, Dept. of History, Univ. of Delaware, Newark)

**Society of the Sigma XI** (T. T. Holme, Sigma XI, 51 Prospect St., New Haven, Conn. 06511)

**Society of Technical Writers and Publishers** (G. Marx, Director of Communications, Illinois Inst. of Technology, Research Inst., Chicago)

---

*27–29.* American **Philosophical** Assoc., Boston, Mass. (L. E. Hahn, Dept. of Philosophy, Southern Illinois Univ., Carbondale, Ill. 62903)

*27–30.* American **Statistical** Assoc., Chicago, Ill. (D. C. Riley, ASA, 810 18th St., NW, Washington, D.C. 20006)

*28–30.* American **Economic** Assoc., annual, Chicago, Ill. (H. F. Williamson, AEA, 629 Noyes St., Evanston, Ill.)

*28–30.* American **Geophysical** Union, Seattle, Wash. (W. W. Kellogg, Rand Corp, 1700 Main St., Santa Monica, Calif.)

*28–30.* **Linguistic** Soc. of America, New York, N.Y. (A. A. Hill, Box 8120, University Station, Austin, Tex. 79712)

*28–30.* Western Soc. of **Naturalists**, Univ. of Washington, Seattle. (I. A. Abbott, Hopkins Marine Station of Stanford Univ., Pacific Grove, Calif.)

*30.* **Scientific Research** Soc. of America, Cleveland, Ohio. (D. B. Prentice, 51 Prospect St., New Haven 11, Conn.)

**January**

*5–7.* **Glass Formation, Phase Equilibria, Nucleation and Crystal Growth**, symp., Sheffield, England. (D. Hawksworth, Soc. of Glass Technology, Thorton, 20 Hallam Gate Rd., Sheffield 10)

*5–8.* **Solid State Physics**, 2nd annual conf., H. H. Wills Physics Laboratory, University of Bristol, England. (Administrative Assistant, Inst. of Physics and Physical Soc., 47, Belgrave Square, London, S.W.1)

*6–8.* **Industrial Electronics and Control Instrumentation**, 13th annual conf., Philadelphia, Pa. (E. Weiss, Sun Oil Co., Marcus Hook, Pa.)

*6–9.* **Psychopharmacological** Conf., Czechoslovak Medical Soc., Psychiatry Section, Jesenik Spa. (M. Vojtechovsky, Budejovicka 800, Pavilion A1, Prague, Czechoslovakia)

*8–9.* **Orthopaedic** Research Society, New York, N.Y. (R. A. Calandruccio, 869 Madison Ave., Memphis, Tenn.)

*9–14.* American Acad. of **Orthopedic Surgeons**, annual, New York, N.Y. (H. K. Hart, AAOS, 29 E. Madison, Chicago 2, Ill.)

*11–14.* **Civilian and Military Uses of Aerospace**, conf., New York, N.Y. (I. B. Laskowitz, New York Acad. of Sciences, 2 E. 63 St., New York)

*12–14.* **Reliability and Quality Control**, symp., Miami, Fla. (H. D. Hulme, Westinghouse R&D Center, Bldg. 601-1346, Churchill Boro, Pittsburgh, Pa.)

*12–15.* **Crustacea**, symp., Cochin, India. (Marine Biological Assoc. of India, Marine Fisheries P.O., Mandapam Camp, S. India)

*14.* American **Genetic** Assoc., Washington, D.C. (W. R. Singleton, Biology Bldg., Univ. of Virginia, Charlottesville)

*18–20.* **Solar Radiation Simulation**, intern. conf., Los Angeles, Calif. (H. F. Sander, Inst. of Environmental Science, 34 S. Main St., Mount Prospect, Ill.)

*19–20.* **Die Design and Press Tooling** Conf., American Soc. of Tool and Manufacturing Engineers, Hartford, Conn. (M. Zapico, Asst. Conf. Director, ASTME, 10700 Puritan Ave., Detroit 38, Mich.)

*20–22.* **Instrumentation**, College Station, Tex. (P. T. Eubank, Chemical Engineering Dept., Texas A&M Univ., College Station)

*20–23.* National Soc. of **Professional Engineers**, New Orleans, La. (P. H. Robbins, 2029 K St., NW, Washington, D.C. 20006)

*22.* **Bibliographical** Soc. of America, New York, N.Y. (Mrs. H. C. Ralph, P.O. Box 397, Grand Central Station, New York 10017)

*22–1.* **Earthquake Engineering**, 3rd world conf., Auckland and Wellington, New Zealand. (Administrative Secretary, Third World Conf. on Earthquake Engineering, P.O. Box 5180, Wellington)

*22–23.* **Blood**, annual symp., Detroit, Mich. (W. H. Seegers, Dept. of Physiology and Pharmacology, Wayne State Univ. College of Medicine, Detroit)

*25–26.* **Fundamental Phenomena in the Material Sciences**, 3rd annual symp., Boston, Mass. (D. B. Fay, Ilikon Corp., Natick Industrial Centre, Natick, Mass.)

*25–26.* **Viruses of Laboratory Rodents**, symp., Atlanta, Ga. (R. Holdenried, Natl. Cancer Inst., NIH, Bethesda, Md. 20014)

*25–27.* American Inst. of **Aeronautics and Astronautics**, New York, N.Y. (J. Bidwell, AIAA, 1290 Avenue of the Americas, New York 10019)

*25–28.* American **Meteorological** Soc., annual, New York, N.Y. (K. Spengler, AMS, 45 Beacon St., Boston 8, Mass.)

*25–28.* American Society of **Heating, Refrigerating and Air-Conditioning Engineers**, Chicago, Ill. (R. C. Cross, 345 E. 47 St., New York 10017)

*25–28.* Modern Methods of **Analytical Chemistry**, 18th annual intern. symp., Baton Rouge, La. (P. W. West, Dept. of Chemistry, Louisiana State Univ., Baton Rouge)

*25–28.* **Cardiovascular Diseases**, 2nd natl. conf., Washington, D.C. (C. H. Maxwell, 9650 Wisconsin Ave., NW, Washington, D.C. 20014)

*25–29.* American **Mathematical** Soc., Denver, Colo. (G. L. Walker, AMS, 190 Hope St., Providence, R.I.)

*25–29.* American Soc. for **Testing and Materials**, steel meeting, Mexico City, Mexico. (H. H. Hamilton, Public Relations, ASTM, 1916 Race St., Philadelphia, Pa. 19103)

*25–30.* American **Library** Assoc., Washington, D.C. (D. H. Clift, ALA, 50 E. Huron St., Chicago, Ill.)

*27–30.* American **Physical** Soc., New York, N.Y. (K. K. Darrow, Pupin Physics Laboratory, Columbia Univ., New York 10027)

*27–30.* **Electrochemistry**, 5th seminar, Karaikudi-3, South India. (M. A. V. Devanathan, Central Electrochemical Research Institute, Karaikudi-3, South India)

*27–30.* **Geological** Soc., Southwestern Federation, Austin, Tex. (S. P. Ellison, Jr., Department of Geology, Univ. of Texas, Austin)

*27–31.* **Neurosurgical** Soc. of America, San Juan, Puerto Rico. (C. H. Davis, Jr., Bowman Gray School of Medicine, Winston-Salem, N.C.)

*28–30.* American **Geophysical** Union, southwest regional, Socorro, N.M. (J. B. Franzini, Civil Engineering Dept., Stanford Univ., Stanford, Calif.)

*28–30.* International **Medical** Assembly of Southwest Texas, San Antonio. (S. E. Cockrell, Jr., 202 W. French Pl., San Antonio 12)

*28–30.* **Large-Scale Air-Sea Interaction**, symp., Bombay, India. (UNESCO, Office of Oceanography, Pl. de Fontenoy, Paris 7e, France)

*28–30.* **Mathematical** Assoc. of America and American Mathematics Soc., Denver, Colo. (H. M. Gehman, MAA, Univ. of Buffalo, Buffalo 14, N.Y.)

*29–31.* Southern **Radiological** Conf., Point Clear, Ala. (M. Eskridge, P.O. Box 4097, Mobile, Ala.)

*31–2.* Institute of **Electrical and Electronics** Engineers, New York, N.Y. (C. A. Woodrow, c/o General Electric Co., 1 River Rd., Schenectady 5, N.Y.)

*31–5.* Institute of **Electrical and Electronics** Engineers, New York, N.Y. (E. C. Day, IEEE, Box A, Lenox Hill Station, New York 10021)

*31–6.* International Festival of the **Scientific Film**, Brussels, Belgium. (Cercle des Sciences, Université Libre de Bruxelles, 22 avenue Paul Heger, Brussels, 5)

# New Products

**Bench-top fermentor,** 24 by 21 by 29½ inches, eliminates the conventional water bath by circulating temperature-regulated water through hollow baffles from an integral recirculating system. This baffle system which fits inside the fermentor vessel is a single four-tube assembly with tubes for water circulation and one for oxygenation. A single instrument accepts four interchangeable vessels of 2, 5, 7½, and 14 liters, all of which are designed for repeated sterilizations in a 20-inch autoclave. A thermistor controller maintains temperature of the culture medium within a range from 5°C above water supply temperature to 60°C. Control tolerance and temperature gradient are both maintained within ±0.25°C. Close thermal regulation is achieved by the electronic controller which energizes an in-line immersion heater or a cold-water-feed solenoid valve. Automatic circulation of cold water through the baffles overcomes the temperature influences of impeller friction, exothermic reactions, and the high-intensity lights used in photosynthetic investigations. A lock-in control knob prevents accidental change in the temperature setting. Smooth, reproducible agitation is attained by an electronically controlled drive mechanism which delivers full power, regardless of line voltage fluctuations and changes in viscosity of the culture medium. The fermentor's design is ideal for irradiating cultures with intense illumination for photosynthetic studies of algae and photosynthetic bacteria. Semicircular light manifolds are available with removable fluorescent or neon lamps. The plug-in manifold is readily installed directly behind the fermentor vessel to provide uniform illumination over a wide area. A variable transformer can be furnished to regulate light intensity. For automatic control of light and dark cycles, a special electronic programer can be supplied. The fermentor can be adapted to individual requirements by adding available accessories, which include: automatic *p*H controller with autoclavable electrodes, automatic foam control system, a strip chart temperature recorder, sintered disc sparger and ring sparger, stainless-steel fermentor jar with subsurface viewing window, variable-pitch impellers, and overhead and submersible ultraviolet light.—D.J.P. (New Brunswick Scientific Co., Inc., Box 606, New Brunswick, N.J.)

**Circle 1 on Readers' Service card**

**Laboratory glassware** partially coated with conductive and semiconductive films provides rapid and uniform electrical heating of contents. Heat is supplied through an electrical heating element which clamps onto a groove in the side of the piece of glassware. The conductive films, fused to the surface of the vessel, conduct the heat from this element over the surface in such a way as to eliminate uneven heating and "bumping." Various sizes of beakers, flasks, funnels, a chromatographic column, and other standard items are available with coatings suitable for 200°C operation; 360°C coatings are available on special order. The contact clamps are spring brass double-contact types molded into epoxy resin handles which can be safely handled with the current on. Several sizes of clamps are offered, depending on the size of the individual vessel to be used. Power to the clamp is provided by a power supply consisting of a double-wound transformer with multiple-tapped secondary. Eleven steps of 3 and 4 volts supply voltages from 3 to 34 volts, with currents up to 7 amp, continuous duty, possible. The 11-position tap switch is on the top of the supply; the power switch, indicator light, 0- to 10-amp meter, and power receptacle are on the front panel. For flasks of 50 ml and smaller, an additional autotransformer is required. This new laboratory equipment is said to provide superior temperature regulation, more rapid heating, quick response to changes in control setting, easier handling, and longer glass life.—D.J.P. (Ace Glass Inc., Vineland, N.J.)

**Circle 2 on Readers' Service card**

**Expanded scale pH meter** is a direct-reading, line-operated, pushbutton-controlled instrument designed to provide accurate *p*H and millivolt determinations. In addition, this meter can be the readout element of a modular, electrochemical-potential measurement system. Used with the proper accessory, it can measure specific ions (such as $Na^+$, $Cl^-$, $Li^+$, $NH_4^+$, $K^+$, and $Ag^+$), blood *p*H, gaseous oxygen, dissolved oxygen and carbon dioxide in blood, oxidation-reduction potentials, and end-point determinations in Karl Fischer and other electrometric titrations. The large, direct-reading meter has taut-band suspension and an 8.2-inch scale length. The meter has three scales for readout: a standard 0 to 14 *p*H (and ± 1400 mv) scale; an expanded scale for greater sensitivity; and a 2-decade logarithmic scale that relates *p*H to hydrogen-ion activity. The expanded scale of the Beckman Expandomatic displays any two *p*H units, 200 mv, or 200 mm of partial pressure (for oxygen determinations) full scale, with readability to the nearest 0.002 *p*H. The scale is divided into 200 increments, each of which corresponds to 0.01 *p*H, 1 mv, or 1 mm of partial pressure. The front panel of this instrument has dial controls for *p*H standardization and temperature compensation (0° to 100°C) and pushbutton controls for selecting meter function. Optional scale expansion accessories offer the operator additional readout versatility. A range selector accessory makes it possible to expand any 4, 2, 1, or 0.5 *p*H units (or equivalent millivolts) full scale, with temperature compensation over the 0° to 100°C sample temperature range. Simple, plug-in 1-*p*H scale expansion accessories are also available to expand any 1-*p*H unit full scale at fixed temperatures. It is unnecessary to restandardize the instrument when switching from one range to another so long as the span (for example, 1-*p*H unit full scale) remains

---

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 pages 705 and 835. Circle the department number of the items in which you are interested on this card.

the same. Accuracy with scale expansion can be as good as ± 0.003 *p*H, compared to ± 0.05 *p*H with the standard scale. Repeatability is ± 0.001 *p*H compared to ± 0.015 *p*H.—D.J.P. (Beckman, Scientific and Process Instruments Div., 2500 Harbor Blvd., Fullerton, Calif. 92634)

**Circle 3 on Readers' Service card**

**Bacteria colony counter** provides a convenient method of making marks and simultaneously counting the total number of marks made. The Markounter is a device for holding a pen or pencil, which, when used to make a mark, operates an internal micro-switch. Operation of the switch produces one or more digital readouts which can be set to zero at the end of each count or left for addition to later counts. The device utilizes the mechanical advantage of the lever to actuate the micro-switch with a minimum of marking force. Maximum counting speed is about ten per second, and the switch can control 5 amp at 230 volts a-c. In addition to colony counting, other applications requiring rapid, convenient counting can be handled by this simple device. The counter and a digital display unit are available separately or together.—D.J.P. (Scientifica, 148 St. Dunstan's Ave., Acton, London, W.3., England)

**Circle 4 on Readers' Service card**

**Automatic radiochromatogram scanner** records the exact location and intensity of separated low-energy beta emitters on paper strips and glass plates used in thin-layer chromatography (TLC) as well as emitters of higher energy used in thick gel applications. Up to 100 ft of assembled strips can be loaded onto spools whose width can be adjusted to accept chromatograms up to 1½ inches wide. Both sides are counted simultaneously as the paper strip passes vertically between two gas-flow detectors made of oxygen-free copper. For standard operations, windowless detectors are used. However, ultrathin windows (less than 100 $\mu g/cm^2$) or mylar windows (0.9 $mg/cm^2$) are available on request. Where beta energies are high enough, the use of windows helps reduce gas consumption. A choice of four collimators (1.5, 3, 4.5 and 6 mm) may be used. The specially designed detectors have a high sensitivity and a small volume which reduces the background. For paper strip counting, the background is lowered further by a lead shield which

completely surrounds the detectors. Half of the upper shield swivels on a hinge to give unobstructed access to the paper strip and detectors. Background is 12 to 14 count/min. Model RSC-363 has three gas-flow detectors. Two are used in the paper strip mode while the third is for thick gels and TLC. A front-panel control enables the operator to switch the flow of geiger gas from the paper system to the gel/TLC system. However, only one gas inlet is required for all operations. Gas input and output flow meters regulate the flow of geiger gas and help detect gas leaks. Efficiency for paper strips is 1 to 2 percent for tritium and 5 to 10 percent for carbon-14. The instrument also includes provision for counting thick gels and glass plates used in thin-layer chromatography. It accepts plates 2 inches wide and up to 32 inches long with a maximum thickness of ¼ inch. The plates or gels are placed in a gear-driven tray and pass under a shielded, 2-pi OFC detector in the rear of the scanner. A vernier dial permits an infinite selection of collimation widths from 0 to 12 mm. The detector has a special ultrathin window less than 100 $\mu g/cm^2$. For higher energies, mylar windows are available on request. Efficiency for TLC/gels is 10 percent for carbon-14. The Deluxe Scanner includes an automatic event marker and an automatic gas and power shut-off circuit. A special pen in the recorder makes an impression whenever a solvent front, leading or trailing edge, passes the detector. When the last strip or plate has been scanned, the gas and a-c power are turned off automatically. A single channel, rectilinear galvanometric recorder drives the scanner by direct coupling in the same gear ratio. The resulting graph represents an exact picture of the location and intensity of activity on the chromatogram. A simple rotary switch instantly selects any one of ten chart speeds: ½, 1, 2, 4, or 8 inches per minute or per hour. The rate meter, which is suitable for other laboratory applications, provides seven linear ranges from 0 to 100,000 count/min and seven time constants from 0.3 to 300 seconds. Recorder output is 0 to 1 ma, 0 to 100 mv. Accuracy of the rate meter is better than 2 percent on all ranges. The complete Deluxe Scanner weighs 200 lb. A model is available without the provisions for gels and TLC.—D.J.P. (Atomic Accessories, Inc., 811 West Merrick Rd., Valley Stream, N.Y.)

**Circle 5 on Readers' Service card**

## NEW BOOKS

*(Continued from page 761)*

**Applications of NMR Spectroscopy in Organic Chemistry: Illustrations from the Steroid Field.** Norman S. Bhacca and Dudley H. Williams. Holden-Day, San Francisco, Calif., 1964. 208 pp. Illus. $7.95.

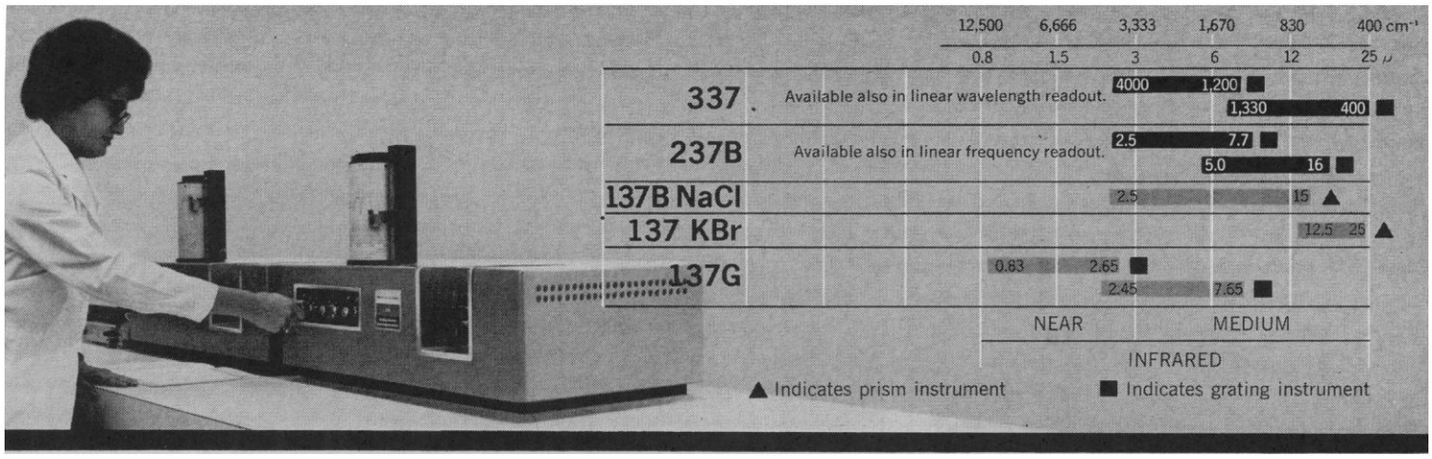
**Arctic Communications.** Proceedings, 8th meeting, AGARD Ionospheric Research Committee (Athens, Greece), July 1963. B. Landmark, Ed. Published for North Atlantic Treaty Organization by Pergamon, London; Macmillan, New York, 1964. 307 pp. Illus. $15. 25 papers.

**Aspects of Theoretical Mineralogy in the U.S.S.R.** M. H. Battey and S. I. Tomkeieff, Eds. Translated from the Russian. Pergamon, London; Macmillan, New York, 1964. 515 pp. Illus. $30. Thirty-five papers on the definition and classification of minerals, the classification of individual groups of minerals, and the correlation of the properties of minerals with their crystal chemistry.

**Astronomy Highlights.** *Apollo and the Moon*, Franklyn M. Branley (32 pp.); *Birth and Death of the Stars*, Kenneth L. Franklin (32 pp.); *Captives of the Sun: The Story of the Planets*, James S. Pickering (32 pp.); *Design of the Universe*, S. I. Gale (32 pp.); *Man in Space*, Fred C. Hess (32 pp.); *Space Age Astronomy*, Kenneth L. Franklin (32 pp.); *The Sun in Action*, Thomas D. Nicholson (32 pp.); *Time and the Stars*, Joseph M. Chamberlain (32 pp.). Published for the American Museum–Hayden Planetarium by the Natural History Press, Garden City, N.Y., 1964. Illus. Paper, 50¢ each. Popularizations based on lectures given at the Hayden Planetarium. They are intended for junior high school and high school students as well as laymen.

**Asymptotic Solutions of Differential Equations and Their Applications.** Proceedings of a symposium (Madison, Wis.), May 1964. Calvin H. Wilcox, Ed. Wiley, New York, 1964. 259 pp. Illus. $4.95. Ten papers presented at a symposium sponsored by the Mathematics Research Center, U.S. Army, at the University of Wisconsin. Papers: "Asymptotic expansions for ordinary differential equations: Trends and problems" by Wolfgang Wasow; "Solvable related equations pertaining to turning point problems" by Hugh L. Turrittin; "Asymptotic methods for the solution of dispersive hyperbolic equations" by Robert M. Lewis; "Asymptotic solutions and indefinite boundary value problems" by Robert W. McKelvey; "Some examples of asymptotic problems in mathematical physics" by C. C. Lin; "On the problem of turning points for systems of linear ordinary differential equations of higher orders" by Yasutaka Sibuya; "Error bounds for asymptotic expansions, with an application to cylinder functions of large argument" by Frank W. J. Olver; "Asymptotic solutions of elastic shell problems" by Robert A. Clark; "The integral equations of asymptotic theory" by Arthur Erdélyi; and "Application of Langer's theory of turning points to diffraction problems" by Nicholas D. Kazarinoff.

**Atoms, Radiation, and Nuclei.** Thomas H. Osgood, Arthur E. Ruark. and



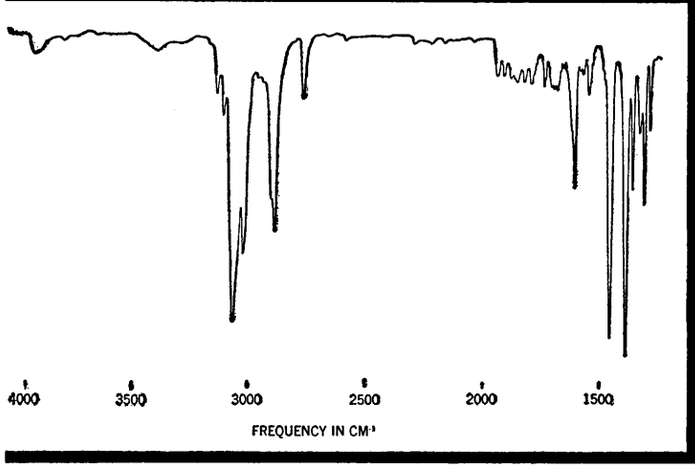

# TWO NEW LOW-COST SPECTROPHOTOMETERS USE VARIABLE SLIT PROGRAMMING TO PROVIDE A WIDE RANGE OF RESOLUTION AND ENERGY SCHEDULES

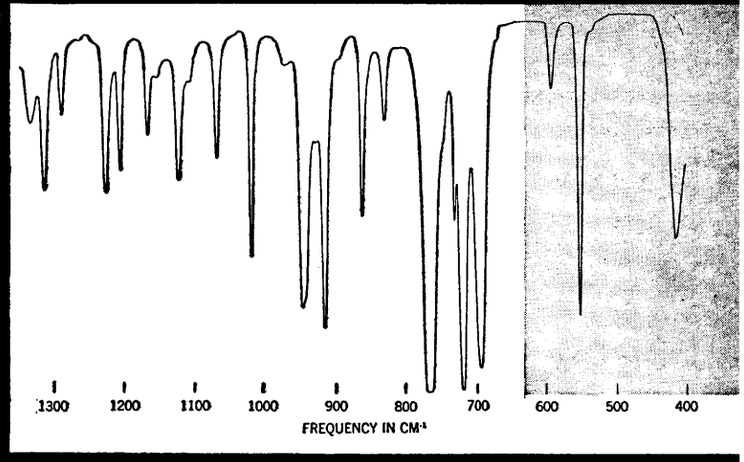
Perkin-Elmer's new low-cost infrared spectrophotometers, the Models 237B and 337, share outstanding new capabilities:

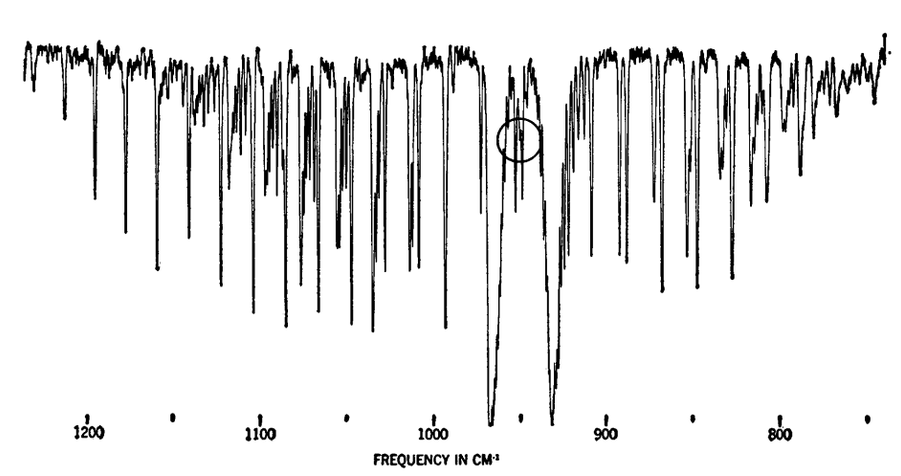
- three-minute scan option for reliable fast surveys;
- variable slit programming, to optimize spectral slit widths under varying requirements of sample, speed and resolution;
- external recorder attachment provisions, for abscissa expansion or compression, as required;
- dual-grating monochromator, for resolution better than that of many instruments costing twice as much.

The Model 237B covers the range from 4000 to 625 $cm^{-1}$, with a version available in linear wavelength. It is ideal if you normally operate in this fundamental region. The Model 337, also available in either linear frequency, or linear wavelength, scans from 4000 to 400 $cm^{-1}$. Both instruments cover their individual ranges in two serial scans, on convenient 8½" x 11" charts.

No matter what your choice, either the Model 237B or the Model 337 will provide all the performance you want at the lowest price available. For more information, write Instrument Marketing Division, Perkin-Elmer Corporation, 779 Main Avenue, Norwalk, Conn.




▲ Typical dual scan of indene, run in six minutes in the three-minute scan mode of the Model 337, demonstrates excellent definition possible even at this recording rate. Slit program was 6. Shaded area shows range added by the Model 337 to that of the Model 237B. In this region you gain access to carbon-bromine, carbon-iodine and carbon-chlorine vibrations, out-of-plane aromatic carbon-hydrogen bonds, and data on inorganic and metal-oxygen or metal-nitrogen bonds in complexes. Recent work also points to characteristic vibrations of ketones, aldehydes, acids and esters occurring in the 500 $cm^{-1}$ region.

◀ Ammonia scan from 1200 to 800 $cm^{-1}$ points out one wavenumber resolving power of Model 337, with abscissa expanded on auxiliary recorder.

PERKIN-ELMER

Elmer Hutchisson. Wiley, New York, ed. 3, 1964. 215 pp. Illus. Paper, $2.25.

**Automation of Continuous Production Processes**. V. L. Lossiyevskii and L. G. Pliskin. Translated from the Russian edition (Moscow, 1960) by R. P. Froom. D. K. Ghosh, Ed. Pergamon, London; Macmillan, New York, 1964. 126 pp. Illus. $6.50.

**Boron, Metallo-Boron Compounds, and Boranes**. Roy M. Adams, Ed. Interscience (Wiley), New York, 1964. 789 pp. Illus. $27.50.

**Crystal Structures**. vol. 2, *Inorganic Compounds* $RX_n$, $R_nMX_2$, $R_nMX_3$. Ralph W. G. Wyckoff. Interscience (Wiley), New York, ed. 2, 1964. 596 pp. Illus. $24.

**The Current Interpretation of Wave Mechanics**. A critical study. Louis de Broglie. Elsevier, New York, 1964. 104 pp. Illus. $6.

**Determination of Molecular Weights of High Polymers**. Ch'ien Jên-Yüan. Translated from the Russian edition (Moscow, 1962) by J. Schmorak. Israel Program for Scientific Translations, Jerusalem, 1963; Davey, New York, 1964. 160 pp. Illus. $7.95.

**Digital Differential Analysers**. A. V. Shileiko. Translated from the Russian edition (Moscow, 1961) by D. P. Barrett. A. D. Booth, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 117 pp. Illus. $6.50.

**Dispersion Relations and Their Connection with Causality**. Course 29, International School of Physics "Enrico Fermi." E. P. Wigner, Ed. Academic Press, New York, 1964. 274 pp. Illus. $12.

**Dynamics of Structures**. Walter C. Hurty and Moshe F. Rubinstein. Prentice-Hall, Englewood Cliffs, N.J., 1964. 473 pp. Illus. $16.

**Electromagnetism for Engineers**. An introductory course. P. Hammond. Pergamon, London; Macmillan, New York, 1964. 223 pp. Illus. $5.

**Elementary General Topology**. Theral O. Moore. Prentice-Hall, Englewood Cliffs, N.J., 1964. 186 pp. Illus. $7.95.

**Elementary Particle Physics**. Gunnar Källén. Addison-Wesley, Reading, Mass., 1964. 560 pp. Illus. $15.

**Energetics of Propellant Chemistry**. Bernard Siegel and Leroy Schieler. Wiley, New York, 1964. 254 pp. Illus. $10.

**First Course in Mathematical Logic**. Patrick Suppes and Shirley Hill. Blaisdell (Ginn), New York, 1964. 286 pp. Illus. $6.50.

**Functional Analysis**. Albert Wilansky. Blaisdell (Ginn), New York, 1964. 299 pp. Illus. $9.50.

**Geochronology in Canada**. F. Fitz Osborne, Ed. Published in cooperation with the Royal Society of Canada by the Univ. of Toronto Press, Toronto, 1964. 166 pp. Illus. $5.95.

**Geology of Erie County, New York**. Edward J. Buehler and Irving H. Tesmer. Buffalo Soc. of Natural Sciences, Buffalo, N.Y., 1963. 126 pp. Illus. Map. Paper, $4.

**The Groups of Order 2″ ($n \leq 6$)**. Marshall Hall, Jr., and James K. Senior. Macmillan, New York, 1964. Unpaged. Illus. Paper, $15.

**Introduction to Phase Transformations**

**in Condensed Systems**. Morris E. Fine. Macmillan, New York, 1964. 143 pp. Illus. Paper, $3.40.

**Introduction to Probability and Statistics**. Henry L. Alder and Edward B. Roessler. Freeman, San Francisco, Calif., ed. 3, 1964. 327 pp. Illus. $6.

**Introduction to Properties of Materials**. Daniel Rosenthal. Van Nostrand, Princeton, N.J., 1964. 381 pp. Illus. $7.95.

**Isotopic and Cosmic Chemistry**. H. Craig, S. L. Miller, and G. J. Wasserburg, Eds. North-Holland, Amsterdam, 1964. 579 pp. Illus. $15.

**Laboratory Physics**. pt. A. Berkeley Physics Laboratory. Alan M. Portis, Ed. McGraw-Hill, New York, 1964. 127 pp. Illus. Paper, $2.25.

**Lectures in Theoretical Physics**. vol. 6. Lectures delivered at the Summer Institute, Boulder, Colo., in 1963. Wesley E. Brittin and Willard R. Chappell, Eds. Univ. of Colorado Press, Boulder, 1964. 526 pp. Illus. Paper, $7. Eleven lectures: "The higher order virial equations and their applications to the equilibrium and stability of rotating configurations" by S. Chandrasekhar; "Rigorous results in statistical mechanics" by D. Ruelle; "Consequences of a fundamental length in very high energy scattering" by R. L. Ingraham; "Group theoretical properties of complex angular momenta" by Enrico Beltrametti; "Remarks on the $|\Delta I| = \frac{1}{2}$ rule in weak interactions" by Jean Nuyts; "Some aspects of the liquid helium problem" by W. E. Parry; "Selected topics in modern theoretical physics" by H. Y. Chiu; "Theory of superfluids" by J. G. Valatin; "Recent progress in potential scattering theories" by Tullio Regge; "Nuclear and neutrino processes in stars and supernovae" by William A. Fowler and Joseph L. Vogl; and "The method of complex angular momenta in relativistic quantum theory" by Peter G. O. Freund.

**Lectures on Magnetoionic Theory**. K. G. Budden. Gordon and Breach, New York, 1964. 96 pp. Illus. Paper, $1.95; cloth, $3.95.

**A Manual of Physical Methods in Organic Chemistry**. F. L. J. Sixma and Hans Wynberg. Wiley, New York, 1964. 356 pp. Illus. Paper, $8.75.

**Mathematics: The Study of Axiom Systems**. G. E. Witter. Blaisdell (Ginn), New York, 1964. 332 pp. Illus. $6.50.

**Matter and Energy**. The foundations of modern physics. James H. MacLachlan, K. G. McNeill, and John M. Bell. Noble and Noble, New York, 1964. 416 pp. Illus. $5.48.

**Methods of Real Analysis**. Richard R. Goldberg. Blaisdell (Ginn), New York, 1964. 373 pp. Illus. $9.50.

**The Microscopical Characters of Artificial Inorganic Solid Substances: Optical Properties of Artificial Minerals**. Alexander Newton Winchell and Horace Winchell. Academic Press, New York, ed. 2, 1964. 453 pp. Illus. $14.50.

**New Sources of Energy**. Proceedings, United Nations Conference (Rome), August 1961. vol. 2, pt. 1, *Geothermal Energy*. Jesús Ruiz Elizondo, Ed. United Nations, New York, 1964. 428 pp. Illus. Paper, $5. This volume contains papers,

most of which are summarized in both French and English, relating to the agenda item "Prospection of geothermal fields and investigations necessary to evaluate their capacity." The papers are presented in alphabetical order by the authors' names. Six additional volumes of proceedings papers have been announced.

**Partial Differential Equations: An Introduction**. Günter Hellwig. Blaisdell (Ginn), New York, 1964. 279 pp. Illus. $9.50.

**The Physical Chemistry and Mineralogy of Soils**. vol. 1, *Soil Materials*. C. Edmund Marshall. Wiley, New York, 1964. 398 pp. Illus. $12.

**Physics Laboratory Manual**. Edward B. Nelson. Brown, Dubuque, Iowa, ed. 2, 1964. 150 pp. Worksheets. Illus. Paper, $4.50.

**Physics of III-V Compounds**. Otfried Madelung. Translated from the German by Dietrich Meyerhofer. Wiley, New York, 1964. 425 pp. Illus. $13.

**Physics of the Air**. W. J. Humphreys. Dover, New York (reprint, 3rd edition, 1940), 1964. 692 pp. Illus. Paper, $3.

**Phytochemistry**. A symposium. Proceedings of a meeting (Hong Kong), September 1961. H. R. Arthur, Ed. Hong Kong Univ. Press, Hong Kong; Oxford Univ. Press, New York, 1964. 270 pp. Illus. $10. 46 papers on structural and biosynthetic relationship in plant products (5 reports); isolation, structure, and chemistry of plant products (32 reports); and survey reports (9 reports).

**Plutonium**. Mieczysław Taube. Translated from the Polish edition (Warsaw, 1964) by Eugeniusz Lepa and Zbigniew Nanowski. Pergamon, London; Macmillan, New York, 1964. 264 pp. Illus. $8.50.

**Principles of Physical Geography**. F. J. Monkhouse. Philosophical Library, New York, ed. 5, 1964. 537 pp. Illus. $10.

**Problems in Modern Mathematics**. S. M. Ulam. Wiley, New York, 1964 (reprint of 1960 edition). 168 pp. Illus. Paper, $1.95.

**Problems of Metal Fatigue**. V. I. Belyaev. Translated from the Russian edition (Minsk, 1962) by Ch. Nissenbaum. Israel Program for Scientific Translations, Jerusalem, 1963; Davey, New York, 1964. 84 pp. Illus. Paper, $3.95.

**Progress in Boron Chemistry**. vol. 1. H. Steinberg and A. L. McCloskey, Eds. Pergamon, London; Macmillan, New York, 1964. 495 pp. Illus. $20. Ten papers: "The chemistry of compounds which contain boron-boron bonds" by R. J. Brotherton; "Some aspects of the coordination chemistry of boron" by T. D. Coyle and F. G. A. Stone; "The structures of the boron hydrides" by George W. Campbell, Jr.; "Boron compounds in cancer therapy" by Albert H. Soloway; "Heteroaromatic boron compounds" by Michael J. S. Dewar; "Organoperoxyboranes" by Alwyn G. Davies; "Organoboron heterocycles" by Roland Köster; "The reactions of diazoalkanes with boron compounds" by C. E. H. Bawn and A. Ledwith; "The chemistry of boronic and borinic acids" by Kurt Torssell; and "Nuclear magnetic reso-

nance spectroscopy of boron compounds" by Riley Schaeffer.

**Projective and Related Geometries.** Harry Levy. Macmillan, New York, 1964. 415 pp. Illus. $11.

**Projective Geometry**. H. S. M. Coxeter. Blaisdell (Ginn), New York, 1964. 176 pp. Illus. $5.

**The Propagation of Electromagnetic Waves in Plasmas**. V. L. Ginzburg. Translated from the Russian edition (Moscow, 1960) by J. B. Sykes and R. J. Tayler. Pergamon, London; Addison-Wesley, Reading, Mass., 1964. 555 pp. Illus. $14.75.

**Research in Geophysics**. vol. 1, *Sun, Upper Atmosphere, and Space* (598 pp.); vol. 2, *Solid Earth and Interface Phenomena* (619 pp.). Hugh Odishaw, Ed. M.I.T. Press, Cambridge, Mass., 1964. Illus. $12.50 each.

**Scientific Uncertainty and Information**. Leon Brillouin. Academic Press, New York, 1964. 178 pp. Illus. $6.50.

**Selected Papers on the Theory of Thermal Convection**. With special application to the earth's planetary atmosphere. Barry Saltzman, Ed. Dover, New York, 1962. 471 pp. Illus. Paper, $3. Twenty-five papers selected from the writings of such men as Lord Rayleigh, H. Jeffreys, S. Chandrasekhar, H. von Helmholtz, and H. -L. Kuo.

**Size Effect in Wear and Fatigue of Steel**. D. A. Draigor and G. I. Val'chuk. F. P. Belyankin, Ed. Translated from the Russian edition (Kiev, 1962) by A. Wald. Israel Program for Scientific Translations, Jerusalem, 1963; Davey, New York, 1964. 93 pp. Illus. $3.95.

**Solar Plasma, Geomagnetism, and Aurora**. Sydney Chapman. Gordon and Breach, New York, 1964. 151 pp. Illus. Paper, $1.95; cloth, $4.95.

**Spectroscopy and Photochemistry of Uranyl Compounds**. Eugene Rabinowitch and R. Linn Belford. Pergamon, London; Macmillan, New York, 1964. 380 pp. Illus. $12.50.

**Structure Elucidation of Natural Products by Mass Spectrometry**. vol. 2, *Steroids, Terpenoids, Sugars, and Miscellaneous Classes*. Herbert Budzikiewicz, Carl Djerassi, and Dudley H. Williams. Holden-Day, San Francisco, Calif., 1964. 316 pp. Illus. $10.50.

**Synthetic Hetero-Chain Polyamides**. V. V. Korshak and T. M. Frunze. Translated from the Russian edition (Moscow, 1962) by N. Kaner. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 574 pp. Illus. $17.95.

**Tables for Emission Spectrographic Analysis of Rare Earth Elements**. Ch. Kerekes. L. Láng, Ed. Macmillan, New York, 1964. Unpaged. $15.

**Tables of the Principal Unitary Representations of Fedorov Groups**. D. K. Faddeyev. Translated from the Russian edition (Moscow, 1961) by Prasenjit Basu. Pergamon, London; Macmillan, New York, 1964. 181 pp. Illus. $10.

**The Theory of Dielectric Breakdown of Solids**. J. J. O'Dwyer. Oxford Univ. Press, New York, 1964. 151 pp. Illus. $7.20.

**Wood and Cellulose Science**. Alfred J. Stamm. Ronald, New York, 1964. 559 pp. Illus. $15.

## General

**Bibliography and Index of Geology Exclusive of North America.** vol. 27. Marie Siegrest, Mary C. Grier, and others. Geological Soc. of America, New York, 1964. 844 pp. Literature published during 1962 and titles for material which was published prior to 1962 but not cited in previous volumes of the bibliography are included.

**Bibliography of North American Geology, 1960** (*Geol. Surv. Bull. No. 1196*). James W. Clarke *et al.* U.S. Department of the Interior, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 781 pp. Paper, $2.25.

**The Birth of the Gods.** The origin of primitive beliefs. Guy E. Swanson. Univ. of Michigan Press, Ann Arbor, 1964 (reprint, 1960 edition). 272 pp. Paper, $1.95.

**The Columbia Encyclopedia.** William Bridgwater and Seymour Kurtz, Eds. Columbia Univ. Press, New York, ed. 3, 1963. 2400 pp. Illus. $49.50.

**Ethics and Science.** Henry Margenau. Van Nostrand, Princeton, N.J., 1964. 314 pp. Illus. $7.50.

**Evolution in Action.** Julian Huxley. New American Library, New York, 1964 (reprint, 1953 edition). 141 pp. Illus. Paper, 60¢.

**Existentialism and Education.** George F. Kneller. Wiley, New York, 1964 (reprint, 1958 edition). 186 pp. Paper, $1.45.

**Face of North America.** The natural history of a continent. Peter Farb. Harper and Row, New York, 1964. 270 pp. Illus. $3.95 (Young Readers' edition).

**Food for Man.** W. R. Aykroyd. Pergamon, London; Macmillan, New York, 1964. 103 pp. Illus. Paper, $2.45.

**Heredity and the Nature of Man.** Theodosius Dobzhansky. Harcourt, Brace and World, New York, 1964. 191 pp. Illus. $4.75.

**The History of Flight.** Alvin M. Josephy, Jr., and the Editors of *American Heritage*. Golden Press, New York, 1964. 105 pp. Illus. $3.95 (juvenile book).

**A History of Science.** Ancient science through the golden age of Greece. George Sarton. Wiley, New York, 1964 (reprint, 1952 edition). 672 pp. Illus. Paper, $2.65.

**Hypnotherapy.** A survey of the literature. Margaret Brenman and Merton M. Gill. Wiley, New York, 1964 (reprint, 1947 edition). 288 pp. Paper, $1.65.

**Illness and Cure.** Studies on the philosophy of medicine and mental health. Joost A. M. Meerloo. Grune and Stratton, New York, 1964. 288 pp. Illus. $8.75.

**The Machine in the Garden.** Technology and the pastoral ideal in America. Leo Marx. Oxford Univ. Press, New York, 1964. 402 pp. $6.75.

**Men of Ingenuity: From Beneath the Orange Tower, 1884–1964.** W. R. Woolrich, Associated Faculty, and Alumni. Engineering Foundation, Univ. of Texas, Austin, 1964. 286 pp. Illus. $5.75. A history of the University of Texas, College of Engineering.

**Military Information Systems.** The design of computer-aided systems for command. Edward Bennett, James Degan, and Joseph Spiegel, Eds. Praeger, New York, 1964. 192 pp. Illus. $5.

**Patents for Chemical Inventions.** Elmer J. Lawson and Edmund A. Godula, Eds. American Chemical Soc., Washington, D.C., 1964. 125 pp. $4. Eleven papers presented at symposia sponsored by the Division of Chemical Literature and the Division of Industrial and Engineering Chemistry at the 145th Meeting of the American Chemical Society (New York), September 1963.

**Preface to Philosophy.** H. P. Rickman. Schenkman, Cambridge, Mass., 1964. 221 pp. $4.95.

**Quanta and Reality.** A symposium. David Bohm, N. R. Hanson, Mary B. Hesse, Nicholas Kemmer, A. B. Pippard, and Maurice Pryce. World, Cleveland, 1964. 96 pp. Illus. Paper, $1.25.

**Radioisotopes and Radiation.** Recent advances in medicine, agriculture, and industry. John H. Lawrence, Bernard Manowitz, and Benjamin S. Loeb. McGraw-Hill, New York, 1964. 143 pp. Illus. $18.

**Report of the Commission on Drug Safety.** The Commission, Washington, D.C., 1964 (order from Federation of American Societies for Experimental Biology, Washington, D.C.). 238 pp. Illus. $5.

**Research, U.S.A.** Knowledge for the future. Albert V. Crewe and Joseph J. Katz. McGraw-Hill, New York, 1964. 229 pp. Illus. $18.

**Science Citation Index, 1964.** 2 vols. Prepared and published by the Inst. for Scientific Information, Philadelphia, 1964. Unpaged. $1950; $1250, per year.

**Signs.** Maurice Merleau-Ponty. Translated from the French edition (Paris, 1960) by Richard C. McCleary. Northwestern Univ. Press, Evanston, Ill., 1964. 389 pp. $7.50.

**Small World.** A history of baby care from the stone age to the Spock age. Joan Bel Geddes. Macmillan, New York, 1964. 287 pp. $4.95.

**Soviet Scientist in Red China.** Mikhail A. Klochko. Translated by Andrew MacAndrew. Praeger, New York, 1964. 223 pp. $4.95.

**The Space Around Us.** A. Edward Tyler. Harper and Row, New York, 1964. 251 pp. Illus. $4.95 (juvenile book).

**Spiders of Australia.** A guide to their identification, with brief notes on the natural history of common forms. Barbara York Main. Jacaranda Press, Brisbane, Australia, 1964. 124 pp. Illus. Paper, 14s. 6d.

**The Strange Tactics of Extremism.** Harry and Bonaro Overstreet. Norton, New York, 1964. 315 pp. $4.50.

**A Tracer Experiment.** Tracing biochemical reactions with radioisotopes. Martin D. Kamen. Holt, Rinehart, and Winston, New York, 1964. 127 pp. Illus. Paper.

**United States Government Organization Manual 1964–1965.** Natl. Archives and Records Service, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 791 pp. Illus. Paper, $1.75.

**Wernher von Braun, Rocket Engineer.** Helen B. Walters. Macmillan, New York, 1964. 219 pp. Illus. $4.50.

**The Winged Armada.** The story of the strategic air command. Martin Caidin. Dutton, New York, 1964. 182 pp. Illus. $3.50.

*(Continued from page 754)*

tion on the preparation of copy for slides and transparencies, their production, and their effective use in the presentation of technical papers. (AAPG Slide Manual, AAPG, P.O. Box 979, Tulsa, Oklahoma. 32 pages, $1.25)

The final report of a National Science Foundation survey of 272 private foundations was released by NSF last month. The survey shows that, of the $437 million the foundations spent in 1960 for all purposes, $89 million went for **research activities**, and more than half of that ($42 million) for basic research, mostly in the physical and life sciences. Of this, educational institutions received about $35 million. (Research and Other Activities of Private Foundations, 1960, Superintendent of Documents, U.S. Government Printing Office, Washington 25. 35 cents)

## Scientists in the News

**Leslie E. Orgel**, formerly with the chemistry department at the University of Cambridge, England, has been appointed resident fellow at the Salk Institute for Biological Studies in San Diego, California.

**Gordon W. Perkin**, formerly assistant director of clinical research for the Ortho Research Foundation, has been appointed associate medical director of the Planned Parenthood–World Population organization.

**William R. Upthegrove**, research metallurgist with the International Nickel Company, Bayonne, N.J., has been appointed professor of mechanical engineering at the University of Texas.

**Fred Wendorf**, formerly with the University of New Mexico, has been appointed professor of anthropology and director of an anthropological research center at Southern Methodist University.

**George Adomian**, head of theoretical studies groups, Hughes Aircraft Co., has been named professor of engineering research at Pennsylvania State University's ordnance research laboratory.

**Mariano A. Estoque**, chairman of the department of meteorology at the University of Hawaii, has been ap-

pointed visiting professor of atmospheric science at the school of environmental and planetary sciences at the University of Miami, Florida, for the 1964–65 academic year.

## Recent Deaths

**Walter A. Anderson**, 61; dean of the New York University School of Education; 26 October.

**Ernest Clare Bower**, 74; retired astronomer and former consultant on mathematical astronomy for the Rand Corporation and North American Aviation; 2 September.

**Alexander Graham Christie**, 83; past president of the American Society of Mechanical Engineers, and professor of engineering at Johns Hopkins University, 1914–1948; 26 October.

**George Miles Conrad**, 53; director of the board of trustees and staff of *Biological Abstracts*; 9 September.

**Edward M. Dorr**, 62; president-elect of the American Association of Maternal and Child Health and head of the obstetrical section of Chicago Wesley Memorial Hospital; 26 October.

**John David Evans**, 53; associate professor of physiology, Temple University; 20 October.

**Dwight Gunder**, 61; special adviser on rockets and missiles to the Navy Bureau of Ordnance, Washington, D.C., and former head of the department of engineering mechanics, Cornell University; 20 October.

**Walter Emil Heck**, 49; associate clinical professor of otolaryngology, University of California School of Medicine. San Francisco; 19 September.

**Walter C. Jacob**, 49; associate head of the department of agronomy at the University of Illinois; 4 September.

**Gardner M. Riley**, 54; professor of obstetrics and gynecology. University of Michigan School of Medicine; 26 September.

**Games Slayter**, 67; retired vice president of research and development, Owens-Corning Fiberglas Corporation; 15 October.

**Richard L. Weaver**, 53; professor of conservation, University of Michigan; 16 October.

*Erratum*: In the report "Chromatography of ribonuclease-treated myosin extracts from early embryonic chick muscle" by E. F. Baril, D. S. Love, and H. Herrmann (16 Oct., p. 413) the key in the legend to Fig. 1 should have read: "Solid line (optical density at 280 m$\mu$), and short dashes (optical density at 260 m$\mu$), after treatment with 0.005 percent ribonuclease. Long dashes (optical density at 280 m$\mu$) and crosses (optical density at 260 m$\mu$), untreated."