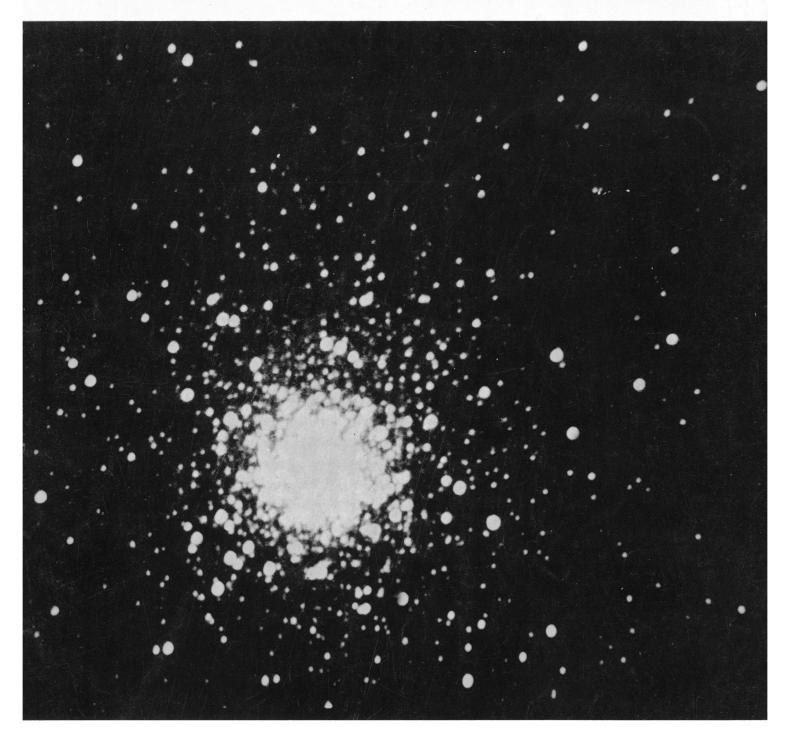
SCIENCE 20 October 1961 Vol. 134, No. 3486

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Instrument Issue



specialized versatility

for

ways of seeing

THE LABORATORY MICROSCOPE THAT FULFILLS RESEARCH REQUIREMENTS

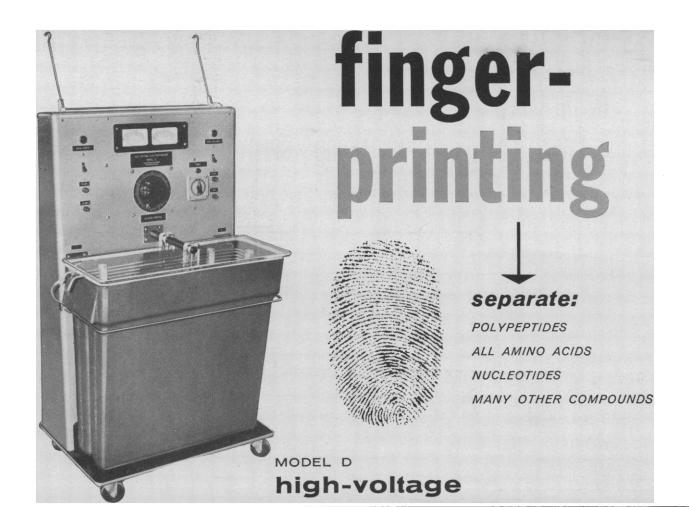
1 BRIGHT FIELD 2 DARK FIELD 3 PHASE CONTRAST 4 INCIDENT LIGHT 5 FLUORESCENCE 6 PHOTOMICROGRAPHY

The technical highlights below are your assurance that Leitz has given its traditional exacting attention to the perfection of each individual function of the Labolux, despite its almost infinite variety of interchangeable combinations. It's the only truly **versatile** microscope that can be **specialized** to meet the critical standards of experts in each field of application.

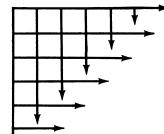
TECHNICAL HIGHLIGHTS

* Magnification from 45 to 1250X * Achromats, Apochromats or the new Plano-Objectives * Inclined 1.25X binocular tube with interpupillary adjustment * 360° rotation of interchangeable instant-lock Binocular and Monocular tubes * Built-in illumination with appropriate transformer provides variable light intensity * Interchangeable condensers * Exclusive Leitz anti-backlash, single-knob coarse and fine focusing * Convenient low-position controls * Built-in graduated mechanical stage with coaxial controls * Quadruple interchangeable revolving nosepiece * Spring-loaded medium and high-power objective mounts * FS tube for binocular observation and photomicrography * Easily adapted for use with the new ORTHOMAT

eitz Distributors o Ernst Leitz G.m.b.H	I PARK AVENUE SOUTH, f the world-famo L, Wetzlar, Germany∸Er aMERAS•LENSES•PROJE	ius products nst Leitz Canada
E. LEITZ, INC., 468 Par	k Avenue South, N	ew York 16, 1
Gentlemen:		
Please send me com	plete information	on the LABOI
Kindly have Leitz repr demonstrate the LABOLU		
Name		
Address		
City	Zone	State



ELECTROPHORATOR



ELECTROPHORESIS IN ONE DIMENSION

on $18\frac{1}{4}$ " x $22\frac{1}{2}$ " sheets of filter paper (Chromatography may be done in second dimension). Many complex mixtures can be rapidly resolved by electrophoresis in one dimension on papers up to 4 feet long.

Developed in the Laboratory of Cellular Physiology and Metabolism, National Heart Institute, National Institutes of Health, Bethesda, Maryland. Special thanks are due to Dr. William J. Dreyer, whose co-operation and suggestions are gratefully acknowledged by Gilson Medical Electronics.

- ***** Easy loading with folding rack
- 🛨 5,000 volts at 300 ma .
- Paper immersed in bifurcated fiberglass tank containing Varsol
- ★ Varsol, a light petroleum fraction, has a high flash point (over 100° C.), does not conduct electricity, and has the proper degree of volatility
- Cold tap water run through stainless steel coils at top of tank is only coolant necessary

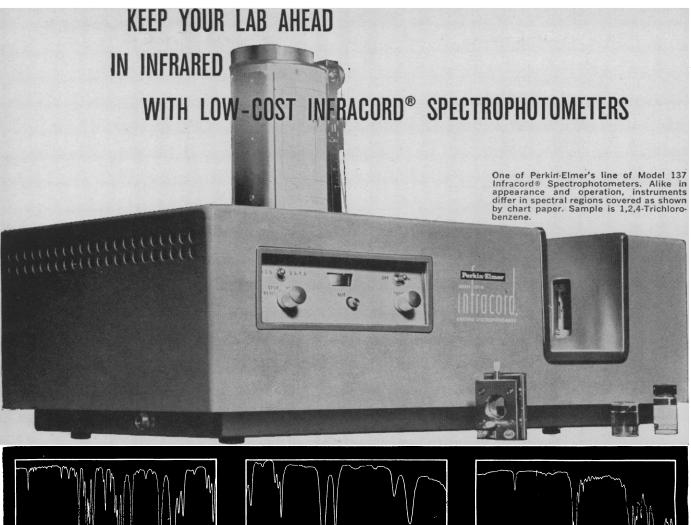
GME

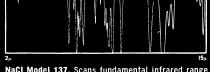
Safety features:

- Strong, joint-free fiberglass tank eliminates electrical and fluid leaks
- High voltage connected to inside of tank by Nylon and stainless steel plugs attached to edge of tank
- Highly reliable interlock provided by an extension of the cover handle
- When cover is removed, high voltage is ipso facto turned off
- ✓ No capacitors to sneakily store electricity in apparatus

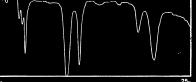
GILSON MEDICAL ELECTRONICS MIDDLETON, WISCONSIN (ON MADISON'S WEST BELTLINE HIGHWAY)

SCIENCE is published weekly by the AAAS, 1515 Massachusetts Ave., NW, Washington 5, D.C. Second-class postage paid at Washington, D.C., and additional mailing office. Annual subscriptions: \$8.50; foreign postage, \$1.50; Canadian postage, 75¢.





NaCl Model 137. Scans fundamental infrared range -2.5μ to 15μ —in 12 minutes; suitable for 70% of all analytical problems involving organic chemicals.



KBr Model 137. Scans from 12.5 μ to 25 μ in 6.5 minutes; provides data impossible or difficult to obtain at shorter wavelengths.

12.5

Model 137-G. Newest Infracord, this strument covers the highly significar 7.5 μ region with high resolution. Two-sp Trive permits either 24-min analysis or 8-minute scan

INSTRUMENTS COVER THREE IR RANGES. Three Infracord Spectrophotometers are available. All are doublebeam instruments, similar in appearance, accuracy, reliability, simplicity, low cost and availability of accessories for sampling and special analyses. They differ only in the IR spectral region covered and in their optics.

Any laboratory can improve its analytical efficiency with one or more low-cost Perkin-Elmer Model 137 Infracord® Spectrophotometers.

The cost is one-half to one-third that of infrared instruments designed for more complex and demanding work. Despite this difference in price, P-E Infracords can handle most analytical problems a chemist in research and development, process or quality control, must perform. This means you don't pay for performance you don't need ... nor for a high-salaried specialist, since a technician can operate the Infracord after a few minutes' instruction.

For laboratories with no IR instrument, an Infracord means' cutting analytical time from hours to minutes . . . achieving accuracy and reliability unmatched by other techniques. Results are presented as standard spectra on notebooksize paper for easy reference and filing as a permanent record.

For large laboratories, the use of a number of Infracords provides rapid, accurate analysis of the more routine samples ... prevents delays at the spectroscopy lab ... keeps more sophisticated IR equipment and skilled spectroscopists busy at problems only they can handle.

For multi-purpose organizations, an Infracord at each of a company's decentralized labs stems the flow of samples to the central research lab for IR analysis. It provides better analytical service in the field ... leaves the central lab free, for more basic work.

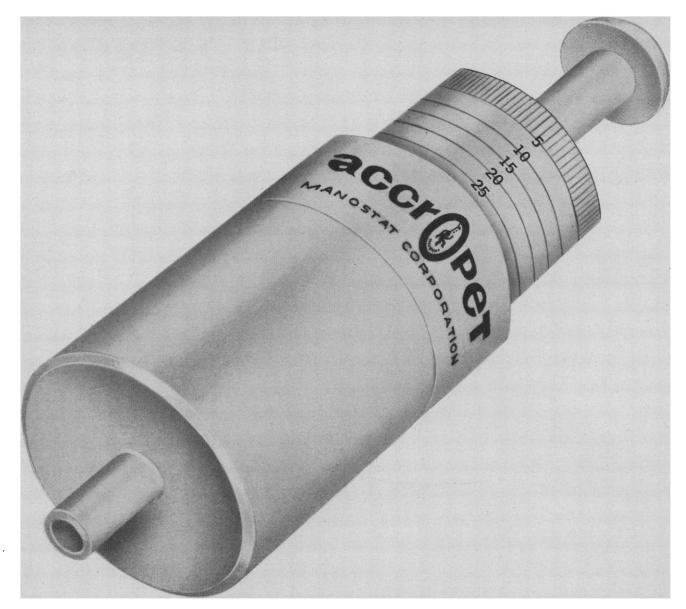
For complete information on all Infracords, write to the Perkin-Elmer Corporation, 750 Main Avenue, Norwalk, Conn.



Science

SCIENCE

Editorial	The Other Fellows' Ball Park	1163
Articles	New Frontiers of Astronomical Technology: A. B. Meinel	1165
	Where Does Instrumentation Enter into Medicine?: D. A. Holaday Modern technology can help medicine meet growing demands through instrumentation and automation.	1172
	Fuel Cells: E. Yeager They produce more electricity per pound of fuel than any other nonnuclear method of power production.	1178
	The Cambridge Electron Accelerator: M. S. Livingston and W. A. Shurcliff This 6-billion-volt machine will be the world's highest energy electron synchrotron.	1186
	Defocusing Images To Increase Resolution: <i>H. Osterberg</i> and <i>L. W. Smith</i> Resolution of two luminous particles is improved by defocusing the microscope or telescope.	1193
	Radio Telemetering from within the Body: R. S. Mackay Inside information is revealed by tiny transmitters that can be swallowed or implanted in man or animal.	1196
	Emission Spectrochemistry in Nutrition Research: C. L. Grant	1207
	New Method for Heart Studies: N. J. Holter	1214
	Mass Spectrographic Analysis of Solids: N. B. Hannay High sensitivity for bulk and surface impurities is provided by a new analytical method.	1220
e and the News	The Consortium Proposal: Private Industry Offers a Plan for Developing Satellite Communications; Food for Peace; Mental Retardation	1226
Book Reviews	Hiroshima Revisited: A. H. Compton Governments seek agreements to control the atom, but historians still disagree on its first military use.	1231
	K. G. Zimmer's Studies on Quantitative Radiation Biology, reviewed by A. Hollaender; other reviews	1233
Departments	Forthcoming Events	1236 1243
Cover	Globular star cluster M3 in yellow light, taken at Kitt Peak 19 March 1961 with a GL-7629 image orthicon. Exposure time, 8.5 seconds. See page 1165.	



NEW! THE MOST VERSATILE PRECISION PIPETTOR YET DESIGNED! **Macro accropet pipettor**

You asked for it...it's here: the new "big brother" in our justly popular and dependable family of Accropets. The most adaptable pipettor ever devised. Any capacity within the range of 2 to 25 ml. can be set accurately... and this one precise setting can be used repetitively, without error, until the Accropet is reset to a new volume. In addition, unsanitary, unsafe mouth-operated pipetting is banished forever.

The one-hand operation is quick, simple,

PP-2000 Macro Accropet, for pipets 2 ml. to 25 ml. \$12.00 each; in lots of six \$10.80 each, in lots of twenty-four \$9.60 each.

PP-1200 Micro Accropet, for pipets up to and including 2 ml., and red and white blood pipets. \$4.95 each; package of six \$23.70. safe. Set the Accropet—push to fill—push to dispense. Fine screw thread gives micrometer-like adjustment and control for both filling and discharging.

Expertly constructed of pure, white, high temperature polypropylene that can be sterilized, (withstands up to 320° F.). "O" ring construction provides exceptionally accurate, reliable, leak-proof action. Rubber tubing connection permits considerable flexibility, helps eliminate pipet breakage.

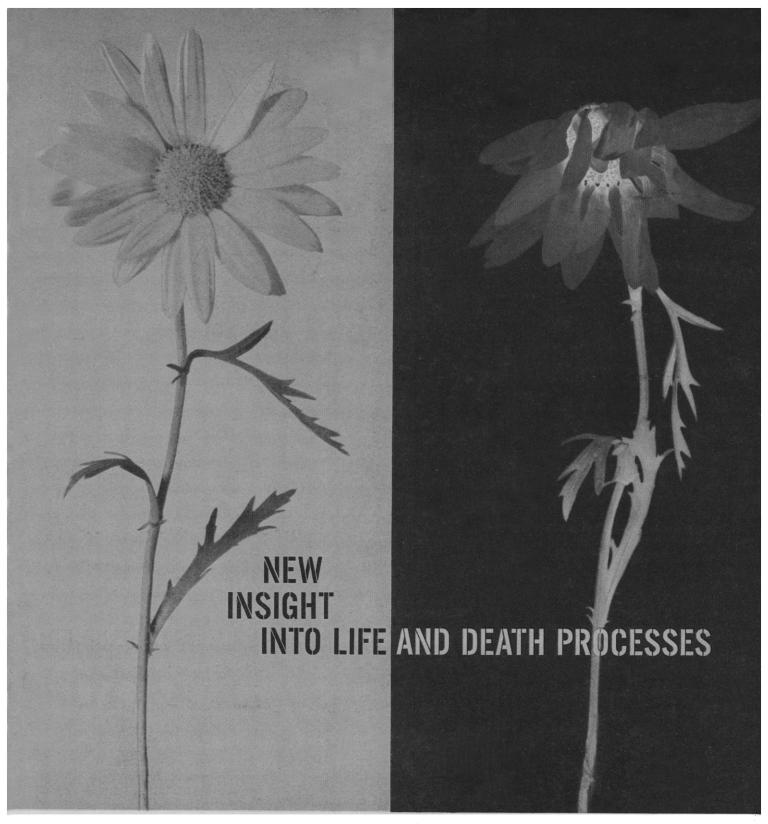
PP-1000 Ultramicro Accropet, for pipets up to and including 2/10 ml., and especially recommended for lambda-pettes. \$3.50 each; package of six \$16.80. All sizes from ultramicro to 25 ml. are now available.





Write for Accropet brochure

20-26 N. Moore St., DPT. 427, N.Y. 13, N.Y. SCIENCE, VOL. 134



Although the innermost secrets of life and death still remain a mystery, continuing investigations are helping us gain better insight into these fundamental processes. One of the newer techniques being used successfully to study these phenomena is EPR (Electron Paramagnetic Resonance) Spectroscopy.

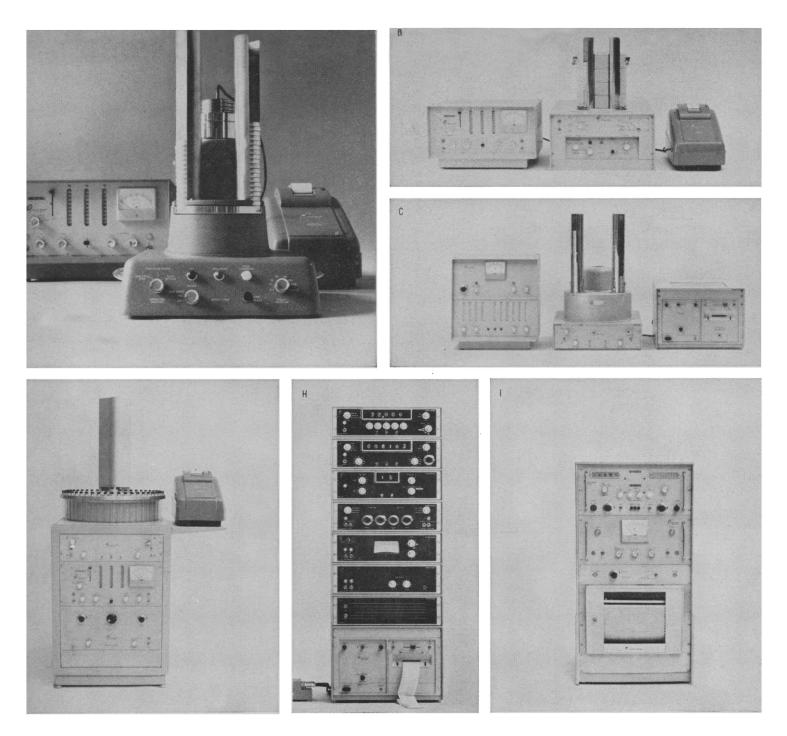
Several recent experiments using EPR to detect the presence of free-radicals have helped confirm new theories concerning the nature of the life and death processes which previously had been based on rather inconclusive evidence.

For example: EPR has been used to study photosynthesis, an important life process in **Chlorella pyrenoidosa** (an algae). It was demonstrated that more than one pigment must be activated by light for efficent photosynthesis to occur. And in

another experiment, the results of EPR analysis were used show a strong correlation between the death process and fr radical concentration in freeze-dried **Serratia marcesce** (a common bacteria).

Perhaps EPR analysis can be of value in your investigation If you would care to discuss possible applications, plea contact the INSTRUMENT DIVISION.



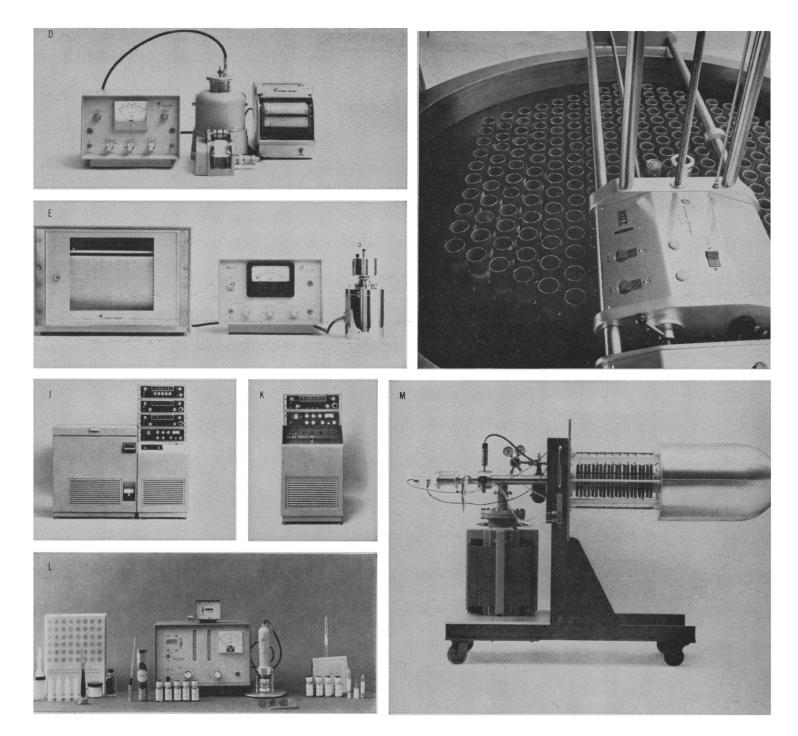


Advanced nuclear instrumentation from Nuclear-Chicago for industry, education, medicine and science The thirteen systems presented here demonstrate the scope and completeness of Nuclear-Chicago's products for the radioisotope user. They are — instrument by instrument, and system by system — capable of efficient, precise performance with unusual reliability. They are representative of the more than 250 instruments, counting systems, radionuclides and accessories presented in detail in Nuclear-Chicago's new, 96-page general catalog. Please send for your copy — you will find unequalled variety and versatility in the complete Nuclear-Chicago line.

A. C110B Automatic Sample Changer accepts up to 35 solid beta samples 1 in. or $1\frac{1}{4}$ in. diameter.

B. C115 Automatic Beta Sample Changer is supplied with guarded gas-flow detector with background of only 2 cpm.

C. C210 Automatic Sample Changer accepts 50 or more beta samples up to 2 in. diameter.



D. C100B Actigraph II[®] automatically scans strip radiochromatograms.

E. 6000 Dynacon Electrometer measures beta radiation in solid, liquid, or gaseous samples.

F. 9000 Subcritical Assembly is widely used in college engineering, physics, and chemistry education.

G. C120 Automatic Sample Changer accepts up to 49 gamma-emitting samples in test tubes. Scintillation well detector is mounted in console.

H. 804 Digital Automatic Spectrometry System provides automatic channel programming, scaling, timing. Elapsed time, accumulated count, and channel identification are printed by digital recorder.

I. 1832 Recording Analyzer is used with standard scintillation detectors to provide graphic record of count rate vs. energy in gamma spectrum analysis.

J. 703 Automatic Liquid Scintillation Detector accepts

up to 50 samples. Supplied with precision, custom-built temperature chamber.

K. 701 Liquid Scintillation Detector is used for highefficiency, room-temperature measurement of soft beta samples.

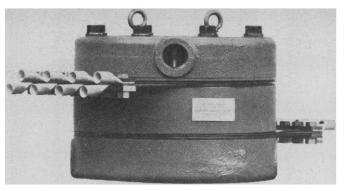
L. 4001 Nuclear Training System is ideal for laboratory studies or classroom demonstration in undergraduate science programs.

M. 9500 Neutron Generator provides high neutron flux for activation analysis, process control, student training, applied research and development.



349 East Howard Avenue

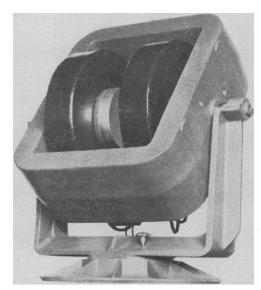
Des Plaines, Illinois

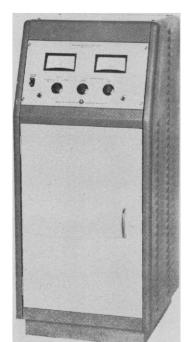


Model HF-26 2" Bore Solenoid Magnet

Model HS-1050 Magnet Power Supply

Model L-128 12" Electromagnet





magnets, power supplies, nmr* equipment

Model L-128 — 12" Diameter Electromagnet and HS — 1050 fully transistorized 5 KW Power Supply: Homogeneity 1x10⁵ readily available over 4 in³ at 8 KG (cylindrical caps — 2" gap); maximum field this configuration in excess of 13 KG. Much higher fields available with tapered caps. Magnet features rugged cast frame, low impedance coils, rotation about two axes — Other Magnets available: 23" dia. — 7" dia. — 2¹/₂" dia. standard — plus custom special purpose. Power supplies of 250 KW, 50 KW, 20 KW, 5 KW, 2.5 KW — all solid state design.

Model HF-26 Iron Clad Solenoid — 52 KG at 240 KW power with 2" diameter Bore 6" length — calculated 95 KG at 500 KW power and 1" Bore: Low carbon steel housing for high power efficiency, pressure confinement and water cooling.

*nuclear magnetic resonance gaussmeters and field control systems

HARVEY-WELLS CORPORATION P.O. BOX 189

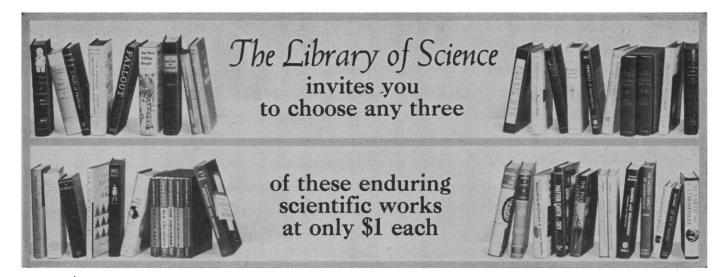


FRAMINGHAM, MASSACHUSETTS TR 2-4365

The research worker encounters new problems every day-his work is rarely simple and clear-cut. His needs are diverse, his requirements are precise. Diversity is the key word: diversity with uniformity; diversity with purity; diversity with utmost precision. And this describes Whatman filter products...designed and developed to meet the analyst's every separation need. Diversity means a wide range of sizes and shapes for every grade of filter paper; it means a choice of specific grades of paper for every particular function, and for a complete spectrum of qualitative and quantitative control factors. Diversity exists in the range of products, too: from filter papers through cellulose ion exchange and glass fibre products. Yet within this diversity the analyst can rest assured that results achieved through Whatman products are reproducible time and time again ... anywhere in the world. Diversity ... purityuniformity.....universality.....



Sole sales agents: REEVE ANGEL 9 Bridewell Place, Clifton, New Jersey • 9 Bridewell Place, London, EC4



An expanding world of knowledge, presented by leading scientific discoverers and thinkers-41 fine volumes currently available to members

OPERATIONS RESEARCH, by Churchman, Ackoff and Arnoff. 640 pages-the definitive introduction to the subject. LIST PRICE \$12.00

SCIENCE IN SPACE, ed. by Lloyd V. Berkner and Hugh Odishaw. LIST PRICE \$7.00

MATHEMATICS AND PLAUSIBLE REASONING, by George Polya. Two volumes that set forth the science and art of mathematical reasoning. LIST PRICE \$9.00

PETER B. MEDAWAR: THE FUTURE OF MAN and THE UNIQUENESS OF THE INDIVIDUAL, two volumes by the Nobel Prizewinner. LIST PRICE \$7.00

FOSSIL MEN, by Marcellin Boule and Henri V. Vallois. LIST PRICE \$9.50

GEORGE SARTON: A HISTORY OF SCIENCE. Vol. 1 – from the begin-nings of writing through the Golden Age of Greece. LIST PRICE \$11.00 Vol. 2—the flowering of ancient sci-ence in the last three centuries B.C. LIST PRICE \$11.00

TACTICS OF SCIENTIFIC RESEARCH, by Murray Sidman. LIST PRICE \$7.50

SCIENCE AND THE NEW NATIONS ed by Ruth Gruber. The impact of science on the under-developed countries of Africa, Asia and Latin America. LIST PRICE \$6.50

A STUDY OF THINKING, by Jerome S. Bruner. LIST PRICE \$6.00

Up to \$42.00 worth of books for only \$3.00

PHYSICAL THEORY OF NEUTRON CHAIN REACTORS, by Alvin M. Weinberg and E. P. Wigner. "First authoritative and unified account of modern reactor theory." Robert A. Charpie. LIST PRICE \$15.00

ASSAULT ON THE UNKNOWN, by Walter Sullivan. First complete account of the discoveries and achievements of the International Geophysical Year. 474 pages; 39 illustrations. LIST PRICE \$7.95

CHAMBERS' TECHNICAL DICTION-ARY. Greatly revised, enlarged Third Edition of *the* standard reference work, covering 120 branches of mod-ern science. 1028 double-columned pages; 60,000 entries. LIST PRICE \$7.95

FALLOUT, ed. by J. M. Fowler. The most complete roundup to date of biological, medical and meteorologi-cal knowledge on the effects of nu-clear testing. LIST PRICE \$5.50

WORDS AND THINGS, by Roger Brown. The psychology of language and the nature of meaning. LIST PRICE \$6.75



MATHEMATICS DICTIONARY, by Glenn and Rob-ert C. James. Definitions of over 7,000 mathematical terms, concepts and relationships, with 423 integral tables, over 400 mathematical symbols, differentiation formulas, and a 72-page four-lan-guage index of basic terms. LIST PRICE \$15.00

> W. E. LE GROS CLARK: THE ANTE-**CEDENTS OF MAN.** The modern classic, wholly revised, on the evolu-tion of the primates. LIST PRICE \$6.00

> LINUS J. PAULING: THE NATURE OF THE CHEMICAL BOND. The Nobel Prizewinner's newly revised, third edition of his celebrated intro-duction to modern structural chem-istry. LIST PRICE \$8.85

SIGMUND FREUD: The Interpretation of Dreams. The only complete English translation. LIST PRICE \$7.50

BOOK OF BIRD LIFE, by Arthur A. Allen. Encyclopedic inventory of North American bird life-species, population, range, habits. 252 illus-trations, 52 in color. LIST PRICE \$9.75

PRINCIPLES OF GEOCHEMISTRY, by Brian Mason. Most complete intro-duction available to the sciences that deal with the earth, its structure, composition and immediate environ-ment. LIST PRICE \$8.50

GROWTH IN LIVING SYSTEMS, ed. by **M. X. Zarrow** and others. First-hand reports by 33 explorers and pioneers on the frontiers of research today – viruses and bacteria, hor-mones and aging, DNA and RNA, protein synthesis, and other subjects. 755 pages. (Counts as two Selections; \$2.00) LIST PRICE \$15.00

GAMES AND DECISIONS: An Intro-duction to Game Theory, by R. Duncan Luce and Howard Raiffa. R. LIST PRICE \$8.75

EVOLUTION OF GENETIC SYSTEMS, by C. D. Darlington. LIST PRICE \$5.50.

MATTER, EARTH AND SKY, by George Gamow. LIST PRICE \$10.00

HISTORICAL GEOLOGY, by Carl O. Dunbar. The history of the earth-from its cosmic origin to the pres-ent. LIST PRICE \$7.95

The Library of Science, 39 FOURTH AVENUE NEW YORK 3. N.Y.

THEORETICAL PHYSICS IN THE TWENTIETH CENTURY, ed. by M. Fierz and V. F. Weisskopf. List Price \$10.00

DRUGS AND BEHAVIOR, ed. by Uhr and Miller. LIST PRICE \$10.75

SCIENTIFIC EXPLANATION, by R. B. Braithwaite. "The best account of the logic of scientific reasoning." J. Bronowski. LIST PRICE \$8.50

SPACE BIOLOGY, by Hanrahan and Bushnell. How science is preparing man to survive the bizarre conditions of space flight-weightlessness, solitude, disposal of wastes, radiations, fantastic accelerations, etc. LIST PRICE \$6.00

RECENT ADVANCES IN SCIENCE, edited by Shamos and Murphy. Hans Bethe, Edward U. Condon, Victor Weisskopf, I. I. Rabi, and 8 others, lead a guided tour of laboratories and research stations in physics and explicit mathematics and research stations in pro-applied mathematics. LIST PRICE \$7.50

SIR JAMES G. FRAZER'S NEW GOLDEN BOUGH. One-volume abridgment, ed. by Theodor H. Gaster. LIST PRICE \$8.50

MATHEMATICS IN WESTERN CUL-TURE, by Morris Kline. LIST PRICE \$8.00

THE LOGIC OF SCIENTIFIC DIS-COVERY, by Karl R. Popper. LIST PRICE \$7.50

CONCEPTS OF SPACE and CON-CEPTS OF FORCE. Two volumes by Max Jammer. LIST PRICE \$9.25

MODERN ASPECT OF MATHEMA-TICS, by Lucienne Felix. The Bour-baki revolution in mathematics and its consequences. LIST PRICE \$5.00

THEORIES OF THE UNIVERSE, by Milton K. Munitz. From primitive myth to modern astronomy, physics and mathematics. LIST PRICE \$6.50

HARLOW SHAPLEY: SOURCE BOOK IN ASTRONOMY. From 1900 to the present—with 62 illustrations. LIST PRICE \$10.00

STRANGE WORLD OF THE MOON, by V. A. Firsoff, LIST PRICE \$6.00

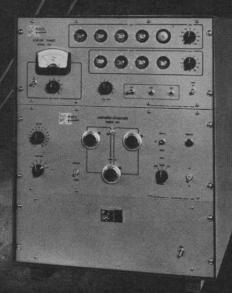
JOHN R. PIERCE: ELECTRONS, WAVES AND MESSAGES. List Price \$5.00

MARTIN GARDNER: LOGIC MA-CHINES AND DIAGRAMS. LIST PRICE \$5.00

1100

New 🚰 Gamma Spectrometer _

luxury features in a compact, economy package



Model 8250 Spectrometer incorporating the All-Electronic Scaler Model 135, the Model 250 Amplifier-Analyzer and Model F-8 Fan Filter Assembly.

Baird-Atomic announces the new Model 8250 single channel Spectrometer which can be quickly and easily calibrated in energy units (Mev) for any energy range from X-rays to cosmic rays. Spectra can be positioned as desired by the high voltage and the gain controls. Any degree of differential operation (relative window width) or integral operation may be obtained.

The Model 8250 is a combination of two instruments just added to the Baird-Atomic line. They are the Model 250 Amplifier-Analyzer and a new all-electronic Model 135 Scaler. The Scaler, which combines a 5 decade, 5 micro-second scaler and an electronic timer on one chassis, is excellent for both general lab counting work and for use with the most sophisticated automatic sample changing systems.Write today for details on these instruments and their system combinations.

Offices in Cambridge • New York • Philadelphia • Detroit • Cleveland • Washington, D.C. • Atlanta • Dallas • Chicago • Los Angeles • San Francisco • Ottawa, Canada.

Engineers and scientists: Investigate challenging opportunities with B/A. Write Industrial Relations Director. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.



ADVANCED OPTICS AND ELECTRONICS...SERVING SCIENCE

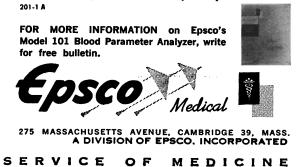


Make direct measurements of pH, pCO_2 & pO_2 from whole blood in only 3 minutes

The Epsco Model 101 Blood Parameter Analyzer has been developed to satisfy the need for greater speed and accuracy in determining physiologically significant whole blood parameters. Sensitive and readable without interpolation to better than 0.002 pH, it provides direct readings in millimeters of mercury of pO_2 in 1 minute and pCO_2 in 3 minutes. The unit may also be used as a gas analyzer, and for measuring changes in O_2 and CO_2 in various biologic fluids. A completely integrated system, Epsco's Blood Parameter Analyzer realizes speeds not possible with chemical techniques, and accuracies unobtainable by infra-red analyses of expired air. SIMPLE, RELIABLE OPERATION — The Analyzer requires minimum "set-up" time. Electrodes are calibrated by using readily available standardizing gas. Controls are functionally-grouped for operating ease, and lock-equipped to safeguard calibration settings. Built-in design features prevent instrument drift that may be caused by room temperature changes; and an internal standard reference cell protects against long-term drift. Since nomographs or calibration curves are not required, the chance of operator error is reduced.

pH, pCO_2 or pO_2 . Specially calibrated meter faces are available for uses requiring direct readout. **WIDE APPLICATION** — Especially useful in clinical laboratories doing pH and blood gas analyses, the unique capabilities of the Blood Parameter Analyzer make it a valuable aid in surgery, cardiac catheterization, pulmonary function determinations and anesthesia studies. Versatile, accurate and fast, the Analyzer has been designed and built to the exacting Epsco standards — established during years of experience in advanced military and industrial instrumentation programs — that assure the greatest possible reliability in operation.

permitting continuous recording of changes in



The unit has connections for an external recorder

IN

THE

ELECTRONICS

AMSCO Microbiological Equipment /

FREEZE DRY EQUIPMENT

Models for laboratory, pilot plant and production. Used for the preservation and concentration of labile substances.

WATER STILLS and DEIONIZERS

STILL capacities from $\frac{1}{2}$ to 500 gal./hr. Steam, Electric or Gas heat. Automatic or manual controls. DEIONIZERS — Complete line ranging from 2 to 1000 gal./hr.

STERILIZERS

Pressure Steam, Ethylene Oxide and Combination Gas-Steam models. Chambers $16^{\prime\prime}$ x $16^{\prime\prime}$ x $24^{\prime\prime}$ to $60^{\prime\prime}$ x $66^{\prime\prime}$ x $120^{\prime\prime}$

CONTINUOUS CULTURE APPARATUS

"Biogen" Continuous Culture Apparatus produces microbial cells and/or their byproducts on a continuous or batch basis under precisely controlled conditions.

DRY BOXES

Flexible Film disposable chamber. Economical, efficient and easy to use. Ideal for laboratory and production.

GERM-FREE LIFE APPARATUS

Flexible Film Isolators for operating, rearing and transfer of germ-free animals. Economical, disposable chamber-

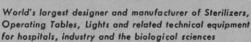
For good reason more and more universities, pharmaceuticals and industrials confidently specify AMSCO Freeze Dryers, Sterilizers, Water Stills and other specialized microbiological equipment. Each is designed and built to accomplish a specific job better . . . more dependably . . . and with less time and attention from the staff.

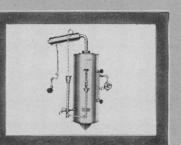
If you have a problem in the area of technical microbiological equipment, a letter to our Scientific and Industrial Department may lead to its economical resolution.

Meanwhile we'll be happy to send along literature on any of the equipment illustrated.

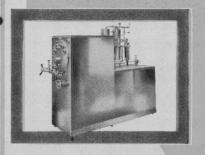
SCIENTIFIC AND INDUSTRIAL DEPARTMENT

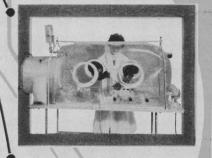




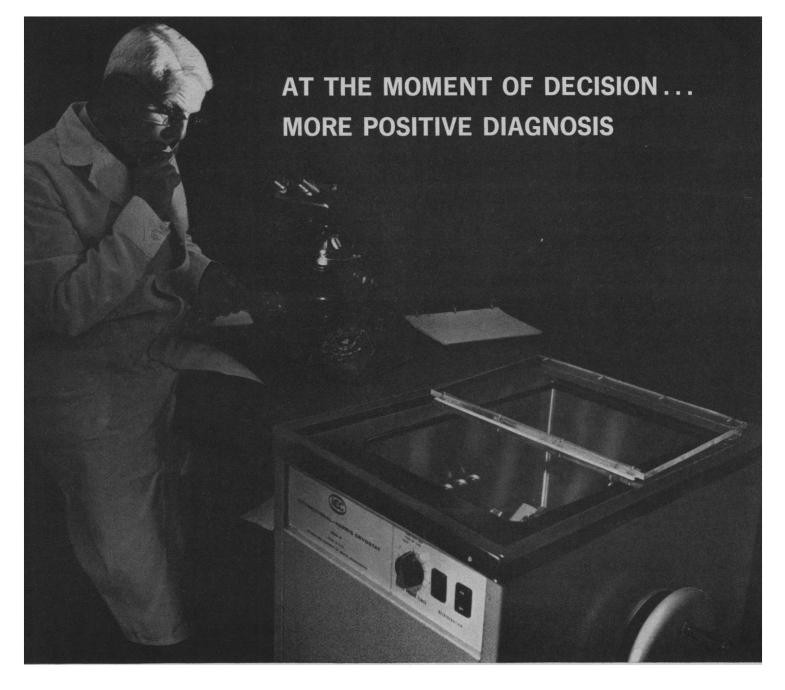












To provide more positive diagnosis ... to speed slide preparation ... to perfect it technically and thereby produce exceptional cytological detail in thin undistorted sections ... these are the aims and accomplishments of International's new model CT Microtome Cryostat.

Everything necessary for precise, frozen sectioning has been conveniently packaged in one superbly engineered compact instrument. From fresh tissue to finished slide in minutes. There is a new, integral Freon fast freezing arrangement. Controlled temperatures from -10° C to -20° C are held even with the top open. Laboratories significantly speed their service. Pathologists get the best possible sections to help them achieve diagnostic certainty even under pressure of time. Write for our latest brochure.



Measure PRESSURE TEMPERATURE · AIR FLOW VELOCITY · DISPLACEMENT · FORCE with PRECISION SANBORN TRANSDUCERS

You can meet a wide variety of requirements from this broad selection of accurate, compact Sanborn Transducers. Series 267 and 268 Physiological Pressure Transducers are designed for either differential or single-ended measurements in such applications as cardiac catheterization and studies of circulatory, respiratory, esophogeal, spinal or gastric pressures. Two basic sensitivities are available: 1.0 or 0.1 mm Hg produces 1 cm. chart deflection. Model 270 Bi-Directional Differential Gas Pressure Transducer permits measurements of small pressure changes (1 cm/0.5 mm H_2O) over a wide range with excellent linearity and low drift. Pneumotach heads for respiratory air flow measurements are available for use with the 270. Excellent stability and temperature compensation also make the Model 270 particularly

suitable for plethysmography applications.

Model 760-53 Calibrated Temperature Bridge and a variety of interchangeable thermistor probes are available for use with any Sanborn Carrier Preamplifier for accurate recording or monitoring of physiological temperatures with full scale sensitivity of 1°C and 2.5°C.

In addition, Sanborn offers pneumograph and pulse wave attachments, heart sound microphones, linear velocity and displacement transducers, and transducers for force measurements in myographic studies. For complete information contact your nearest Sanborn Branch Office or Service Agency – or write Manager, Research Instrument Sales, Medical Division.



ATTENUATED TOTAL REFLECTION A promising new infrared sampling technique especially suited for analyzing films and solids

At the 1959 Spectroscopy Symposium in Bologna, Dr. J. Fahrenfort of the Shell Research Laboratories in Holland discussed the application of attenuated total reflection to infrared spectroscopy. Greatly intrigued by his work, we at Connecticut Instrument Corporation have spent several months studying the technique and developing practical equipment for its routine application in the infrared laboratory. While we have just begun to scratch the surface of potential uses for the ATR method of sampling, we have learned enough to believe that it will soon become as useful to the spectroscopist as the KBr pellet technique.

In a somewhat oversimplified form, attenuated total reflection may be explained as follows:

Assume that a beam of radiation is passed into a prism so that it is totally reflected from the back face, as in Figure 1. It has been shown, both mathematically and by physical measurements, that some portion of the energy of the beam escapes from the totally reflecting face and then is returned into the prism. It is almost as though the ray had a wave front of a finite width and behaved as shown in the diagram.

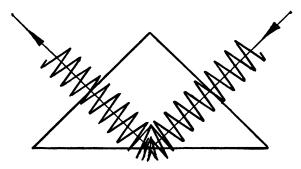


Figure 1. Schematic of attenuated reflection effect

It would appear that, if an absorbing material is placed in contact with the reflecting surface, the energy that escapes temporarily from the prism would be selectively absorbed, much as in a transmission spectrum. Under the proper conditions this is indeed the case.

The absorption-like spectra obtained by this method have two important and unique features:

1. The band intensities are the equivalent of an extremely shallow (5 microns or less) penetration into the sample.

2. They are completely independent of the sample thickness.

As manufacturers of infrared cells, it comes as a considerable relief to find a sampling procedure that eliminates precise and extremely short pathlengths as a requirement for infrared sampling!

Because of these characteristics, it is apparent that the ATR technique will have widespread application in the infrared analysis of solid materials and other strongly absorbing substances. To make practical application of the ATR technique we have developed an attachment that will fit into most commercial infrared spectrometers and which has a reflecting surface available from which the spectrometer beam may be reflected at an adjustable angle of incidence (Figure 3).

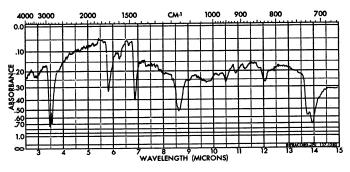


Figure 2. ATR spectrum of Carnauba wax made with a pressed plate

We have worked out several different sampling techniques for handling solids and liquids, including an expendable Frisnel type reflector plate upon which samples may be permanently deposited. The spectrum in Figure 2 shows some typical results.

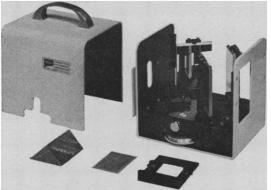


Figure 3. CIC's new ATR attachment, cover removed, showing sampling accessories

The ATR technique offers fascinating possibilities to the spectroscopist in enabling him to obtain spectra on samples that are difficult or impossible to analyze by conventional techniques — plastics in the solid state, strongly absorbing liquids, such as water solutions, naturally occuring materials and inorganics—to name a few.

The Model ATR-1 attachment developed by C I C will enable the spectroscopist to experiment with this new technique for a moderate investment. It is simply installed and extremely versatile. We will be pleased to send you full details.





Another "Performance Plus Economy" Product by JKM

JKM Instrument Company is pleased to announce the introduction of "Stat," a new control unit to be used in maintaining a given pH in a reaction vessel.

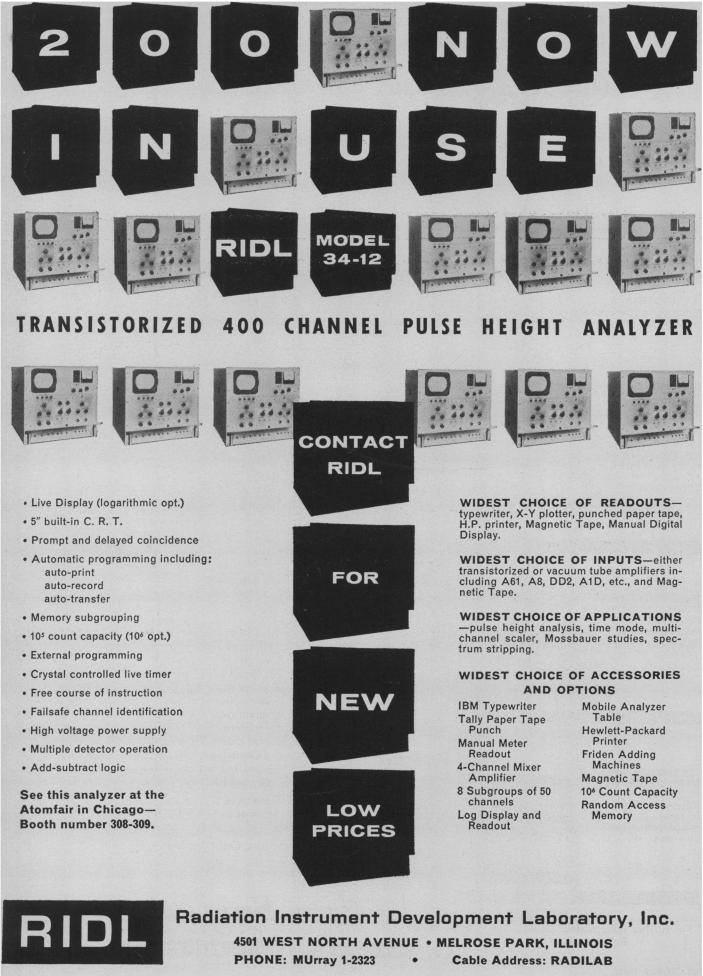
"Stat" maintains the pH level within .05 pH units and can be set at any point in the pH scale. There is virtually no dead zone since the unit has a built-in delay at the end of the equilibration to prevent overshoot. The "Stat" unit is 5" high, 12" wide, and 6" deep. "Stat" operates with any pH meter, and with any electrically controlled equilibrant addition system, such as the JKM Sample Injection Syringe.

Our customers and distributors know of the many advantages of JKM equipment. Each product is designed and manufactured by engineers who are fully aware of the ruggedness and accuracy demanded by the researcher.

PRICE.....\$200.00



JKM INSTRUMENT COMPANY INCORPORATED OLD PHILADELPHIA PIKE DURHAM, PENNSYLVANIA





introducing exclusive <u>NEW APPLICATOR</u> for <u>THIN LAYER CHROMATOGRAPHY</u> THE ONLY CONTROLLED METHOD FOR APPLYING REPRODUCIBLE LAYERS OF VARIABLE THICKNESS

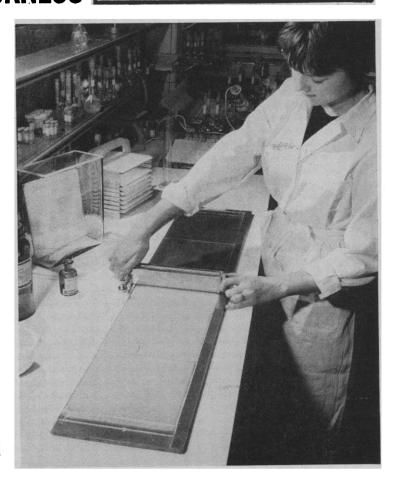
In addition to the previously offered standard applicator for TLC, already used by hundreds of laboratories in the U. S. and Canada, Desaga has now developed a variable thickness instrument — MODEL "S." By means of a micrometer screw setting any layer thickness to 2000μ may be applied — the only applicator available which permits the selection and reproduction of a specific layer thickness. This feature not only increases the versatility of the equipment but permits its use with ordinary (high quality) window glass.

Only the new Desaga equipment (after Stahl) offers a complete line of apparatus and adsorbents for TLC. Besides the previously available Silica Gel G, Aluminum Oxide G and Kieselguhr G from Merck (Darmstadt, Germany) we are now introducing two new Cellulose Powders from Macherey, Nagel & Co.—with and without binding agents.

The major advantages of TLC are:

- 1) The speed of separation -20 to 40 minutes.
- 2) The wide quantitative range from less than one microgram to 10 mg on a single glass plate.
- 3) The possibility of using highly aggressive (corrosive) sprays.
- 4) The simplicity of the technique and the limited financial investment necessary for its introduction.

Equipment for TLC may be ordered as complete assemblies or as individual components – all available for immediate delivery from stock. In experience, Desaga TLC puts you ten years ahead. For further information request our NEW TLC BULLETIN.



BRINKMANN INSTRUMENTS, INC., 115 CUTTER MILL ROAD, GREAT NECK, N.Y. PHILADELPHIA - CLEVELAND - HOUSTON - MIAMI - MENLO PARK, CAL. - ST. LOUIS



ACCIDENTIAL MARCHART MARCHART

Single-Unit Cyclo-Mixer with Foot Switch: When used with the unique Clay-Adams Foot Switch, both hands are left free for holding tubes or flasks. The compact, easily portable Single-Unit Cyclo-Mixer mixes solutions, dissolves most solids in only seconds. It accommodates containers of various shapes and sizes — from 0.25 microchemistry tubes to 40-mm. diameter tubes and flasks.

For procedures requiring prolonged, controlled mixing in test tubes: Two-Unit or Four-Unit Cyclo-Mixers

provide any desired degree of agitation—from gentle mixing to violent churning. They operate at 3 speeds with separate motor and speed control for each tube. Equipped with interchangeable cups, they can accommodate round-bottom tubes from 15 mm. to 25 mm. in diameter and up to 200 mm. in length. Tube clips and support bars eliminate the need for constant monitoring. *Available from your dealer.*

New York 10, N.Y.



Cyclo-Mixer, Single Unit, with foot switcheach **\$68.50** Cyclo-Mixer, Single Unit, without foot switcheach **\$59.50**



Cyclo-Mixer, Two Uniteach \$154.00



Cyclo-Mixer, Four Uniteach \$248.00

20 OCTOBER 1961



* Mixing time required for one typical laboratory procedure reduced from 20 minutes to 11 seconds!

1111



ANALYTICAL and PREPARATIVE METHODS of SEPARATION GEL ELECTROPHORESIS

Electrophoresis on gel supporting media affords much improved resolution in comparison with paper-strip or free-solution electrophoresis. As many as 24 distinctlyseparated components can be obtained from serum samples. Altho equally suitable for micro quantities, gel electrophoresis also accepts much larger quantities making it a practical method for preparative separations on a semi-micro scale; up to 200 mg of protein mixture can be separated on one gel slab. If directcontact cooling of the gel slab is employed, complete serum protein patterns can be obtained in less than two hours, showing better resolution than a 20-hour pattern on paper electrophoresis.

The gel material used as supporting medium may be hydrolyzed starch, agar, or the synthetic polyacrylamide Cyanogum (Reg. American Cyanamid Co.). Each of these media gives a different type of resolution, and in many problems it will be advantageous to employ all three concurrently or successively; the procedure then becomes analogous to two-dimensional chromatography. Migration thru a gel slab in the horizontal position introduces undesirable gravitational-convection effects in the migrating zone; therefore, a vertical gel slab is preferable, providing that a proper supporting apparatus is available.

COUNTERCURRENT DISTRIBUTION

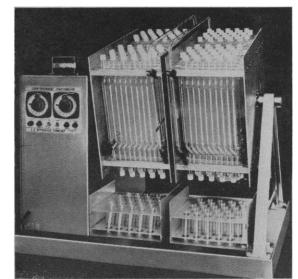
Counter-current extraction is a method of analyzing or separating the components of a mixture by dissolving in one phase of a two-phase solvent system, and extracting it with the other phase. This effects a rela-tive separation of the components accord-ing to the distribution co-efficients of each. Repeating the extraction many times in a systemic manner multiplies the effects of even small differences in distribution coefficients, so that closely similar substances can be separated. The separated volumes may be analyzed by any applicable method, preferably one which gives the total quan-tity of solute in each volume. Thus the total volume of solvent may be titrated when dealing with a mixture of acids. The most generally applicable when non-volamost generally applicable, when non-vola-tile solutes are concerned, is the determination of the weight of solute in each fraction. It should be noted, however, that macro quantities of material are not required. Extremely low concentrations may be used, which may be far below those required for weight determinations. Necessary, course, are sensitive analytical methods, such as color reactions or ultraviolet absorp-tion. With such methods, counter-current extraction can analyze quantities as small as those in any other analysis. Results using low concentrations may be even more ac-curate than those with high concentrations owing to a closer approach to the laws of ideal solutions from which the following equations are derived. Counter-current extraction follows very exactly the Distribution Law

$$Ki = \frac{(i)}{(i)}$$

(1) 2 where K_1 is a constant characteristic of the compound i; (i), and (i)₂ are the concentrations of compound i at equilibrium in phase 1 and phase 2 of the solvent system. This fact allows a very mathematical analysis of the quantitative results obtained in counter-current extraction, and permits the direct comparison of experimental and theoretical results.

20 OCTOBER 1961

COUNTERCURRENT FRACTIONATOR

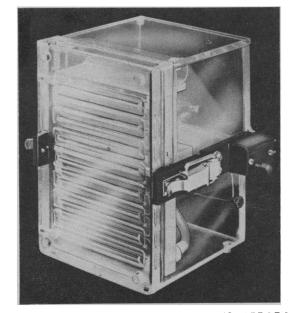


EC520 COUNTERCURRENT FRACTIONATOR with two racks of 100 20-ml tubes on base 24" x 24".

Technical Representative Available

For: Application Studies Technical Advice Reference Material

VERTICAL GEL ELECTROPHORESIS



EC470 VERTICAL GEL ELECTROPHORESIS APPARATUS.

E-C APPARATUS CORPORATION

538 WALNUT LANE SWARTHMORE, PA. Phone — Code 215 — Kingswood 3-7473

Thomas-Hoover MELTING POINT APPARATUS

with new back-lighting THERMOMETER ILLUMINATOR

• Provides superior illumination, increasing speed and accuracy of readings

THE HOOVER MELTING POINT APPARATUS, "Uni-Melt," which is rapidly becoming a standard instrument for determination of capillary melting points, has recently been improved to overcome fluctuation in laboratory lighting. Glareless illumination, restricted to the scale of the thermometer, is provided by an 8-watt fluorescent lamp in ventilated metal housing. The more sharply visible thermometer meniscus reduces operator eye-strain, promotes greater accuracy of individual readings and decreases the time for a series of determinations, especially when used with the Periscopic Thermometer Reader.

The Apparatus was designed by Dr. John R. E. Hoover to meet official U.S.P. requirements, and offers the following outstanding features:

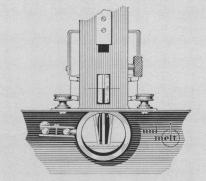
- **Safety.** Bath enclosed in cabinet except for observation port which is shielded by the magnifier. Removal of bath automatically disconnects heater and stirrer.
- **Rapid heating and cooling.** Coiled Nichrome wire heater responds rapidly to changes in input voltage, providing rapid, lagless heat. Bath temperature can be raised rapidly to within a few degrees of the anticipated melting point, i.e., to 350°C in 6½ minutes, and then raised slowly until melting occurs. Bath can be cooled rapidly for the next determination, i.e., from 300°C to 150°C in approx. 5 minutes, by attaching compressed air line.

Capillary Vibrator. Recessed in top of housing. Shakes capillaries thoroughly, insuring uniform packing of sample.

Both the Thermometer Illuminator and Periscopic Thermometer Reader are available for attachment to the basic instrument. The Reader presents a magnified scale image in a window just above the sample observation port. Fusion of sample can be observed and melting temperature noted without raising the head. Thermometer meniscus can be followed by turning knob at right. 6406-H. Melting Point Apparatus, Hoover "Uni-Melt," with armored ther-

The group of the second second

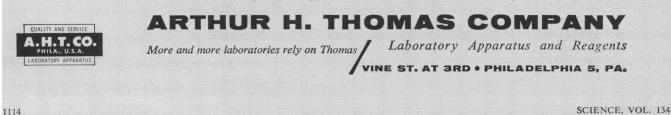
6406-M. Hoover Melting Point Apparatus, complete with Periscopic Reader and Thermometer Illuminator



Enlarged field of view when using Periscopic Reader

Accessories (For attachment to instruments already in use)

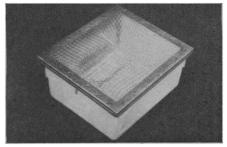
For more detailed description, see pp 624-625 of our new 1961 catalog.



ECONO-CAGE presents the disposable cage that stands by itself...

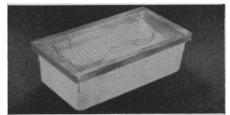
added to the line that stands by itself

The New Disposable Econo-Cage #21, Pictured Above, Brings To Animal Care A Rigid Plastic Disposable Cage That Spells Real Economy. It Stands By Itself Requiring No Expensive Supports That Prevent Full Visibility. Designed Primarily For Mice, The Cage Is $11\frac{1}{2}$ " X $7\frac{1}{2}$ " X 5" Deep. The Floor Area Of 84 Square Inches Will Adequately House Up To 12 Mice. All 20 Series Lids Fit The New Disposable Econo-Cage #21.



ECONO-CAGE #50 SERIES

The new 50 Series Econo-Cages and lids are designed for Hamsters or rats. Dimensions are 12% " X 14% " X 6%" deep with room for 11 adult Hamsters per cage. The cages are available in clear Acrylonitrile-Styrene Copolymer-Econo-Cage #53, Linear Polyethylene -Econo-Cage #54 and Polypropylene-Econo-Cage #55. All 50 Series lids fit interchangeably on 50 Series cages.



ECONO-CAGE #40 SERIES

Number 40 Series cages can be used interchangeably for Hamsters and/or rats. #43 is made of clear Acrilonitrile-Styrene-Copolymer, #44 of Linear Polyethylene and #45 of translucent Polypropylene. All 40 Series lids are standard 20 OCTOBER 1961 $\frac{1}{2}$ " mesh designed for rat housing and fit interchangeably on all 40 Series cages. All 30 Series lids also fit all 40 Series cages but have the $\frac{5}{16}$ " for mice.



ECONO-CAGE #30 SERIES

Number 30 Series cages are designed as breeding and holding cages for mice. The over-all dimensions are $19" \times 10^{1/2}"$ $\times 5^{1/8}"$ deep. Cage #32 is made of fiberglass, reinforced by plastic. Cage #33 is made of clear Acrylonitrile-Styrene Copolymer. Cage #34 is made of linear high density Polyethylene. Cage #35 is made of Polypropylene. All 30 Series lids are interchangeable on 30 Series cages.

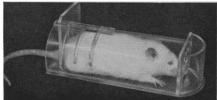


ECONO-CAGE #20 SERIES

Econo-Cages in the 20 Series are designed primarily for mice. Over-all dimensions of the cages are 111/2" X $7\frac{1}{2}$ " X 5". This cage is used for housing animals during experimentation and also as a one-to-one and two-to-one breeding cage. The cages are available in Polvstyrene - new disposable Econo-Cage #21, Fiberglass, reinforced plastic -Econo-Cage #22, clear Styrene-Acrylonitrile Copolymer - Econo-Cage #23, transculent Linear Polyethylene-Econo-Cage #24, autoclavable Polypropylene-Econo-Cage #25 and Polycarbonate Resin-Econo-Cage #27. All 20 Series lids are interchangeable on 20 Series cages.



GENERAL PURPOSE ECONO-CAGE #12 Over-all dimensions of the Econo-Cage general purpose unit are $11\frac{1}{2}$ " X 8" X 6" deep. This cage is designed especially for laboratories with changing animal use requirements. It can be used to house mice, Hamsters, rats and guinea pigs. Because of its versatility, it is ideal in teaching situations. The cage is available with or without windows. It is made of fiberglass reinforced polyester plastic. All #12 lids can be used on General Purpose Cage #12.



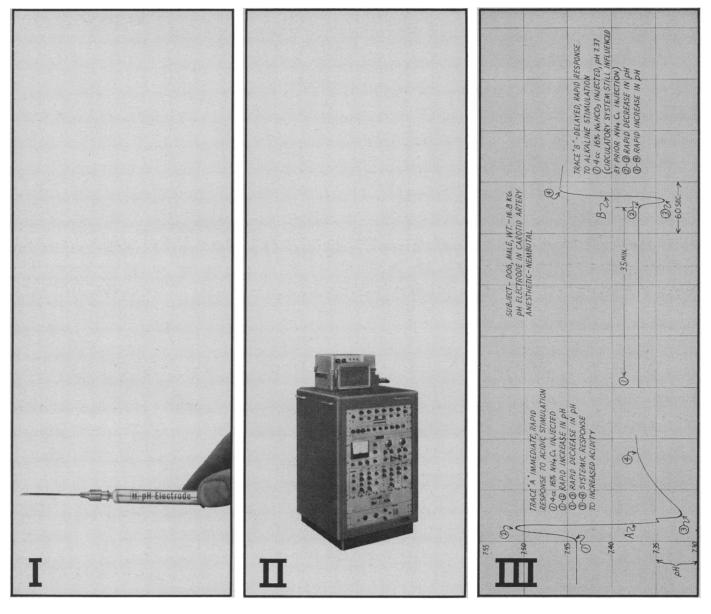
ECONO-RESTRAINING CAGES #90 SERIES

The small Restraining Cage #88 can be varied from 2" to $3\frac{1}{2}$ " in length and is $1\frac{1}{4}$ " wide. Econo-Cage #90 can be varied from $4\frac{1}{2}$ " to 6" in length and is $2\frac{1}{2}$ " wide. Econo-Cage #91 can be varied from 5" to 7" in length and is 3" wide. All these units can be cleaned chemically or with hot water. They are not autoclavable.

FOR MORE INFORMATION ABOUT THE LINE THAT STANDS BY ITSELF, write:



ECONO-CAGE DIVISION MARYLAND PLASTICS, INC. 9 East 37th Street, New York 16. N. Y.



HONEYWELL MEASURES in vivo pH PLUS

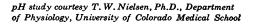
Now being used in bio-medical research, the *in vivo* pH channel is one of the twentyeight physiological measurement channels which you may select for your Honeywell Electronic Medical System.

The new Honeywell pH electrode enables you to now measure and record blood pH continuously with consistent accuracy. A one-piece instrument in which both active and reference electrodes are within a hypodermic needle, its accompanying circuitry is permanently sealed within the syringe barrel. The electrode (I) and its amplifier make up only one channel of a typical Honeywell Electronic Medical System(II).

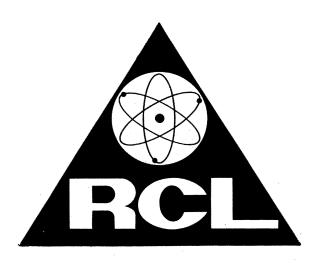
The pH record (III) is produced immediately (and simultaneously with contemporary data) on a direct-writing Honeywell multi-channel Visicorder oscillograph. Other Honeywell recorders, digital print-out devices, tape recorders, and automatic data reduction equipment are available for incorporation into any Honeywell Electronic Medical System.

MINNEAPOLIS-HONEYWELL ELECTRONIC MEDICAL SYSTEMS 5202 EAST EVANS AVENUE • DENVER 22, COLORADO

> Honeywell [H] Electronic Medical Systems-



Why doesn't everyone package quan	titative filter paper this way?
X	
Qua	ntitative RATORY APERS
To safeguard the purity, cleanliness and freshness of its quantitative filter paper, E-D takes an extra measure of precaution — uses a special protective polyethylene wrap to seal out every trace of dust and dirt. It's an extra guarantee of freshness and quality you just don't get from any other brand of quantitative paper.	Please send me free samples of the three new E-D Quantitative Filter Papers (#60, #70, and #80).
E-D, the nation's largest and most experienced producer of fine filter papers, is your most reliable source for both quantitative and qualitative paper filters. It is the only U. S. producer with complete pulp-through-product manufacturing process, assuring you of product quality that meets or exceeds all government standards. E-D quanti-	NAME
tative paper is manufactured in 3 grades (slow, medium, fast) to meet all your laboratory requirements. We'd like to send you a sample box to prove to you that these indeed are the best of circles the very finest quantitative papers you can use. Just use the coupon.	ADDRESS
Rigid quality control techniques assure a one-in-a- million chance that the ash content of a single circle will ever exceed Federal & ASTM specifications. Repeated analyses indicate a probability level P = 99 that the ash content of a single circle will be less than 75% of the specification limit.	THE EATON-DIKEMAN COMPANY MOUNT HOLLY SPRINGS, PENNSYLVANIA



your single source for integrated nuclear instrument systems for...

- Reactor Physics
- Chemical Analysis
- Radiochemical Research
- Life Sciences, Biological Studies
- Clinical and Medical Diagnoses, Research
- Health Physics, Monitoring, Safety Applications
- Industrial Control and Regulation

Visit us at the Atomfair Booths 611-612

PULSE HEIGHT ANALYZERS

One to 2048 channels. Quality proved by more than 15 years experience. Widest selection of operating modes; plug-in automatic programming and self-contained automatic operations, including the finest analog-to-digital converter available.

INSTRUMENT ACCESSORIES

Varied indicating, printing, recording, tape and memory storage, and readout accessories to satisfy the most exacting requirements.

POWER SUPPLIES

High and low voltage supplies: positive, negative, or positive and negative for every instrument requirement.

MONITORING INSTRUMENTS, SURVEY METERS

Area-wide or localized detecting instruments for fast, slow, or delayed neutrons.

SCALERS, COUNT RATE METERS

Linear, logarithmic, log/linear; binary or decade; self-printing, glow tube and/or audible outputs; available in module, cabinet or for rack mounting.

TIMERS, TEST INSTRUMENTS

Preset or elapsed timers, timer-scaler in module, cabinet or for panel mounting. Precision pulse generator for reference or calibration.

DETECTORS

Foremost source for all types of conventional and special purpose detectors and emission counters. Widest single or multiple array selection for special research requirements.

- End Window-1.2 to 4.0 mg/sq. cm. thickness.
- Gas Flow—Windowless or thin window, 2 or 4 pi geometry.
- Beta-Gamma—Organic or halogen quenched.
- Gamma—Thin or thick walls, for small or large samples.
- Slow Neutron—Size range: pencil to 20-inch threaded plug. Fast Neutron Detectors—Single to quadruple chambers.
- Gas Sample—From 250 to 1000 cc chamber; glass or stainless steel. Cosmic Ray—Organic quenched.

PROBES, COLLIMATORS, DETECTOR ACCESSORIES

Complete selection with or without preamplifier or cathode follower. **PREAMPLIFIERS, AMPLIFIERS**

Features: transistorized; high gain; low noise; extreme linearity. In module, cabinet, or for rack mounting.

SHIELDING, TRANSPORT, HANDLING, STORAGE, SAFETY ACCESSORIES

Complete supplies and accessories for laboratory requirements.

REFERENCE AND CALIBRATION SOURCES

Low-activity level, calibrated spectrometer reference sources: Co40, Cs137, Mn54, and Na22.

LABORATORY SPECIAL GLASSWARE, QUARTZ, AND REPAIR SERVICES.

Complete facilities for preparing glass or quartz ware to special chemical and radio-chemical laboratory requirements. Fast delivery of quartz rod, ingot, or tubing—*from stock*—in all commonly required sizes.

SELF-CONTAINED NUCLEAR INSTRUMENT SYSTEMS

Scaler-Ratemeter Counting System Scaler Counting System Clinical Laboratory Diagnostic Systems Whole Body Scanning System Four Pi Chromatogram Scanning System 512/256 Channel Analyzer System 256/128 Channel Analyzer System Neutron Activators

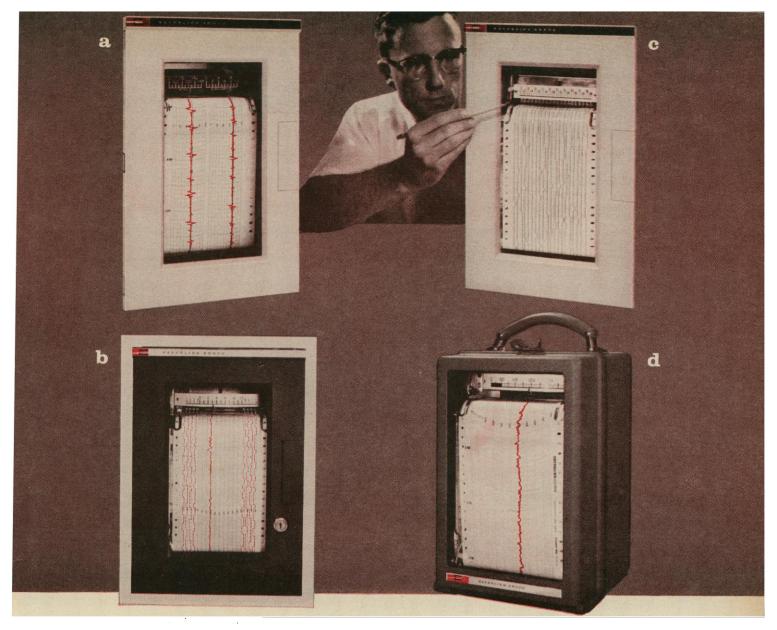
Neutron Activation / Proton Generation System



For detailed specifications, prices, delivery schedules or a demonstration of RCL transistorized instruments and systems write: Dept. N10,

RADIATION COUNTER LABORATORIES, INC.

5121 West Grove Street, Skokie, Illinois, U.S.A. Phone: YOrktown 6-8700 SCIENCE, VOL. 134



Available in portable, wall, flush and projection mounting switchboard cases

NEW Instrument Designs, Applications from Esterline Angus

B New "602" Two-channel Recorder • Simultaneously records two variants on adjacent 2"-sections of single 6"-wide chart. Applications: checking current and voltage, quality determination of arc welds, records of input vs. output.

b New Analog-Event Recorder • One instrument does the work of two . . . simultaneously records analog data and up to 8 channels of event information on single 6"-wide chart. Applications: wind speed and direction, substation bus voltage and breaker operation, rate of production (speed) and conveyor operation.

C New "620" Event Recorder with Tempen • Writes without ink, using electrically-heated styluses. Simultaneously records "when," "how long" and "how many" on as many as 20 channels. Applications: productive and nonproductive time of any or all machines in a plant, circuit breaker action, qualitative analysis, missile performance.

d New Expanded Scale Voltmeter • Provides increased readability of voltage records as upper ¼ of voltage range is expanded to fill upper 80% of chart span. Applications: checking voltage regulation, voltage records, trouble-shooting.

Standing solidly behind the creative designs of our engineering staff are the highly-developed skill and attention to detail of our master craftsmen. At right, M. R. Felske, Master Craftsman at Esterline Angus for 34 years. For more detailed information on any instrument or its applications, write: ESTERLINE ANGUS INSTRUMENT COMPANY, INC., Box 596-L, Indianapolis 6, Indiana.



Excellence in graphic recording for over 50 years - ESTERLINE ANGUS Makers of instruments to record: MICROAMPERES, DC · MILLIAMPERES, DC · AMPERES, AC AND DC · VOLTS, AC AND DC · WATTS, AC AND DC MAKERS OF INSTRUMENTS AC · FREQUÊNCY · POWER FACTOR · EVENTS · SPEED · POSITION · MOTION · PRESSURE · VACUUM

GET YOUR ADVANCE COPY of the General Program of the AAAS Denver Meeting by first class mail – early in December

The General Program of the 128th Meeting of the AAAS in Denver, 26–31 December 1961, will be available to you, at cost, within the first week in December—whether you can attend the Meeting or not.

Program Content

- 1. The two-session AAAS General Sessions, "Moving Frontiers of Science," Part I-Speakers: Howard A. Meyerhoff and Arthur R. von Hippel; Harrison Brown, presiding. Part II-Speakers: Halton C. Arp and E. W. Fager; Harrison Brown, presiding.
- 2. The 29th John Wesley Powell Memorial Lecture. Speaker: Glenn T. Seaborg; Paul M. Gross, presiding.
- 3. On "AAAS Day," the four broad, interdisciplinary symposia-Physics of the Upper Atmosphere; Geochemical Evolution-The First Five Billion Years; Existing Levels of Radioactivity in Man and His Environment; and Water and Climate-arranged by AAAS Sections jointly.
- 4. The Special Sessions: AAAS Presidential Address and Reception; Joint Address of Sigma Xi and Phi Beta Kappa by Harrison Brown; the Tau Beta Phi Address by John A. Logan; National Geographic Society Illustrated Lecture; and the second George Sarton Memorial Lecture by Joseph Kaplan.
- 5. The programs of all 18 AAAS Sections (specialized symposia and contributed papers).
- 6. The programs of the national meetings of the American Astronomical Society, American Society of Criminology, American Nature Study Society, American Society of Naturalists, American Society of Zoologists,

Beta Beta Beta Biological Society, Biometric Society (WNAR), National Association of Biology Teachers, Scientific Research Society of America, Society for General Systems Research, Society of Protozoologists, Society of Systematic Zoology, and the Society of the Sigma Xi.

- 7. The multi-sessioned special programs of the American Astronautical Society (Hugh L. Dryden as dinner speaker), American Physiological Society, American Psychiatric Association, Association of American Geographers, Ecological Society of America, National Science Teachers Association, National Speleological Society - and still others, a total of some 70 to 80 participating organizations.
- 8. The sessions of the Academy Conference, the Conference on Scientific Communication, and the Conference on Scientific Manpower.
- 9. The sessions of the AAAS Cooperative Committee on the Teaching of Science and Mathematics, of the AAAS Committee on Science in the Promotion of Human Welfare.
- 10. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
- 11. Exhibitors in the 1961 Annual Exposition of Science and Industry and descriptions of their exhibits.

Advance Registration

Advance registration has these decided advantages: (1) You avoid delay at the Registration Center upon arrival; (2) You receive the *General Program* in ample time to decide, unhurriedly, which events and sessions you particularly wish to attend; (3) Your name is posted in the Visible Directory as the Meeting opens.

The following coupon may be used both by advance registrants and by those who wish only the advance copy of the General Program.

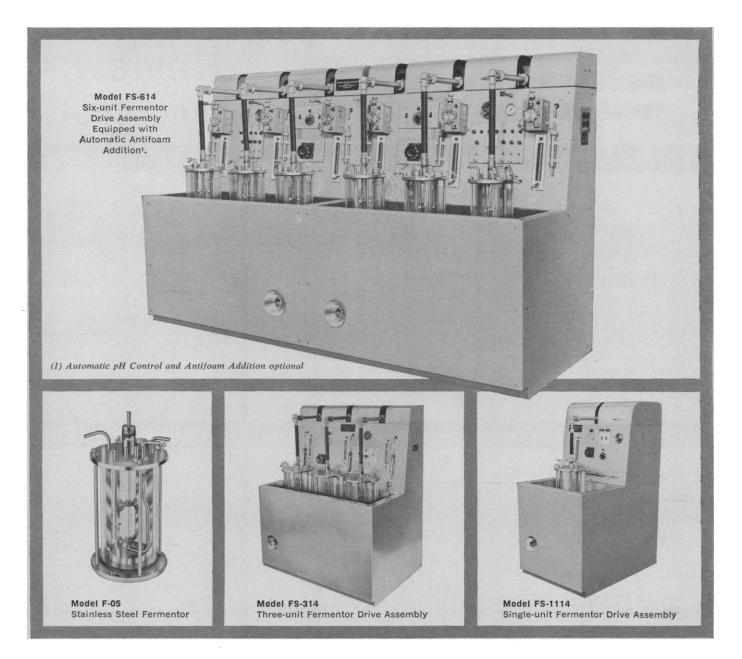
1b. □ Enclosed is \$2.50 for only the General Program. (It is understood that, if I should attend the Meeting later, the Badge-necessary for the privileges of the Meeting-will be secured for \$1.00 more.) (check 1a or 1b)

2. FULL NAME (Dr., Miss, etc.)	(Last)	(First)	(Initial)	
3. OFFICE OR HOME ADDRESS (For receipt of General Program)	· · · · · · · · · · · · · · · · · · ·	•••••	••••••••••••••••••••••••••••••••••••••	••
СІТҮ				
4. FIELD OF INTEREST	· • • • • • • • • • • • • • • • • • • •			••
5. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION				
6. CONVENTION ADDRESS	(May be added later, after arrive	al)		•
Please mail this coupon an AMERICAN ASSOC	nd your check or money ord IATION FOR THE ADVAN	er for the total amount NCEMENT OF SCIENC	to the E	

1515 Massachusetts Avenue, NW, Washington 5, D.C.

ORDERS RECEIVED AFTER 15 DECEMBER 1961 CANNOT BE PROCESSED





NBS FERMENTATION APPARATUS for the growth of Bacteria, Fungi, Yeasts, Tissue Cultures and Viruses

For Aerobic and Anerobic Studies of Microbial and Chemical Processes at Laboratory and Pilot Plant Levels The NBS Fermentor Drive Assemblies offer a convenient and efficient means for culturing microorganisms under well-defined conditions. Temperature, agitation, pH^1 , air volume and pressure can be selected and rigidly controlled while sterility is maintained.

Stainless steel fermentors with Pyrex glass jars are available in 5, $7\frac{1}{2}$ and 14 liter sizes. Impellers are driven through a non-freezing, stainless steel agitator housing which incorporates stainless steel ball bearings and leak-

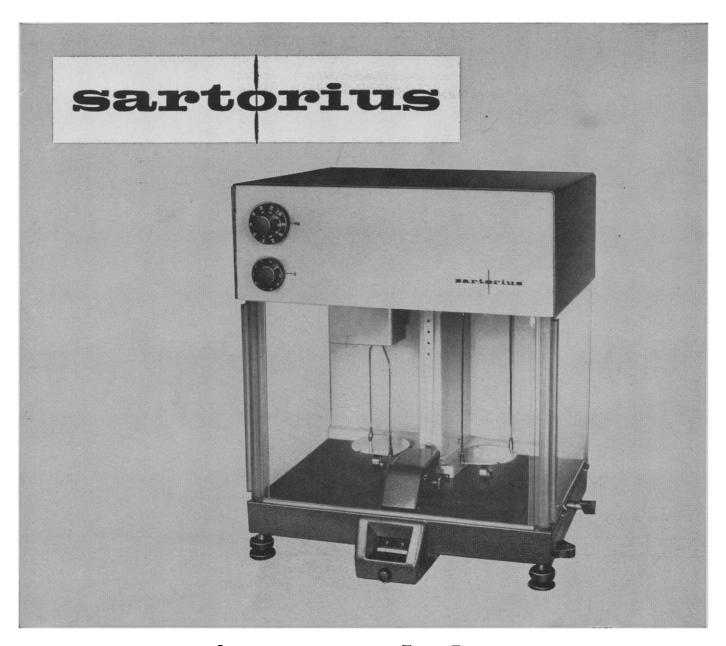
proof Teflon seals. The fermentors are easily and quickly disconnected from the drive and will sustain *repeated* autoclaving.

Water bath temperature is adjustable up to $60^{\circ}C \pm 0.5^{\circ}C$. A continuousduty, variable speed motor enables impeller speed to be regulated between 150 and 750 rpm. Performance is quiet and dependable under continuous operation. All NBS apparatus is unconditionally warranted for one full year. WRITE FOR CATALOG FS5/10201



BS **New Brunswick Scientific Co., Inc.** 1130 Somerset St., New Brunswick, N.J.

Manufacturers and Distributors of Precision Laboratory Apparatus



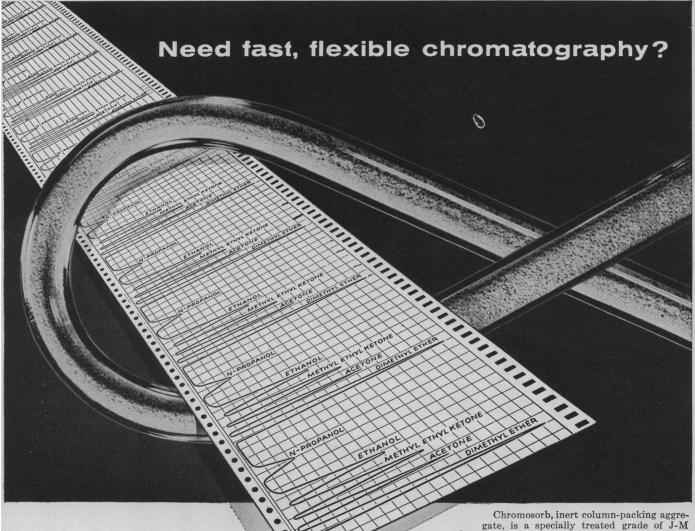
announcing: a new look a new proficiency

Introducing a new series of analytical balances. Modern in every respect — including a new all metal housing, built-in weights, air damping, and projection scale reading. The models in the 1500 series were designed for laboratories seeking the advantages of an automatic balance in a two pan system and medium price range.



A demonstration or trial of any Sartorius balance may be arranged through your nearest Sartorius distributor. For further information on Series 1500 balances, contact:

BRINKMANN INSTRUMENTS, INC. 115 Cutter Mill Road, Great Neck, N. Y. PHILADELPHIA · CLEVELAND · HOUSTON · MIAMI · MENLO PARK, CAL. • ST. LOUIS



gate, is a specially treated grade of J-M Celite*, the diatomaceous silica that was used in earliest gas chromatography studies.

You always get a good "picture" with Johns-Manville Chromosorb

As an aggregate in gas-liquid partition chromatography, J-M Chromosorb[®] gives high partitioning effect with maximum number of theoretical plates. Good resolution is obtained because it is chemically inert and won't adsorb components being passed through. You get uniform results, optimum reproducibility, and good flow of carrier gas without excessive pressure drop.

Chromosorb combines optimum surface area with high uniformity. For reduction of fines, all grades are water-screened to close tolerances. Packing is easy. Its physical stability and non-adsorption let you re-use the same column packing again and again. For further information, contact the dealer nearest you.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

For gas phase chromatography or where inertness is needed . . . Chromosorb **Typical Properties** Calcined diatomaceous earth aggregate.

JOHNS-MANVILLE

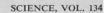
Moisture-% by weight, maximum 1.0 pH (avg.). pH (avg.)..... Surface Area—sq. m./gm. (avg.)....

For chromatographic studies . . . Chromosorb W Typical Properties

Flux calcined diatomaceous earth aggregate.

Free Fail Density-105./Cu. ft. (avg.)
Specific Gravity—true
Water Absorption—cc./gr. (avg.)
Moisture—% by weight, maximum
pH (avg.)
Surface Area (BET Method)-sq. m./gr. (avg.)3-4

For fine filtration of liquids in laboratory application...Celite Analytical Filter Aid Quality diatomite, calcined at high temperatures and acid-washed to remove organic and inorganic impurities. Filters out all types of precipitates, including the difficult-to-handle gelatinous and semi-colloidal materials, and produces brilliantly clear filtrates at high flow rates.



NEW MONEY-SAVING PLAN FOR PURCHASING J.T. BAKER LABORATORY CHEMICALS

620

New free specification catalog just off press gives full details

SPECIFICATION CATALOG and PRICE LIST

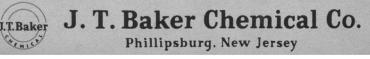
- Up-to-the-minute specifications and prices on more than 1,000 chemicals.
- New ACS reagents and spectrophotometric solvents.
- New, improved containers for safer, more convenient handling and storage.
- Tables on pH and redox indicators and other useful reference data.
- Names and addresses of Baker distributors-your quick, convenient sources of supply.

Here's your new J. T. Baker Specification Catalog and Price List No. 620 . . . bigger, more useful than ever . . . and you save money with Baker's unique new purchasing plan. Get full details - send for your free copy.

Baker Analyzed' Reagents

J. T. Baker Chemical Co. Phillipsburg. New Jersey

You'll find listings for more than 1,000 Baker laboratory chemicals, and specifications for 'Baker Analyzed' Reagents-with the highest purity and most precise labeling in the industry. You'll find 66 new items introduced since Catalog No. 58 and over 250 key organic chemicals for laboratory use.



Important: 'Baker Analyzed' Reagents offer you to-the-decimal definition of purity with the Actual Lot Analysis on every label ... plus the Actual Lot Assay on almost 350. You work faster with greater precision-you save money, too!

YES SEND NEW FR	EE CATALOG w	ith money-saving plan.
NAME		
ADDRESS	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
CITY		ZONE
STATE		DEPT. S-110

monitoring

... across the spectrum with just a turn of a DIAL

Now with just a turn of a dial you can continuously monitor column effluent for compounds absorbing at any wave length in the ultraviolet spectrum. Vanguard's all-new Model 1056 Automatic UV Analyzer performs with greater sensitivity and versatility than ever thought possible. Dualbeam operation utilizing sample and reference cuvettes provides continuous base line compensation for gradient elutions and for other applications where the optical density of the eluent may change. Operates with minimum super-vision and compatible with all Fraction Collectors. Automatic chart recorder marking system speeds identification by quickly and accurately locating test tubes in which absorbing materials are located.



To learn how you can save time while assuring positive identifications—even in the presence of highly absorbing solvents—write direct for complete details on the new Vanguard Model 1056 Automatic UV Analyzer.

- · Analyzes across the spectrum-from 200 to 400 millimicrons
- Particularly well-suited for gradient elution techniques-even when highly absorbing solvents are utilized
- Monochromator-coupled hydrogen light source permits selective dialing across UV spectrum
- Automatic chart recorder marking system locates absorbing materials by test tube
- · Compatible with all Fraction Collectors-regardless of make or model
- · Fully transistorized for long, precision service

P.O. Box 244 • LaGrange, Illinois • Fleetwood 4-5656 Regional Office: 115 New Montgomery Street • San Francisco, California • EXbrook 2-0511

SCIENCE, VOL. 134

.. HARDLY

SCIENTIFIC

INSTRUMENT

Good mixer, yes ... but hardly the tool for the many blending, mixing and grinding requirements of today's scientific laboratory. To meet these

requirements Waring designs and manufactures a specialized line of Blendors® and accessories. Let us send you complete details. Just fill in and mail the coupon.

WARING **COMMERCIAL BLENDORS ARE SERVING FIRMS AND** LABS IN THESE FIELDS

INKS—Detergents to reduce pen clogging **CEMENT**—Waterproof cement testing and mildew repellent concrete

CERAMICS—Kaolin and clay slurries COATINGS-Films, TV tubes, recording tape, adhesive compounds, duplicating machine emulsions

COSMETICS-Shampoos, nail polish, deodorants, powder, hand cream, hair dyes, aerosol hair spray and shaving lather

ELECTRONICS—Cathode ray tube coatings FERTILIZERS-Both liquid and dry, seed research, plants, cross-pollination, crab grass killer development

FOOD PROCESSING-Relishes, herb and condiment blending, dressings, dog foods **GENERAL LABORATORY USE**—Experimental dispersions, emulsions, polymers, slurry and solutions

HOMOGENIZING TEMPLATE EMULSIONS-Sheet aluminum, stainless steel

INSECTICIDES—Repellents and killers

INSULATION-Rock wool-fiber glass, asbestos, ground glass beads

PAINT-Color sampling, water-base, rubber-base, waterproof, enamels

PAPER-Waste paper evaluation, pulping wood fiber, coatings

PETROLEUM-High octane fuel, additives, grease, detergent motor oils

PLASTICS-Experimental mixes, color testing, powder and resin blending

PRINTING INK-Color blending, waterproof inks, engraving fluids

RUBBER-Latex, sponge, synthetic TEXTILES-Strength tests for synthetics, Nylon, Orlon, Dacron, wool and cotton TOBACCO-Chemical analyses, homogenized, experimental blends, mixtures VINYL—Upholstery bases color sampling



WARING PRODUCTS CORPORATION WINSTED . CONNECTICUT

A Subsidiary of **Dynamics Corporation of America**

Send me complete information on your Blendors for laboratory and industrial use. My field of interest is

GENTIEMEN.

Е

20 OCTOBER 1961



This year Harshaw's Crystal Division celebrates its Silver Anniversary. In these 25

years the "art" of growing crystals has given way to scientific procedures. With expanded crystal research and development laboratories, and recently doubled production facilities, Harshaw stands ready to produce your crystals—regardless of technical nature or production magnitude. Our physics, chemistry, and engineering departments enjoy the challenge of increasingly stringent demands from scientists and instrument manufacturers for infrared and ultraviolet optical crystals, and scintillation phosphors.

The Harshaw Chemical Company

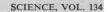
1945 East 97th Street • Cleveland 6, Ohio Utrecht, Netherlands – Contact Harshaw-Van Der Hoorn N. V., Juffaseweg 186 Ultra Violet Transmitting Optics

- Sodium Chloride
- Sodium Chloride Monochromator Plates
- Potassium Bromide
- Potassium Bromide Pellet Powder (through 200 on 325 mesh).
- Potassium Chloride
- Optical Silver Chloride
- Thallium Bromide Iodide
- Lithium Fluoride
- Lithium Fluoride
- Monochromator Plates
- Calcium Fluoride
- Barium Fluoride
- Cesium Bromide
- Cesium lodide

HAR

Write for our 36-page booklet "Synthetic Optical Crystals" or our 44-page booklet "Scintillation Phosphors"

Crystal Division



Crystal detectors designed for

your most sophisticated count-

ing problems. Our physics and

engineering groups are avail-

• Other Phosphors—Rough Cut Thallium Activated Sodium Iodide Crystal Blanks

• Europium Activated Lithium lodide (Normal)

• Europium Activated Lithium lodide (96% Li⁶ Enriched)

Thallium Activated Cesium

Thallium Activated Potassium

able to assist you.

lodide

lodide

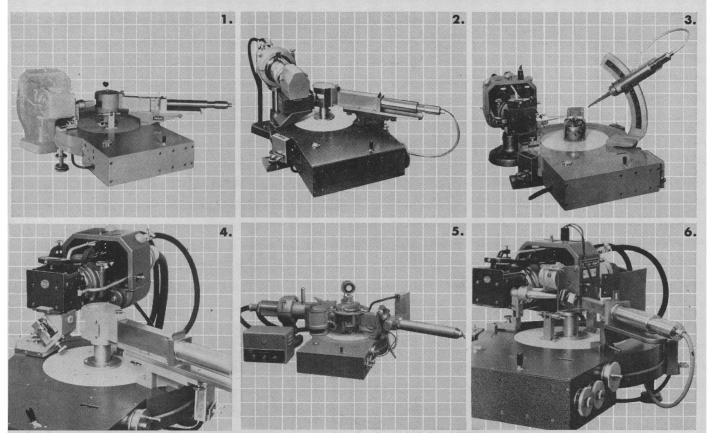
Anthracene

Plastic Phosphors



20 OCTOBER 1961

X-RAY DIFFRACTION AND SPECTROSCOPY



1. Counter Tube Diffractometry. 2. Spectroscopy. 3. Single Crystal Studies. 4. Spectroscopy of Small Areas. 5. Vacuum Spectroscopy of Light and VERSATILITY! Heavy Elements. 6. Studies of Orientation. **RCA's horizontal goniometer performs 6 functions**

Unusual versatility is an important distinguishing characteristic of RCA's X-Ray Diffraction and Spectroscopy Equipment. This versatility is graphically demonstrated by the horizontal goniometer which can perform six different functions merely by adding accessories, as illustrated above.

RCA X-Ray Diffraction and Spectroscopy Equipment offers many other outstanding features which make it one of today's most specified lines. For example, the DC regulated and filtered power supply; the option of mounting two tube stands on the Crystalloflex IV; a kit which permits conversion from diffraction to spectroscopy in minutes; and the new vacuum spectrometer for analysis of light and heavy elements. For those engaged in film studies of all kinds, the RCA Table Model Crystalloflex II can



The Most Trusted Name in Electronics RADIO CORPORATION OF AMERICA

be bought, complete with cameras, for as little as \$4000.

A NEW LEASING PLAN now makes it possible to obtain all RCA scientific instruments, including the Electron Microscope, with no down payment, low monthly terms, and a favorable option to buy.

For complete information write to RCA, Dept. AC-362, Bldg. 15-1, Camden, N.J.



Crystalloflex IV and Electronic Circuit Panel with Diffractometer and Guinier Camera mounted on the generator. SCIENCE, VOL. 134

hdiscount on 150-case orders of PYREX labware

You'll find it easy to build an order that qualifies for this new, big discount. You can fill *all* your lab needs from our line of borosilicate ware—the most complete line in the world.

We've been making borosilicate glass for 45 years. This unmatched experience accounts for the scope of the line and for the quality in each piece of PYREX ware. You can count on a balance of chemical, thermal, and mechanical properties. You can get that balance in the labware that helps you do your job better. Your laboratory supply dealer can help you take advantage of the new top discount and of the smaller case-quantity discounts which remain in effect.

Our new 150-case price list is a good place to start. If you need a copy, just write Laboratory Glassware Dept., 7510 Crystal St., Corning, N. Y.



CORNING GLASS WORKS CORNING MEANS RESEARCH IN GLASS

PYREX[®] laboratory ware... the tested tool of modern research

Books on Instruments and Methods

INSTRUMENTS AND MEAUREMENTS

Chemical Analysis, Electric Quantities, Nucleonics and Process Control

Proceedings of the Fifth International Instruments and Measurements Conference, September 13-16, 1960, Stockholm Edited by Helge von Koch and Gregory Ljungberg

Volume 1, September 1961, 506 pp., \$16.00 **Automatic Process Control Physical Methods of Chemical Analysis**

Volume 2, September 1961, 721 pp., \$22.00

Nuclear Instrumentation Measurements of Electric and Magnetic Quantities **Reactor Control**

The proceedings of this conference, sponsored by the Royal Swedish Academy of Engineering Sciences and the Swedish As-sociation of Technical Physicists, are available in published form within minimum time after their presentation. The subdvisions of the two volumes correspond to the organization of the conference. They contain 117 papers by 210 scientists representing 79 countries. The information included will be highly useful to all measurement and precise control are essential.

FLUORESCENCE ASSAY IN BIOLOGY AND MEDICINE

SIDNEY UDENFRIEND, National Institutes of Health Bν Bethesda, Maryland

December 1961, about 450 pp., approx. \$12.00

Besides providing a working knowledge of fluorescence theory and practice, this work is intended to convey the wide range of potential applications of this method to structural studies on proteins and other macromolecules, to research into enzymecoenzyme-substrate interaction, to immunochemistry, to studies on endocrine secretions, and to many other areas of research and testing. 'Biology' is used in a broad sense and includes applica-tions in public health and sanitation, food inspection (including quality control), toxicology, detection of insecticide residues, and other specialized fields.

QUANTITATIVE ORGANIC MICROANALYSIS

Second Edition, revised and enlarged

By AL STEYERMARK, Hoffmann-La Roche, Inc., Nutley, New Jersey

June 1961, 665 pp., \$16.50

The material included in the first edition has been modified extensively in order to incorporate recent improvements and advances in techniques. In addition, considerable material has been added, including discussions of test samples, blank tests, descrip-tion of a second type of efficient vibration-absorbing balance table, enlargement of the section on microchemical balances, new Kjel-dahl procedures to determine nitrogen in compounds in which nitrogen is connected to nitrogen or to oxygen, oxygen flask combustions, determination of fluorine, and microhydrogenation. All of the methods included have been stringently evaluated for re-liability in the hands of many different chemists.

PHYSICAL METHODS IN CHEMICAL ANALYSIS

Edited by WALTER G. BERL September 1961, 476 pp., \$16.00

ELECTROPHYSIOLOGICAL METHODS IN BIOLOGICAL RESEARCH

By J. BUREŠ, M. PÉTRAŇ, and J. ZACHAR May 1961, 515 pp., \$15.00

GENERAL CYTOCHEMICAL METHODS

Edited by J. F. DANIELLI Volume 2, October 1961, 297 pp., \$10.00

ULTRAVIOLET AND VISIBLE ABSORPTION SPECTRA

INDEX FOR 1955-1959

 $B\gamma$ Herbert M. Hershenson September 1961, 133 pp., \$8.00

ULTRAVIOLET AND VISIBLE ABSORPTION SPECTRA

INDEX FOR 1930-1954

By HERBERT M. HERSHENSON 1956 (Third Printing, 1961), 205 pp., \$12.00

INFRARED ABSORPTION SPECTRA

INDEX FOR 1945-1957

By HERBERT M. HERSHENSON 1959 (Second Printing, 1961), 111 pp., \$7.00

METHODS OF EXPERIMENTAL PHYSICS

Edited by L. MARTON

Volume 3, MOLECULAR PHYSICS Edited by DUDLEY WILLIAMS January 1962, about 550 pp.

Volumes 5A and 5B, NUCLEAR PHYSICS Edited by LUKE C. L. YUAN and CHIEN-SHIUNG WU Volume 5A, October 1961, 733 pp., \$18.00 Volume 5B, in preparation

GAS CHROMATOGRAPHY

Proceedings of the Second International Symposium held in East Lansing, Michigan, June 1959

Edited by HENRY J. NOEBELS, ROBERT F. WALL, and N. BRENNER March 1961, 464 pp., \$16.00

X-RAY ANALYSIS OF ORGANIC STRUCTURES

 $B\gamma$ S. C. Nyburg May 1961, 434 pp., \$13.00

HISTOLOGICAL TECHNIQUES FOR ELECTRON MICROSCOPY

By D. C. Pease 1960, 274 pp., \$7.50

Detailed literature available upon request

ACADEMIC PRESS, New York and London

111 Fifth Avenue, New York 3, New York

17 Old Queen Street, London, S. W. 1

SCIENCE, VOL. 134

NEW from SARGENT

RECORDING TITRATOR

For Potentiometrically Indicated Reactions

- DUAL MOTOR DRIVEN TITRATING ASSEMBLIES
- MULTIPLE DIRECT READING pH RANGES
- MUTIPLE DIRECT READING MILLIVOLT RANGES
- AUTOMATIC RATE CONTROL
- . LOW COST

A basic, universal recording titrator for any and all potentiometrically indicated reactions, using any form of electrode, either glass or metal, accommodating high or low resistance systems, aqueous or non-aqueous media, and all practical orders of constituent quantities whether in trace, micro or macro concentrations. This titrator is at once a fast balancing, high precision, multi-range recording pH meter and millivolt meter and an efficient all-purpose titrating station with two independent working positions, each having full motorized titrant delivery systems with high speed filling and flushing, automatic safety switches and interchangeable small and large volume burette components. Consolidating these facilities to create an unprecedented work capacity are the synchronized burette and chart drive with direct volume reading on the chart axis and the new Sargent wide ratio automatic rate control.

Model D

For Complete Information Write For Bulletin D

Designed and Manufactured by E. H. SARGENT & CO.

SARGENT SCIENTIFIC LABORATORY INSTRUMENTS • APPARATUS • SUPPLIES • CHEMICALS

E.H. SARGENT & CO., 4647 WEST FOSTER AVE., CHICAGO 30, ILLINOIS DETROIT 4, MICH. • DALLAS 35, TEXAS • BIRMINGHAM 4, ALA. • SPRINGFIELD, N. J. • ANAHEIM, CALIF.

20 OCTOBER 1961

THE BEST MOUSE CAGE...AND THE MOST ECONOMICAL! THE NEW S.I.U. DISPOSABLE CAGE

as low as

Proved in America's finest laboratories

Modernize your lab routine this easy way ... save money, too! Try these *disposable* cages that cost less than it costs to clean, maintain and store ordinary metal or plastic types. Tough, inert, escape-proof plastic construction that you use just once ... then throw away! No fuss, no muss, no bother. Always clean, safe, ready to use. Transparent for continuous observation. Used with ventilated

Neur Idea! You can save personnel time and add convenience, by *nesting* a quantity of cages before you start your experiments. Just lift off the used cage at conclusion of the test and you have a fresh, clean cage nested below! A great time-saver.

Complete S.I.U. cage system consists of: Disposable Plastic cage bottom, nickel-plated steel top, cage support (permanent or disposable type), aluminum food hopper, water bottle and stopper, stainless steel feeding tube.

• Write for complete Bulletin and names of exclusive distributors.

metal top and unique support systems.

DISPOSABLE LABORATORY CAGES, Inc. Division of Labline, Inc. 3070 W. Grand Avenue, Chicago 22, Illinois Dept. C

to yourself. Order the inexpensive Test Package at only \$19.75... enough for CAT. NO. 9000 10 complete tests.



YOUR CHOICE OF "CLEER-VUE"

PERMANENT-TYPE

SUPPORTS

Made of nickel-plated steel to provide

firm, safe support for S. I. U. cages. Will

last indefinitely.

OR

A sturdy, practical cardboard support with a perforated record card on the front...Completely disposable.

†Developed by the Microbiology and Design Department of Southern Illinois University, Carbondale, Ill.

Foreign and Domestic Patents Pending

*When purchased in quantities.

SCIENCE, VOL. 134

PICKER NUCLEAR goes all the way... offers first FULLY TRANSISTORIZED SCALERS AT SENSIBLE PRICES

Among these new scalers, there's one (or more) precisely tailored to your need. Common to all are ...

all this counting prowess

all-electronic decades all-electronic timer (optional) preset count and preset time 1 microsecond resolving time 1600, 3200, and/or 500 volt HV supply

12 or 25 mv input sensitivity precision pulse height analyzer or discriminator (optional)

automatic operation count and time read-out (optional) simplified controls

prompt delivery

"你不是一些主要的

get details from your local Picker representative, or write Picker X-Ray Corporation, White Plains, New York

DECKER

no capital investment if you'd rather rent-ask about the PICKER RENTAL PLAN

all these operating advantages

(because they're fully transistorized) greater operating stability greater long term stability no need for warm-up delay longer component life greater compactness easier circuit replacement more uniform production quality

20 OCTOBER 1961



 Stock No. 70,464-W All five Senses _____\$10.00 Postpaid

 Stock No. 70,465-W Eye ______\$ 2.00 Postpaid

 Stock No. 70,466-W Ear ______\$ 2.00 Postpaid

 Stock No. 70,466-W Touch ______\$ 2.00 Postpaid

 Stock No. 70,468-W Smell ______\$ 2.00 Postpaid

 Stock No. 70,468-W Smell ______\$ 2.00 Postpaid

 Stock No. 70,468-W Taste ______\$ 2.00 Postpaid

THERMOMETER TIE BAR AND CUFF LINKS **REGISTER AS HOT CONVERSATION PIECE**



Respondence of the set of curf Links and the set of the set

1000

separately. Stock No. 1700-W Tie Clasp -----\$3.25 Ppd. tax incl. Stock No. 1701-W Cuff Links -----\$6.55 Ppd. tax incl. Stock No. 1702-W Set of Clasp & Links, \$8.75 Ppd. tax incl.

WHIRLING WONDERS

Wonderful World of Whirling Wheels

Here's a new adventure in optical impressions—created by the magi-cal effect of these fascinating, rotating discs. In addition to weird shapes and fantastic "after Images" this kit demonstrates "stop motion" strohoscopic principles—"off center" focus and even hypnotism. Kit includes 13 discs, approx. 5" in dia. battery holder, rheostat, small motor mounted on bracket, bulb, socket, plug and complete booklet of instructions and experimental use.

Stock No. 70,414-W_____\$9.95 Postpaid

LIFE SIZE VISIBLE HUMAN HEAD



Study the most complex organ easily, inex-pensively. Ideal for student, hobbyist, pro-fessional. You will be amazed at the detail. Molded from actual human skull. Eyes, ears, and teeth easily removed and disassembled for complete study. Entire brain, spinal ord and organs of mouth and throat presented in vivid detail. Amazingly low price-conforms to rigid laboratory standards. 16-page fully illustrated medical handbook included.

Stock, No. 70.447-W ______\$9.95 Postnaid

DE LUXE ADVANCED MODEL MARK II Stock No. 70.489-W 15" x 6" x 111/2" ____\$19.95 Pstpd.



Stock No. 60,117-W _____ \$5.95 Postnaid

•

ORDER BY STOCK NUMBER . . . SEND CHECK OR MONEY ORDER . . . SATISFACTION GUARANTEED! (•**)**

SCIENCE, VOL. 134



New PLASTICS ENGINEERING SET Keep pace with advances in plastics

sizes avail. ea. incl. bag of growing medium.

Stock No. 70.490-W Low-lidded model. 7" high \$14.95 Pp.

Stock No. 70,491-W High-lidded model, 15" high \$21,95 Pp.

Experiment in Plastics with

Keep pace with advances in plastics technology. Innumerable profit op-portunities. Designed for working knowledge for non-plastics tech-nicians, etc. Teaches how to identify and shows unusual properties and be-havior of different plastics. Demon-strates heat forming, heat sealing, cementing. Depicts methods of foam casting, solid casting, rotational products by injection molding and blow molding. Kit 15" x 6" x 11%". Incl. non-tech. instr. manual.

Stock No. 70,456-W _____\$25.00 Postpaid

NOW . . . BE YOUR OWN WEATHERMAN!



WEATHER STATION MARK I WEATHER STATION MARK I performs all measurements and com-putations for professional weather forecasts. Rise and fall of fluid in Cape Cod Glass shows changes in barometric pressure. Also compute wind speed and direction, measure rainfall, figure dew point, read wet-bub temperature et Weather man-

built temperature, etc. Weather man-ual included—clear instructions for calculating the Tem-perature-Humidity Index and relative humidity. Fully portable. Panels and packaging of heavy polysterene.

Fully Stock No. 70.488-W 15" x 6" x 81/4" _____\$9.95 Pstpd.

Bring Up Under-water ireasures Heal fun! Profitable, tool Simply trail this powerful 5 lb. Magnet out the stern of your hoat-retrieve outboard motors, fishing tackle, anchors, other metal valu-ables. Alnico V-Type Magnet has ter-rific lifting power-2000 Gauss rating-lifts over 125 lbs. on land-more under water. Many in-dustrial uses, too; recover tools and parts from inacces-sible spots, hold work in place, rid shop floors of metal tragments, plas, etc.

Stock No. 70,183-W 5-lb. size _____\$9.95 Pstpd. Stock No. 70,416-W 3½-lb. size _____\$7.95 Pstpd.



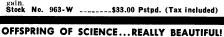
Big savings! Brand new! Crystal clear viewing—7 power. Every opti-cal element is coated. An excellent night glass—the size recommended for satellite viewing. Individual eye focus. Exit pupil 7mm. Approx. field at 1.000 yds. is 376 ft. Carrying case included. American 7 x 50's normally cost \$274.50. Our war sur-plus price saves you real money.

"FISH" WITH A GIANT MAGNET **Bring Up Under-Water Treasures**



____Only \$74.80 postpd. Stock No. 1544-W (Tax included)

x 30 Binoculars-similar to above and a terrific har-



BARRINGTON, NEW

đ,



Shimmering rainbows of gemilike color in jeweiry of exquisite beauty-made with CIR CULAR DIFFRACTION-GRATING REPLICA. Just as a prism breaks up light into its full range of individual colors, so does the diffraction grating. Promises to become a rage in current fashion.

 Stock No. 30,349-W Earrings
 \$2.20 Pstpd.

 Stock No. 30,350-W Cuff Links
 \$2.20 Pstpd.

 Stock No. 30,372-W Pendant
 \$2.0 Pstpd.

 Stock No. 30,390-W Tie-Clasp
 \$1.65 Pstpd.

144 Pages!

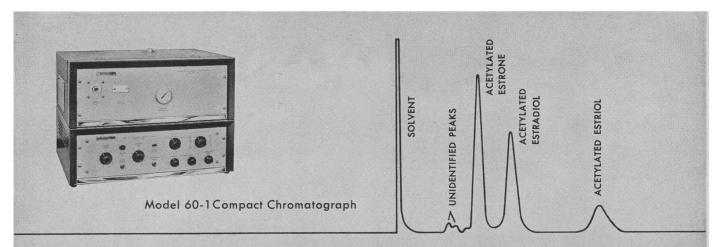
Barrington, N. J.

JERSEY

MATH OPTICS

in Line

4 •



Chromatogram of an estrogenic steroid separation using the Model 60-1 Compact Chromatograph.

from Acetone to Zingerone ...

you'll find in this pair of RSCo Gas Chromatographs the capability you need to separate and quantitate compounds on any scale, from macro volumes to the most minute trace components.

The Versatile, Viable Series 600

Series 600 modules add up to as complete and flexible a gas chromatography system as you will find anywhere, at any price. Any one of several possible modular combinations fashions a system to meet your current needs. Add a new detector and power supply to an existing unit, and you obtain the equivalent of an entirely new instrument. Interchangeability of modules and the ability to expand the system economically in any direction you choose gives you a viable instrument that defies long-term obsolescence.

Accuracy and resolution? More than sufficient to satisfy the most demanding requirements.

The Ultra-Sensitive Model 60-1

Fleeting trace substances are arrested in flight by the remarkable Model 60-1 Compact Chromatograph with hydrogen flame ionization detector. Where that extra surge of sensitivity is needed — enough to spot steroids in blood or urine samples, for example — Model 60-1 delivers up to 2×10^{-13} moles/sec worth. This means detection power that discerns traces of propane down to 3 ppb.

Size? A space-saving $201/_2'' \times 151/_4'' \times 16''$ high. Price? About half that of a large laboratory instrument.

600		
usro.	RESEARCH SPECIALTIES C	0.
9	200 SOUTH GARRARD BLVD. RICHMOND, CALIFOR	NIA

SERIES 600 MODULAR CHROMATOGRAPH

a. lonization Detector and Oven Assembly; b. Calumn Oven; c. Injection and Output Housing; d. Capillary Sample Injector; e. Main Control Unit; f. Detector Power Supply; g. Flow Controller; h. Manual Temperature Controller; i. Proportional Temperature Controller; j. Recorder Unit; k. Instrument Table.

ь

MAIL TODAY

1



200 South Garrard Richmond, Californi	
Model 60-1 C	e checked below: is Chromatograph illustrated catalogue. ompact Chromatograph information bulletin. e bibliography on steroid studies by
gas chromato	graphy.
gas chromato	graphyDept
gas chromato Name	· · · ·
gas chromato Name Institution	Dept

A Model NK-1 Spectrophotometer . . .

most resolution per dollar of any IR instrument!

The Model NK-I's resolution and scanning speed capabilities far exceed those of any other competitively-priced instrument. What's more, its performance equals that of infrared spectrophotometers costing thousands of dollars more. Fast scans with excellent resolution are the result of the globar source and the unusually large optics used in the NK-1 to generate and pass radiant infrared energy. Special electronic circuits for Automatic Scan Control and Accelerated Scan Program allow you to take full advantage of this vast energy superiority. The Model NK-1 has the reproducible

The Model NK-1 has the reproducible photometric and wavelength accuracy required for exacting quantitative analysis and for positive absorption band identification. In addition, the NK-1 is an extremely flexible instrument. Any wavelength region between 0.25 and 38 μ can be selected for study. In the 2.0 to 16.0 μ NaCl region, wavelength resolution is 0.015 μ . And with special optics, sources and detectors available, it can be used for special research in addition to conventional applications. The NK-1 Spectrophotometer also

The NK-1 Spectrophotometer also offers many convenience features. Among them: a large, unique sample area that provides plenty of room to work with special sample cells; and special mountings that allow prisms and associated cams to be changed in less than one minute with no calibration required. Furthermore, it is a compact unit with both optics and electronics enclosed under a single cover. And now, Baird-Atomic supplies a full line of accessories for liquids, solids and gases — including ultra-micro cells, pressure cells, and long path length cells.

Engineers and scientists: Investigate challenging opportunities with Baird-Atomic. Write Industrial Relations Director. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

NEW BROCHURE AVAILABLE. A new, 20-page brochure supplying technical details and specifications for the NK-1 Spectrophotometer and accessory equipment is now available from Baird-Atomic. Write for your copy today and discover why we can say "most resolution per dollar of any IR instrument!"



ADVANCED OPTICS AND ELECTRONICS...SERVING SCIENCE

ENCYCLOPAEDIC DICTIONARY OF PHYSICS

an indispensable work of reference...

8 volumes \$298.00 the set 15,000 terms subject indexed bibliography • 60 sections

.

Editor-in-Chief: J. THEWLIS (Atomic Energy Research Establishment at Harwell) Associate Editors: D. J. HUGHES (Brookhaven National Laboratory) A. R. MEETHAM (N.P.L. Teddington) R. C. GLASS (London) plus 3,609 of the world's internationally known physical scientists.

After many years of preparation, one of the great accomplishments of scientific publishing is now available! Exhaustive, comprehensive in scope and eminently authoritative, this is a work no person active or interested in the field of physical science can afford to be without. It is indispensable to scientists, engineers, doctors, science teachers, students; managers of technical, engineering, research and industrial establishments, consulting and design engineers' offices; university, industrial, technical college, secondary school and large public libraries.

This work covers physics proper, mathematics, astronomy, aerodynamics, hydraulics, geophysics, metrology, physical metallurgy, radiation chemistry, physical chemistry, structural chemistry, crystallography, medical physics, biophysics and photography.

Some of the distinguished to this encyclopaedic work	consultants and contributors
G. ARRHENIUS (California) G. BREIT (Yale) R. L. COOL (Brookhaven) M. J. S. DEWAR (Chicago) G. J. DIENES (Brookhaven) W. M. ELSASSER (Utah) H. EYRING (Utah) M. J. SCOTT (Harwell) R. C. GARTH (Brookhaven) S. A. GOUDSMIT (Brookhaven) J. A. HARVEY (Oak Ridge) W. A. HIGINBOTHAM (Brookhaven)	 B. JIRGENSONS (Texas) E. C. POLLARD (Yale) R. J. SEEGER (Washington, D. C.) A. H. BECK (Cambridge) G. BOMFORD (Oxford) H. BROOKS (Harvard) SIR EDWARD BULLARD (Cambridge) A. L. CULLEN (Sheffield) P. A. SHEPPARD (London) I. A. SINGER (Brookhaven) E. E. SMITH (London)

the whole of physical knowledge

Written by 3,609 of the world's leading physicists, mathematicians, chemists and engineers, this eight-volume work puts the whole of physical knowledge on the bookshelf. Its alphabetical arrangement, bibliographies, subject index and six-language glossary are only a few of the outstanding features of this work. "Advances in Physics", an annual supplement, will keep this work up to date.

six-language glossary

The six-language glossary, included with the set, is a unique compilation of physical terms in six languages—English, French, German, Spanish, Russian and Japanese, enabling terms in any of these languages to be found in the others. Also available separately at \$60.00 the copy.

examine Volume I without obligation

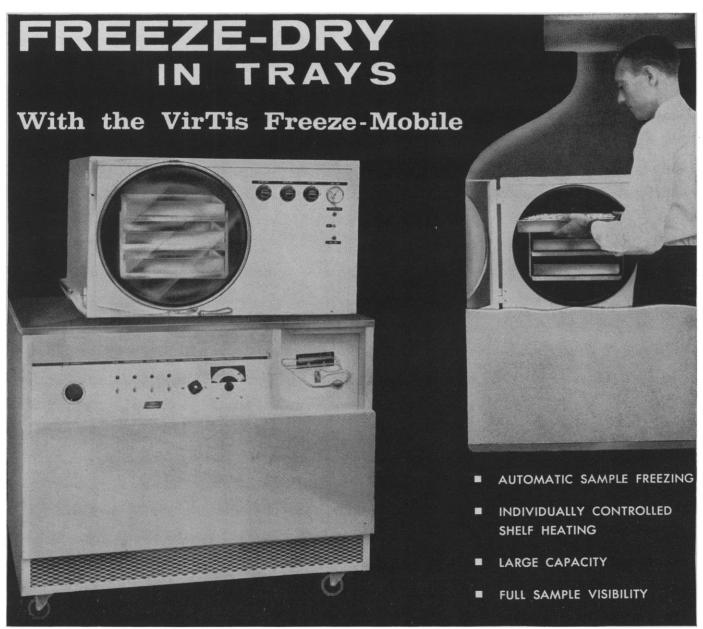
You are invited to examine Volume I of this exceptional and indispensable reference work without cost or obligation! Use the coupon below to obtain your copy for examination during a 30-day period. If you agree it will be of lasting value to you and to your organization, keep Volume I, and receive the subsequent volumes at monthly intervals. Payment in advance need not be sent; invoices for each volume will be forwarded as delivery is made, prorated for the cost of the complete set. If you do not wish to receive the entire ENCYCLOPAEDIC DIC-TIONARY OF PHYSICS, simply return Volume I within 30 days, without further obligation. You risk nothing by taking advantage of this opportunity. USE THE COUPON TODAY!



20 OCTOBER 1961

PERGAMON PRESS, INC., Dept. S1, 122 E. 55th St., New York 22, N.Y. Yes, please send me my advance copy of Vol. I for 30 days' free examination. I understand that if I agree that this work is of lasting interest and value to me, I need take no further action. I will simply keep Volume I, and you will send subsequent volumes to me as published. You will invoice me after 30 days for the first volume and for each volume thereafter as published, on a pro-rated basis.

If I decide to return the first volume, no subsequen	it shipments will be sent to me.	
Name		• • • • •
Street	•••••••••••••••••••••••••••••••••••••••	· • • • •
City		• • • • •



Freeze-drying in trays is the method employed by the pharmaceutical industries for large scale production of heat labile biologicals. Now, VirTis offers this convenient procedure to the research laboratory. The VirTis Mechanically Refrigerated Freeze-Mobile, equipped with the Tray Drying Chamber, provides a fully automatic system for processing volumes up to seven liters at one time. Materials to be dried are simply poured directly into the three stainless steel trays provided, or they are filled into suitable containers such as serum bottles.

Samples are frozen automatically on the refrigerated shelves. Precisely controlled drying rates are easily obtained with thermostatically controlled heat input to samples during freeze-drying.

Tray drying effects enormous economies in both time and material. Large volume dehydrations can be set up in less time than connecting a few ampoules to a manifold type freeze-dryer requires. And dry ice-solvent costs and inconveniences are eliminated.

For special applications, the Tray Drying Chamber may be removed from the Freeze-Mobile cabinet and replaced with a manifold or other type of freeze-drying chamber. Two electrical connections are all that are needed to operate this fully mobile, remarkably compact instrument.

For full details on the Mechanically Refrigerated Freeze-Mobile, Model No. 10-145MR-TR, write:



THE VirTis COMPANY, INC.

GARDINER, NEW YORK

MURANO® COLORS

Interference Films in the form of Microscopic Platelets

The particles of Murano Colors are very thin microscopic hexagonal platelets of a lead compound, each of which acts like a tiny interference film. Thus a plastic film or sheet, containing the pigment, behaves like an interference filter...reflecting one color...transmitting another.

Murano Colors are available as concentrated pastes or suspensions and may be dispersed in lacquers, cast in polymerizable resins, such as acrylates and polyesters, or incorporated in thermoplastics, such as polystyrene and polyvinyl chloride.

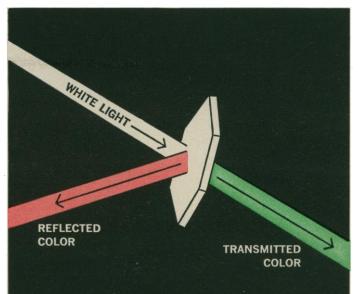
The plate-like character of the particles imparts a pearlescent luster, in addition to color, when viewed by reflection.

Will the Murano Colors have

application in your field?

You are invited to explore the possibilities that these tiny interference films may be employed to help solve research problems in your work...

PLEASE WRITE US for technical literature and samples.

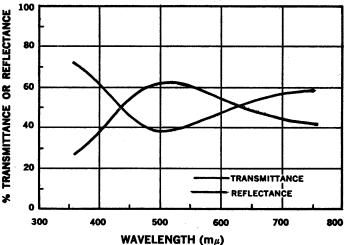


These platelets have the inherent property of reflecting light of one color and of transmitting light of the complementary color without absorption of light.

OPTICAL PROPERTIES OF MURANO COLORS:

Murano Color	Reflected Color	Transmitted Color
BA	YELLOW	BLUE
BD	RED	GREEN
BF	BLUE	
вн	GREEN	RED

TRANSMITTANCE AND REFLECTANCE CURVES FOR MURANO COLOR BD

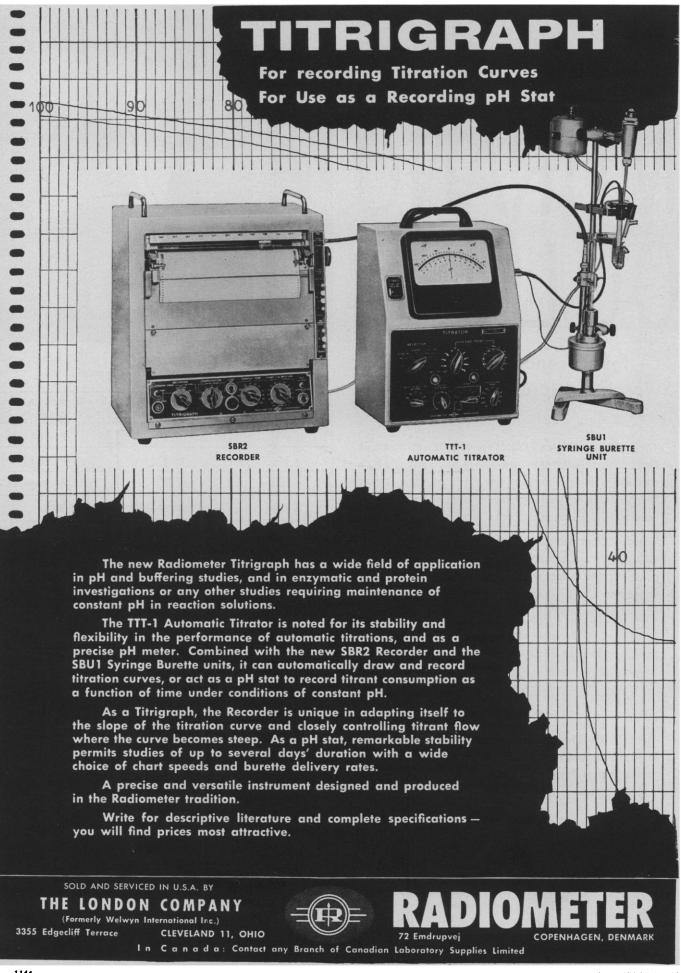


Ossining. New York

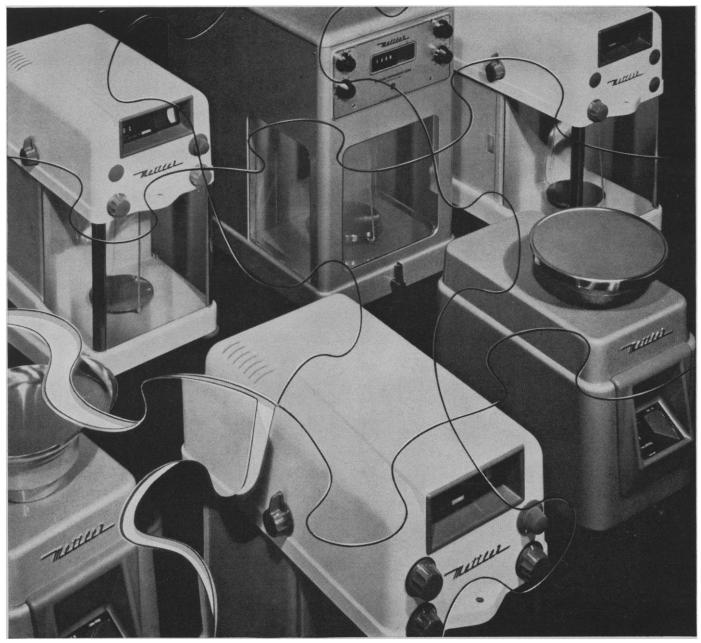
THE MEARL CORPORATION



20 OCTOBER 1961



SCIENCE, VOL. 134



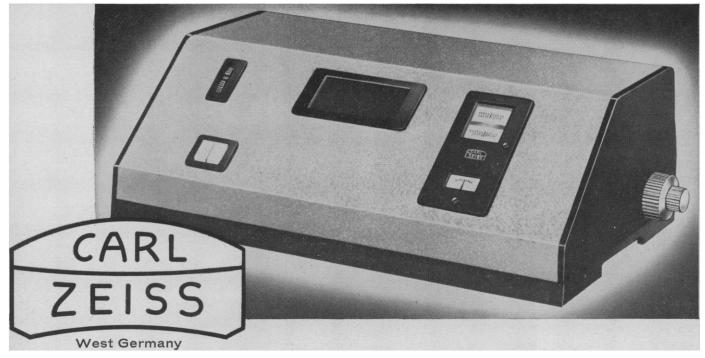
Mettler Balances from S/P which one fits your needs?

From micro to macro, there's a Mettler Balance from S/P that's perfectly suited to your laboratory. These modern single pan balances are fast, accurate, convenient. With Mettler Balances, it takes less than 30 seconds to determine an unknown weight, and they're so simple to operate no special training is required.

Scientific Products has Mettler Balances in stock. For complete literature or a conclusive demonstration, ask your S/P Representative or write our General Offices (address below).



Regional Offices: Atlanta · Boston · Charlotte · Chicago · Columbus · Dallas · Detroit · Kansas City Los Angeles · Miami · Minneapolis · New York · San Francisco · Washington Export Department—Flushing 58, L. I., New York. In Mexico: Hoffmann-Pinther & Bosworth, S. A.



Photoelectric Precision Polarimeter 0.005°

Supreme accuracy and speed in measurement

The unique photoelectric principle used in this polarimeter results in a measuring accuracy of 0.0025° as well as the elimination of subjective-setting and correction of errors. It is remarkably easy to operate.

The polarimeter tubes, with a path length of 10, 20, 50 and 100mm, are automatically lowered into the housing and brought into the path of rays. The electric indicator instrument is set to zero by conveniently located knobs for coarse and fine adjustment, and the angle of rotation can be immediately read off on two projected scales representing diametrically opposed sections at 20x magnification. This projection of the scales permits use of the instrument in undarkened rooms. Reading is direct to 0.005° and by estimation to 0.0025° .

Automatic control maintains full measuring accuracy even for strongly absorbent samples.

Five double-band interference filters for wave lengths 365, 405, 436, 546 and 578 m^{μ} of the light of a built-in mercury lamp permit measuring of optical rotatory dispersion.



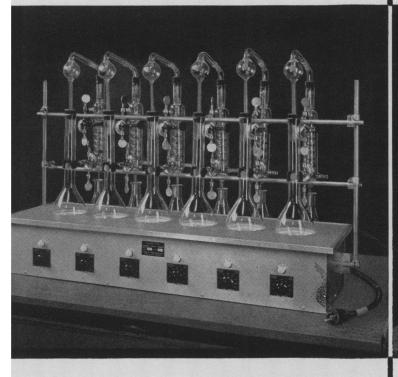
SCIENCE, VOL. 134

• Write for booklet

which gives full details.

1146

Two new heating mantles from Glas-Col



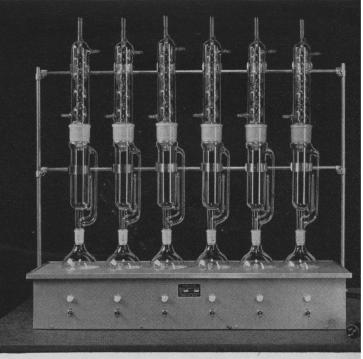
Kjeldahl Heating Mantle

Heat input for each unit can be individually controlled. The mantle has rugged 3-wire cord with one wire grounded to metal housing. Since wattage requirements for distilled aqueous solutions are high, the heating mantles are made from quartz fabric for safe, dependable operation.

SPECIFICATIONS

of controller to
Catalog No. KJ-500 Size of flask
Catalog No. KJ-650 Size of flask
Catalog No. KJ-800 Size of flask
OCTOBER 1961

The new Soxhlet and Kjeldahl heating mantles are by-products of years of Glas-Col research in the development of safe, dependable heating equipment for pilot plant and laboratory use. Nothing has been overlooked for the safe operation of this equipment. Both new units have a beautiful anodized aluminum housing which holds six flasks. Tops are made of a resilient cork-like material to help prevent accidental mechanical flask breakage. Heating units can be individually replaced, if severely damaged by spillage of chemicals, at reasonable cost.



Soxhlet Heating Mantle

Since flammable solvents are most always used in Soxhlet extractions, this new heating mantle has been designed with utmost safety in mind. It utilizes Powerstat type control and is provided with rugged 3-wire cord, one wire grounded to housing.

SPECIFICATIONS

Catalog No. SOX-500	
Size of flask	
Power per unit2	50 watts, 115 volts
Price	\$285.00
Replacement heating elements	\$9.50 each

Prices for other sizes on request. Wire, write, or phone today for complete details.

Glas-Col Apparatus Company Dept. SC, 711 Hulman Street, Terre Haute, Ind.

World's largest manufacturer of heating mantles for laboratory, pilot plant, and production applications.

U. S. Patents . . 2,282,078 . . 2,739,220 . . 2,231,506 . . and 2,739,221

APPLICATION FOR HOTEL RESERVATIONS 128th AAAS MEETING Denver, 26-31 December 1961

The hotels for the AAAS Denver meeting have established special, low rates and have reserved appropriately large blocks of rooms for this meeting. Thus everyone making room reservations for the AAAS meeting is assured substantial savings.

The list of hotels and the reservation coupons below are for your convenience in making your hotel reservation in Denver. Please send your application, *not* to any hotel directly, but to the AAAS Housing Bureau in Denver and thereby avoid delay and confusion. The experienced Housing Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less.

If requested, the hotels will add a comfortable rollaway bed to any room, at \$3.00 per night. Mail your application now to secure your first choice of desired accommodations. All requests for reservations must give a definite date and estimated hour of arrival, and also probable date of departure.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

For a list of the headquarters of each participating society and section, see page 197, Science, 21 July. The Hilton is the AAAS headquarters hotel.

Rates for Rooms with Bath*							
Hotel	Single for one	Double for one	Double for two	Twin Beds for one	Twin Beds for two	Studio Twins	Suites
Hilton	\$8.50	\$10.00	\$14.00		\$14.00	\$15.00	\$27.00 to \$55.50
Brown Palace	8.00	9.00	13.00	\$10.00	15.00	×	24.00 to 65.00
Cosmopolitan	8.50	9.00	13.00	10.00	14.00		25.00 to 60.00
Shirley Savoy		7.50	10.00	9.00	12.00		25.00 to 40.00

* All rooms are subject to a 2% Colorado State sales tax.

Please reserve the following accommodations for the 128th Meeting of the AAAS in Denver, 26-31 December 1961:

TYPE OF ACCOMMODATION DESIRED

Single Room Double-Bedded Room .	Twin-Bedded Room Studio Twins
Suite Desired Rate	Maximum Rate
	oom will be:
·····	
	· · · · · · · · · · · · · · · · · · ·
First Choice Hotel Second Choi	ice Hotel Third Choice Hotel
	dicated—add approximate hour, A.M. or P.M.)
NAME	
(Individual requesting reservation)	
	(City and Zone) (State)

Mail this now to the Housing Bureau. Rooms will be assigned and confirmed in order of receipt of reservation.



NEW, VERSATILE LABORATORY AIDS... THAT SAVE TIME AND LABOR!

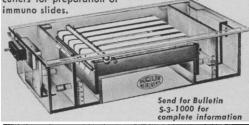
The VARIGRAD VARIABLE GRADIENT MIXER FOR CHROMATOGRAPHY

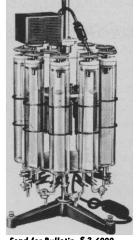
A unique apparatus FOR PRODUCING PRECISELY-CONTROLLED AND REPRODUCIBLE GRADIENTS Developed at the National Institutes of Health

- Makes small changes in specific portions of an elution gradient to improve resolution in certain regions of chromatograms.
- Presents gradient data for duplication in any laboratory.
- Single apparatus can be used to supply identical gradients simultaneously to several columns.
- Any number of independent gradients of different molecular or ionic species can be produced simultaneously.



with PAPER, STARCH, AGAR and almost all other known media! One basic migration chamber can be adapted to all media • Full line of D.C. power supplies • Agar cutters for preparation of





Send for Bulletin S-3-6000 for complete information

FRACTION COLLECTORS

Refrigerated ...the mobile coldroom, refrigeraated from column to collecting tubes ...on casters... glassware and turntable temperature-controlled.

OTHER MODELS (for every program and budget) include CONTINUOUS (for long-term or overnight use) and SECTIONAL (for processing during fraction collecting).



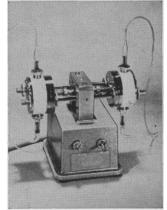
Send for Bulletin S-3-4000 for complete information

The MICROPUMP

Regulates flow of solvents through chromatographic columns at a pre-set constant volume.

Features:

- CONSTANT FLOW RATE of buffer solution
- ADJUSTABLE VOLUME from 25 ml to 950 ml/ hour
- ALL COMPONENTS, which are in contact with the solvent, are made of teflon or glass
- Designed for CONTINUOUS DUTY
- EXCEPTIONALLY LOW COST



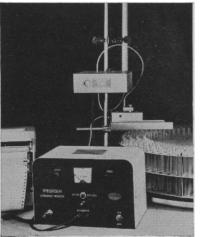
Send for Bulletin S-2-6000 for complete information

FOR AUTOMATIC ULTRAVIOLET MONITORING OF CHROMATOGRAPHIC ELUENTS

> CONTINUOUS FLOW UV MONITOR For Use with all Fraction Collectors

UVISCAN makes possible speedier identification of compounds with great accuracy and automatically indicates, on a recorded chart, the test-tube in which the desired compound is contained.

Amplifier yields signal from 0.05 to 4 Optical Density. Easily accessible Flow Cell with adjustable light-path from 1 to 10 mm.
Minimum volume 0.125 ml.
High Stability. During 24 hours the baseline will remain constant within 0.5 mv.
Wave Length from 240 to 280 millimirons
Linear or Logarithmic Recorders available.



Send for Bulletin .S-3-5000 for complete information

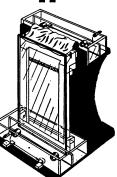
STARCH GEL VERTICAL Electrophoresis Apparatus

For direct insertion of liquid samples without paper or starch granules.

 Samples can be resolved into more zones than with paper electrophoresis without overlapping of components.
 10 samples, 0.040

to 0.045 ml can be processed simultaneously, or 1.6 ml in a single slot. • Special lucite stand

to fit in refrigerator.



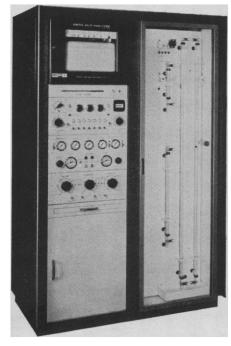
Send for Bulletin S-3-1070 for complete information

	- LABORATORY APPARATUS	
Other Buchler Laboratory Alex FLASH EVAPORATORS ROTARY EVAPOMIX WATER BOOSTERS CHLORIDOMETERS	RUCHIER	BUCHLER INSTRUMENTS, INC. 514 West 147th Street, New York 31, N.Y. ADirondack 4-2626

20 OCTOBER 1961

PHOENIX Amino Acid Analyzers

MODEL K-8000



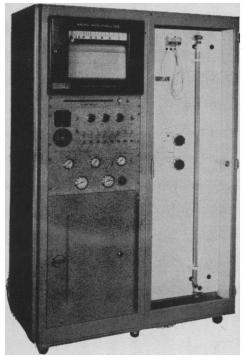
A COMPLETE INSTRUMENT LINE FOR AUTOMATIC ANALYSIS OF AMINO COMPOUNDS IN

• Protein Hydrolysates

- Protein free plasma and other
- Physiological fluids
- Tissue extracts
- Hydroponic solutions
- Foods
- Culture media
- Pharmaceuticals
- Adaptable to Phoenix Stream Splitting System 5500

Sensitivity: 0.1 to 3.0 micromoles of amino acid with a precision of $100 \pm 3\%$. Useful results at even lower levels.

MODEL VG-6000



Phoenix offers a complete line of components, replacement parts, and accessories for use with the Spackman-Stein-Moore Amino Acid Analyzer System, as described in Analytical Chemistry 30, No. 7, pages 1190–1206 (1958) and the Variable Gradient Analyzer System as described by Dr. Karl A. Piez and Louise Morris in the November 1960 issue of Analytical Biochemistry. For complete details, write Phoenix Precision Instrument Company, 3803–05 N. 5th Street, Dept. K, Philadelphia 40, Penna.

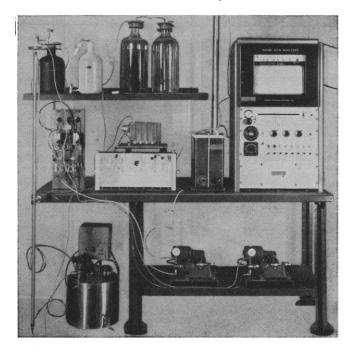
MODEL 5400 RECORDING FLOW-PHOTOMETER



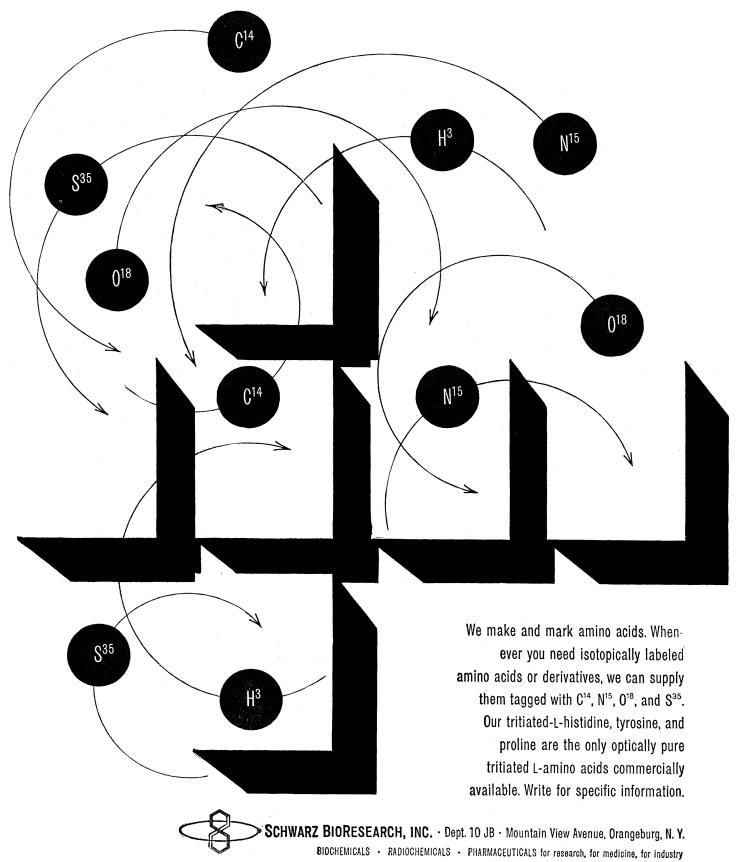


MODEL VG-6000-B

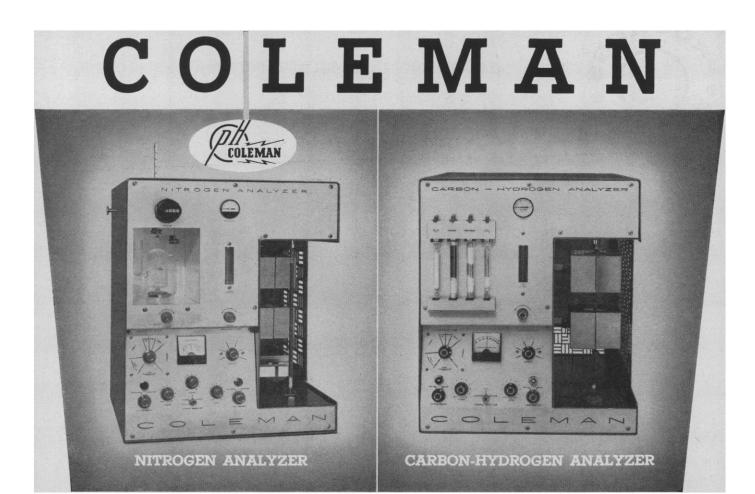
COMPONENTS ALSO AVAILABLE SEPARATELY FOR BENCH-TYPE ARRANGEMENT, AS SHOWN BELOW



PHOENIX PRECISION INSTRUMENT COMPANY 3803-05 NORTH FIFTH STREET • PHILADELPHIA 40, PA. BAldwin 8-7417 • CABLE PPICO supplier of amino acids and derivatives: pioneer in purity; leader in labeling



20 OCTOBER 1961



Automation revolutionizes standard analytical methods

These instruments make a radically new approach to classical analytical chemistry.

WHAT they do is not new . . . HOW they do it is revolutionary.

Both instruments perform standard combustion analyses for nitrogen and carbon-hydrogen . . . but they are **COMPLETELY AUTOMATED**. This, for most of us, is revolution enough!

The Nitrogen Analyzer burns the sample and selectively absorbs the combustion products, except Nitrogen. Nitrogen is collected in a micrometer-driven syringe providing direct volume readout in microliters.

The Carbon-Hydrogen Analyzer performs a similar operation. It collects the combustion products of hydrogen (as water) and carbon (as carbon dioxide) in separate absorption tubes which are weighed after each analysis.

Both instruments provide vast improvements in

reproducibility over traditional methods . . . variations in operator technique are eliminated as a source of analytical error.

Other important benefits common to both instruments:

SPEED—instrument operating cycle is only 8 minutes.

ACCURACY—results of routine nitrogen and carbon-hydrogen determinations agree with theoretical percentages $\pm 0.2\%$.

ECONOMY—each instrument takes only 18 inches on laboratory bench.

VERSATILITY—Sample sizes range from 1 to 100 mg; sample substances include virtually all homogeneous materials that burn below 1100° C.

Put automated combustion analysis to work in your laboratory . . . ask your instrument dealer for a demonstration.





• World-wide use by scientists, teachers at all levels, and science-oriented readers • Continued enthusiastic acceptance of new books in the series • 1,100,000 copies now in print (U.S. & Canada)

• 13 foreign language editions

Here are the two newest volumes in this unique paperback series sponsored by the Physical Science Study Committee-

NEAR ZERO:

The Physics of Low Temperature Internitysics of Low terms and the formation of the form

SHAPE AND FLOW: The Fluid Dynamics of Drag

Ascher H. Shapiro, M.I.T. A basic introduction to fluid dynamics, illustrating fundamental concepts with many photographs of experiments and demonstrations. With a clear account of the governing physical principles of resistance to motion in fluids. 93 photographs. S21 $95\acute{c}$

Previously published titles you'll want to order

THE NEUTRON STORY

Donald J. Hughes. "Rare clarity and simplicity." -N. Y. Herald Tribune. 158 pp. 38 illus. S1 95¢

MAGNETS: The Education of a Physicist

Francis Bitter, M.I.T. "A masterpiece . . . combination of autobiography and popular science exposition."—B. ALDEN THRESHER, Chairman, CEEB. 155 pp. 27 illus. S2 95ψ

SOAP BUBBLES and the Forces Which Mould Them

C. V. Boys. "Superb classic."—DEREK J. DE SOLLA PRICE, Yale University. 155 pp. 69 illus. S3 95¢

ECHOES OF BATS AND MEN

Donald R. Griffin, Harvard University. 1100-oughly scientific, but more fascinating than most novels."—GEORGE GAYLORD SIMPSON. 156 pp. 15 S4 95¢

HOW OLD IS THE EARTH?

Patrick H. Hurley, M.I.T. "Highly readable, stimulating, authoritative."—EDWARD H. WATSON, Bryn Mawr College. 160 pp. 35 illus. S5 95¢

CRYSTALS AND CRYSTAL GROWING

Alan Holden, Bell Telephone Laboratories, and Phylis Singer. "A lucid penetrating introduction to solid state physics."—Science. 320 pp. 210 illus. 13 color plates. S7 \$1.45

THE PHYSICS OF TELEVISION

Donald G. Fink, Philco, and David M. Lutyens. Donald G. Fink, Fnuco, and David M. Lin, "A masterwork of selection and condensation." N. Y. Herald Tribune. 160 pp. 48 illus. S8 956

WAVES AND THE EAR

William A. Van Bergeijk, John R. Pierce and Edward E. David, Jr., Bell Telephone Labora-tories. "Exceptionally comprehensive."—Tech-nology Review. 235 pp. 70 illus. S9 95¢

THE BIRTH OF A NEW PHYSICS

I. Bernard Cohen, Harvard University. "Outto Newton of the single most important idea in physics."—Scientific American. 200 pp. 42 illus. S10 95¢

20 OCTOBER 1961

HORNS, STRINGS, & HARMONY

Arthur H. Benade, Case Institute. "Twin threads of musical understanding and basic physics weave a fascinating fabric."—American Journal of Physics. 271 pp. 76 illus. 95¢

THE RESTLESS ATOM

Alfred Romer, St. Lawrence University. "Clearly written, exciting."—Science. 198 pp. 31 illus. S12 95¢

MICHELSON AND THE SPEED OF LIGHT

Bernard Jaffe. "A rich supplement to the studyof light and optics."—The Science Teacher. 197pp. 14 drawings, 6 photographs.S1395¢

THE UNIVERSE AT LARGE

Hermann Bondi, University of London. Analyzes current theories on the nature of the earth, stars and universe. 154 pp. 52 drawings, 12 photographs. S14 95¢

PASTEUR AND MODERN SCIENCE

 PASIEUR AND MOLLAR

 René Dubos, Rockefeller Institute. "A detailed,

 Science. 159 pp.

 S15 95¢

THE WATERSHED: A Biography of Johannes Kepler

Arthur Koestler. "A great book . . . which no student of science or history can afford to post-pone reading."—Science. 280 pp. 9 drawings, 8 S16 95¢

ACCELERATORS: Machines of Nuclear Physics

Robert R. Wilson and Raphael Littauer, both of Cornell University. "A fine example of the excel-lence of the series."—Science. 196 pp. 52 illus. S17 95¢

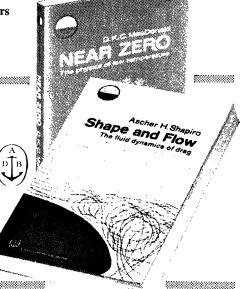
WATER: The Mirror of Science

Kenneth S. Davis and John Arthur Day, Linfield College. Examines H₂O from the viewpoints of physicist, chemist, biologist and geologist. 195 pp. 28 illus. S18 95¢

THE NATURE OF VIOLENT STORMS

Louis J. Battan, Univesity of Arizona. Surveys the cloud physics involved in thunderstorms, tornadoes, hurricanes, etc. 195 pp. 32 illus. S19 95ϕ

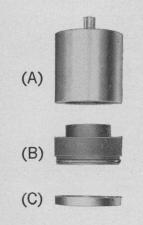
Dept. 1	e send i		sets	of all	twenty	Science	Study S	Series bo	ooks now	available,
] Please	e send n	ne the S	cience S	Study Se	ries title	es circle	d below	:		
S 1	S2	S 3	S4	S 5	S 7	S 8	S 9	S 10	S11	
S12	S 13	S14	S15	S16	S17	S18	S19	S20	S21	
NAME										
ADDRESS.					×					
CITY					ZO	NE	STA	TE		
] Bill n									1.1	





New

Mono-Mol (<125 µg/cm²) Windows... **Exceptional Plateau Characteristics... Plug-In Construction**



Exploded view of the FD Series Flow Counter showing (A) Counter Shield (B) Plug-in Flow Counter (C) Snap-

> first in radiation measurement 1610 Trapelo Rd., Waltham 59, Mass.

2030 Wright Ave., Richmond, Calif.

The new Tracerlab FD Series Mono-Mol Window Flow Counters operate in a variety of counting modes with your choice of counting gas. Excellent plateau characteristics insure a constant counting rate. Mono-mol windows, the world's thinnest windows, permit passage of all but the weakest particles. Plug-in construction simplifies operation.

The basic counters are available in 1" or 2" models and both operate in the geiger region with standard Tracerlab

G-1 gas, or in the proportional region with argon methane G-2 Gas, pure methane or natural gas.

Construction is all plastic to minimize background and cathodes are deposited stainless steel.

A glance at the operating specifications of the new Tracerlab Flow Counters will show you why these low cost, long lasting, extremely efficient units belong in your sample counting system.

Model No.	Operating Mode	Gas	Required System Sensitivity	Operating Voltage		Plateau		
					Background	Length	Slope over entire range	
FD-1*	Geiger	G-1	.25V	$1450V \pm 150$	<12 c.p.m.	300V	<2%/100	
FD-2**	Geiger	G-1	.25V	$1450V \pm 150$	<30 c.p.m.	300V	<2%	
FD-1	Prop.	G-2	a 10 mv	$2200V \pm 500$	$\alpha < 6$ c.p.h.	1000V	<2%	
			β 1 mv	$2300V \pm 200$	β <12 c.p.m.	400V	<2%	
FD-1	Prop.	Pure Methane	a 10 mv	3500V ± 500	$\alpha < 6$ c.p.h.	1000V	<1%	
			β 10 mv	4500V ± 500	β <12 c.p.m.	1000V	<1%	
FD-1	Prop.	Natural Gas	a 10 mv	$4000V \pm 500$	$\alpha < 6$ c.p.h.	1000V	<2%	
			β 10 mv	4700V ± 300	β <12 c.p.m.	400V	<2%	
FD-2	Prop.	G-2	a 10 mv	$2200V \pm 500$	α <12 c.p.h.	1000V	<2%	
			β 1 mv	2300V ± 200	β <30 c.p.m.	400V	<2%	
FD-2	Prop.	Pure Methane	a 10 mv	3000V ± 500	α <12 c.p.h.	1000V	<1%	
			β 10 mv	$4500V \pm 500$	β <30 c.p.m.	1000V	<1%	
FD-2	Prop.	Natural Gas	α 10 mv	4000V ± 500	α <12 c.p.h.	1000V	<2%	
			β 10 mv	4700V ± 300	β <30 c.p.m.	600V	<2%	

SPECIFICATIONS THIN WINDOW FLOW COUNTERS

•FD-1 1" Super/thin Window Flow Counter

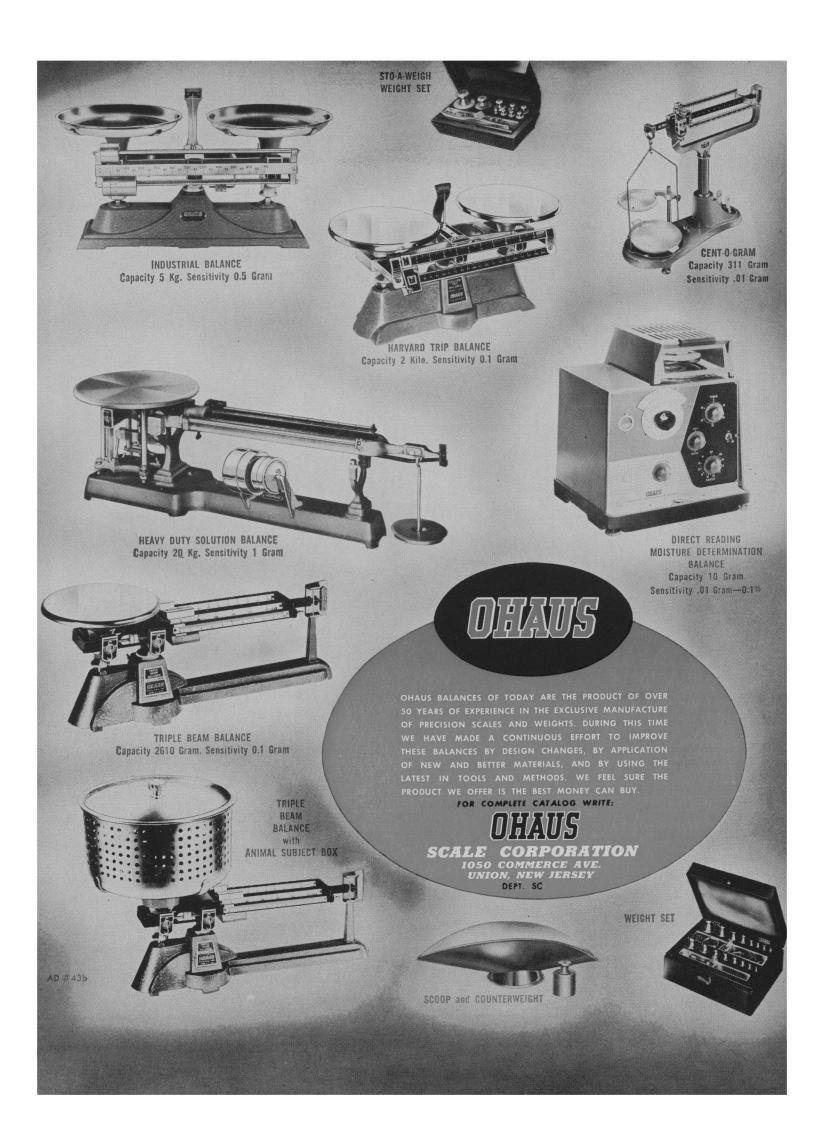
**FD-2 2" Super/thin Window Flow Counter

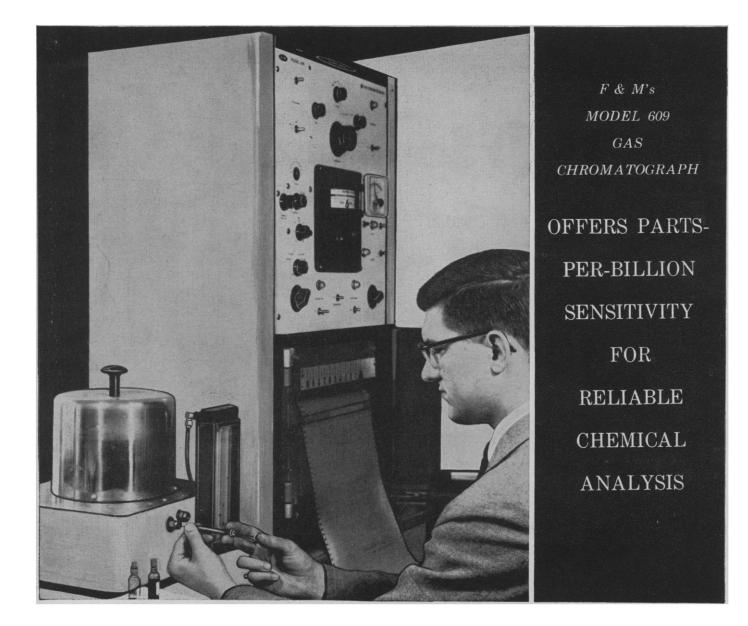
SCIENCE, VOL. 134

1154

racerlab Keleket

On Window.





If you require ultra-sensitivity in your analyses of organic compounds, consider the advantages of F & M's Model 609 Gas Chromatograph with flame ionization detector. It offers parts-per-billion sensitivity. (Typical sensitivity for a light hydrocarbon is 5 to 50 ppb.) Yet, neither water nor air gives a signal. For these reasons, the Model 609 is ideal for reliable analyses of (1) trace components in complex mixtures and (2) trace organic materials in air or aqueous solutions.

In analyses of wide boiling mixtures, the Model 609 can be operated with programmed temperatures up to 300°C (with a choice of 18 linear heating rates from 0.23 to 35°C/min). Or, the instrument can be operated isothermally.

Packed analytical columns with lengths up to 50 feet can be used with the Model 609. Also, adapters are available for capillary columns. Other features of this instrument include (1) attenuation from 1 to 1,000,000; (2) line-operated electrometer; (3) independent heating of column, detector, and injection port. Write today for further information about this versatile, reliable gas chromatograph.

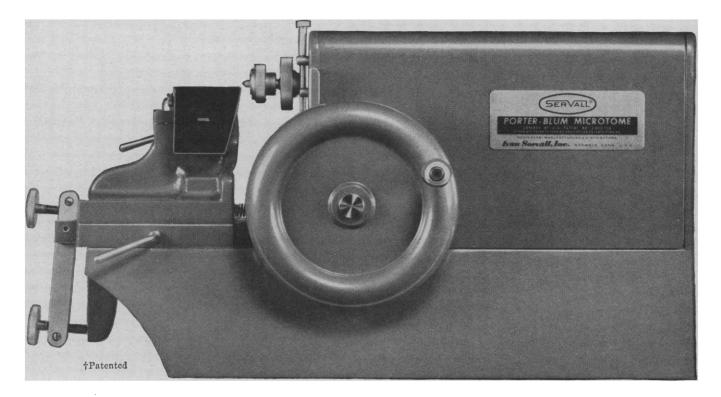
See the Model 609 and other F & M gas chromatographic instruments on display at the *Eastern Analytical Symposium*, New York City, November 15-17 (Booth 45).

F&M

F & M SCIENTIFIC CORPORATION Starr Road and Route 41 • P. O. Box 245 Avondale, Pennsylvania • Colony 8-2281



"Porter-Blum" ULTRA-MICROTOME[†]



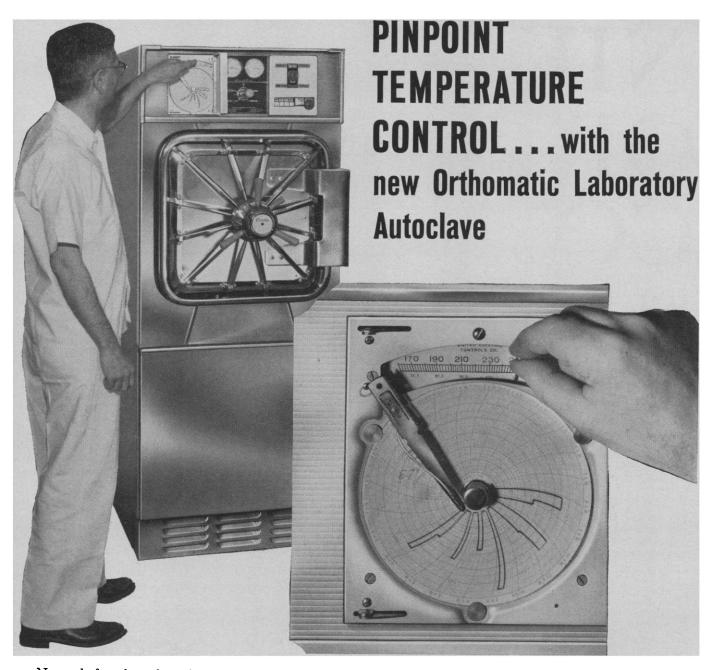
ALSO CUTS COSTS!

The "Porter-Blum" is the inexpensive precision instrument for electron- and light-microscope preparations. This ultra-microtome, known as "the standard in its field," will cut serial sections, or alternate thin and thick sections, of the highest uniformity and at the lowest possible cost. Its purchase price is below what you would expect to pay for an instrument of this quality, and its renowned trouble-free operation keeps maintenance costs to a minimum even under constant use.

The "Porter-Blum" will section a wide range of difficult materials such as bone, teeth, soft metals, plastics, fibers, hard rubber, etc., as well as all types of biological and plant tissues. Fingertip control permits "dialing" required thicknesses from 1/2 to 1/40 micron. The unique "by-pass" feature enables the operator to cut sections thicker than 1/2 micron when desired. Before you purchase any ultra-microtome, investigate the quality and economy available with the "Porter-Blum."

Please ask for Bulletin SC-10MT





Never before has there been such a versatile laboratory autoclave as Castle's new Orthomatic!

With Orthomatic you can pinpoint the exact sterilizing temperature best suited to any given process. Temperature settings between 100-132°C. are made in seconds right on the sterilizer control panel. Supplementary controls may be added for temperatures down to 71°C.

In addition, Orthomatic High-Speed Jet Heating will save your laboratory hours in the preparation of test glassware, allow successful processing of heat-sensitive media, and permit an automatic programming of sterile cycles and a uniformity of repetitive test conditions which cannot be duplicated.

Orthomatic sterilizers are available for every hospital department. Write for full details.





Castle Engineered Sterilization can help you solve your sterilization problems . . . utilizing the latest in dry heat, steam and gas.

NIKON model 6 OPTICAL COMPARATOR for fast, accurate evaluation of ultracentrifuge photo plates

A major pharmaceutical manufacturer recently investigated the use of a Nikon 6 Optical Comparator for measuring and analyzing ultracentrifuge photo plates. The performance was so impressive, the unit was immediately purchased and added to the company's instrumentation facilities. The news travelled.

Within less than a month, a Nikon 6 Comparator was acquired by a large hospital, and shortly thereafter, by several other hospitals and by a food research laboratory. The Comparator, in each instance, demonstrated a marked superiority over equipment previously used-greater speed and convenience, and greater accuracy.

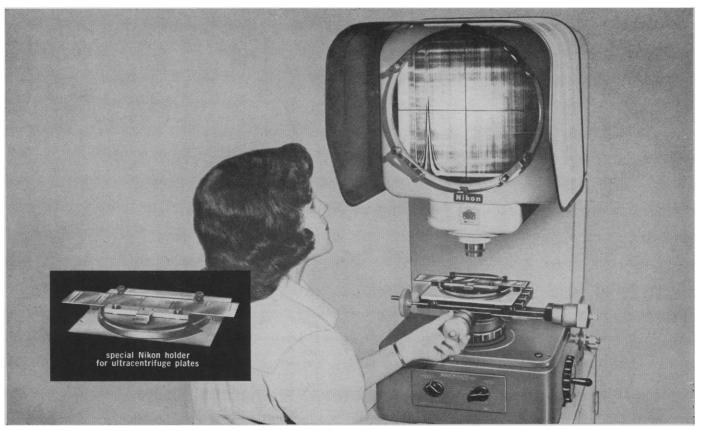
The Nikon 6 Optical Comparator is essentially a macro projector with a magnification range from 10x to 100x-extendable to 500x. Any object, thing, substance, specimen, photo plate or slide placed upon the stage, appears on its 12'' screen as a sharp, bright, magni-

fied image, which can be observed by many people simultaneously -studied, evaluated and precisely measured. And all of this can be done comfortably in a normally lit room. The Model 6 Comparator is provided with surface as well as sub-stage illumination.

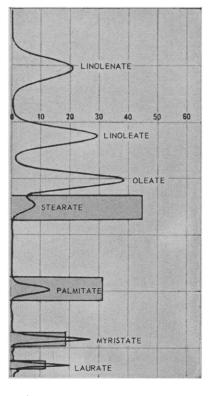
New laboratory applications for the Nikon 6 Comparator are being constantly reported. In addition to the analysis of ultracentrifuge data, its use has been extended to many phases of chromatography, evaluating fringe patterns and reading electrophoresis photo plates and cells.

You may have an inspection or measurement problem which lends itself to the unique capabilities of the Nikon 6 Optical Comparator. Why not tell us about it. Write to Dept. S-10.

NIKON INC., INSTRUMENT DIVISION, 111 Fifth Ave., N. Y. 3, N. Y.







Typical gas chromatogram trace showing mass peaks of fatty acid methyl esters. Superimposed on the mass trace, the bar graph indicates no radioactivity in any of the unsaturates. The Packard Model 830 Tri-Carb® Gas Fraction Collector enables quantitative collection of individual organic components in a gas chromatographic effluent stream. Precise measurement of radioactivity in component peaks can be made after collection.

An 8" diameter turntable holds up to 50 Tri-Carb Cartridges, each packed with silicone-coated scintillation crystals. Vapors leaving the gas chromatography mass detector pass through the heated gas injection nozzle of the collector and condense on the coated surfaces of the scintillation crystals. As the operator observes the beginning and completion of each peak on the mass detector trace, he actuates a control switch to change cartridges. Changing takes only a fraction of a second.

After sample collection, the cartridges are placed in positioning adapters in an Automatic Tri-Carb Liquid Scintillation Spectrometer for completely automatic counting. No sample preparation is necessary and up to 100 samples can be handled at one time.

Counting efficiency for carbon-14 in Tri-Carb Cartridges is over 50%. Backgrounds for these cartridges in the Tri-Carb Spectrometer are extremely low-less than 5 cpm. Consequently, even peaks with very low activity can be accurately measured in short counting periods.

The Packard Model 830 Tri-Carb Collector is suitable for use with any gas chromatograph using a nondestructive mass detection system.

For information call your Packard Sales Engineer—or write for descriptive literature.

INSTRUMENTS FOR RADIOACTIVITY MEASUREMENT AND CHROMATOGRAPHY



BRANCH OFFICES

CHICAGO • ALBUQUERQUE • ATLANTA • BOSTON • DALLAS LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH SAN FRANCISCO • WASHINGTON, D.C. • ZURICH • HANOVER • PARIS

PACKARD INSTRUMENT COMPANY, INC.

LA GRANGE 54, ILLINOIS, Telephone HUnter 5-6330

SCIENCE, VOL. 134

In all these Torsion Dial Balances... That's why hecom **Torsion Balances** (with or without weight loaders) retain their original accuracy after more than a million operations. Supplementing these dial balances, Torsion also manufactures a line of "no-knife-edge" balances with capacities up to 30 kilograms. Write for Catalog DL for complete information.



Main Office and Factory: Clifton, New Jersey Sales Offices: Chicago, Ill., San Mateo, Cal.



TORSION MODEL DWL-3 Capacity: 200 grams Weight-loading Dial: up to 9 grams by 1 gram increments Fine Weighing Dial: 1 gram by .02 gram graduations (Readability: .005 g)



TORSION DWL-5 Capacity: 500 grams Weight-loading Dial: up to 90 grams by 10 gram increments Fine Weighing Dial: 10 grams by .1 gram graduations (Readability: .02 g)



Capacity: 120 grams Weight-loading Dial: up to 9 grams by 1 gram increments Fine Weighing Dial: 1 gram by .01 gram graduations (Readability: .002 g)



TORSION DWL2-1 Specifications are same as the DWL-2 except that this model has scoop for seeds or other bulky material TORSION DLT5 Capacity: 500 grams Dial graduated 10 grams by .1 gram graduations Readability of Dial: .02 grams



TORSION DLT2 Capacity: 120 grams Dial graduated 1 gram by .01 gram graduations Readability of Dial: 2 mg



TORSION DLT2-1 Same specifications as DLT2 but has scoop for seeds or other bulky material

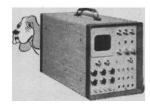


TORSION DRx Capacity: 120 grams Dial graduated 15 grains by 1/8 grain graduations and 1 gram by .01 gram graduations Readability of Dial: 1/4 dial division





efficient 4-input, 400-channel pulse height analyzer is easy to use, has many "system" features, weighs 37 lbs., occupies one cubic foot, operates on 110 or 220 volts, 50 to 400 cycles AC.



Each input has its own linear amplifier and gain control. Information can be stored in four 100-channel groups, two 200-channel groups or one 400-channel group. Direct readout on TMC Model 500 Decimal Printer, X-Y or strip chart recorder, IBM computer typewriter or paper tape punch. Add these facts (and the moderate price of the instrument) to the versatility suggested by front panel photo — and you have the reason for the TMC 404's popularity. Write for Bulletin 400.



TECHNICAL MEASUREMENT CORPORATION 441 WASHINGTON AVENUE, NORTH HAVEN, CONN. — CE 9-2501

20 October 1961, Volume 134, Number 3486

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Board of Directors

CHAUNCEY D. LEAKE, Retiring President, Chairman THOMAS PARK, President PAUL M. GROSS, President Elect HARRISON BROWN DON K. PRICE HENRY EYRING ALFRED S. ROMER H. BENTLEY GLASS WILLIAM W. RUBEY MARGARET MEAD ALAN T. WATERMAN PAUL A. SCHEBER, Treasurer DAEL WOLFLE, Executive Officer

Editorial Board

KONRAD B. KRAUSKOPF H. BURR STEINBACH EDWIN M. LERNER WILLIAM L. STRAUS, JR. PHILIP M. MORSE EDWARD L. TATUM

Editorial Staff

DAEL WOLFLE	HANS NUSSBAUM
Publisher	Business Manager

GRAHAM DUSHANE Editor

JOSEPH TURNER ROBERT V. ORMES Associate Editor Managing Editor ELLEN E. MURPHY. Assistant Editor

NANCY TEIMOURIAN, Assistant to the Editor

News: Howard Margolis, Daniel S. Greenberg, Patricia D. Paddock

Book Reviews: SARAH S. DEES

Editorial Assistants: SUE E. BERKE, NANCY S. HAMILTON, OLIVER W. HEATWOLE, EDGAR C. RICH, JOHN E. RINGLE, CONRAD YUNG-KWAI Staff Assistants: GENEVIEVE M. KIRBY, JEAN P. D. PIEKNIK

Advertising Staff

EARL J. SCHERAGO, Director

BERNICE SCHWARTZ, Production Manager Sales: Richard L. Charles (New York, N.Y., PE 6-1858); C. Richard Callis (Old Bridge, N.J., CL 4-3680); HERBERT BURKLUND (Chicago, III., DE 7-4973); DILLENBECK-GALAVAN (Los Angeles, Calif., DU 5-3991)

SCIENCE, now combined with THE SCIENTIF-IC MONTHLY, is published each Friday by the American Association for the Advancement of Science at National Publishing Company, Washington, D.C. SCIENCE is indexed in the Reader's Guide to Periodical Literature.

Editorial correspondence should be addressed to SCIENCE, 1515 Massachusetts Ave., NW, Washington 5, D.C. Manuscripts should be typed with double spacing and submitted in duplicate. The AAAS assumes no responsibility for the safety of manuscripts. Opinions expressed by authors are their own and do not necessarily reflect the opinions of the AAAS or the institutions with which the authors are affiliated. For detailed suggestions on the preparation of manuscripts, see Science 125, 16 (4 Jan. 1957).

Advertising correspondence should be addressed to SCIENCE, Room 1740, 11 West 42 St., New York 36, N.Y.

Change of address notification should be sent to 1515 Massachusetts Ave., NW, Washington 5, D.C., 4 weeks in advance. Furnish an address label from a recent issue. Give both old and new addresses, including zone numbers.

Annual subscriptions: \$8.50; foreign postage, \$1.50; Canadian postage, 75¢. Single copies. 35¢. School year subscriptions: 9 months, \$7.00; 10 months, \$7.50. Cable address: Advancesci, Washington.

Copyright © 1961 by the American Association for the Advancement of Science.

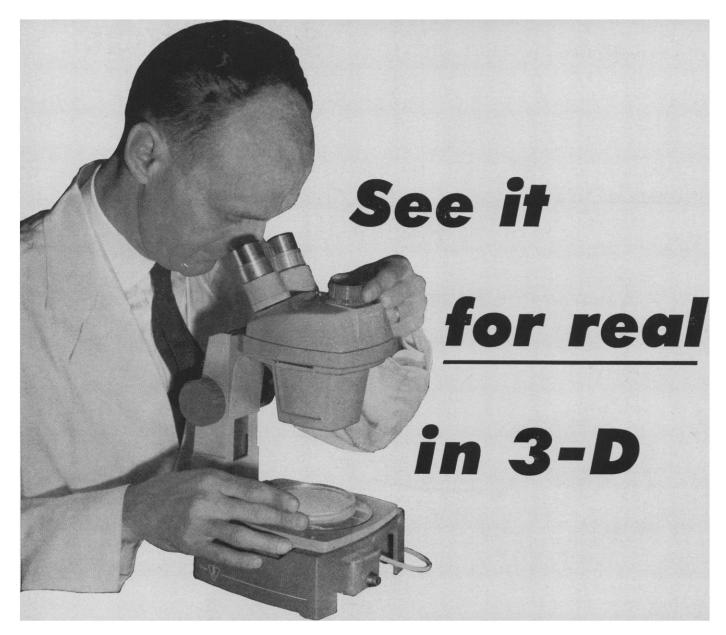
The Other Fellows' Ball Park

There is an old saying that when one goes to play ball in the other fellows' ball park, it is incumbent upon him to learn the others' ground rules. There is no use protesting about these rules or asking that they be altered. The reasonable course is to find out what they are and proceed accordingly.

In the same way, the scientist entering into the affairs of government, and into the political arena, has the duty-if he is to be fully effectiveto find out how men in this arena actually function. It is not sufficient for him to criticize their methods, and it is fatal if he take the point of view that he is now in a section of society which is governed by rules less ethical or less advanced than his own. We live under a democratic system. An essential feature of this system is the means by which men acquire and maintain political position and authority. These means involve a thorough understanding of human nature and of mass reactions. Many men in political life are masters of this art. And in the large majority they are also devoted to the welfare of their country. As a result we have effective working of the democratic system as far as efficiency in government is possible. The democratic system creaks at its joints, it wastes time and money, it bases its decisions more on subtle influences than on rational logic, and it often irritates those who are accustomed to more orderly and systematized functioning. But it just happens that the democratic system with all its faults is the best system of government ever devised by the mind of man. Scientists today are privileged to participate in this whole affair to an extent never before true in this country, and it is certainly incumbent upon them to understand and indeed to sympathize with the local ground rules which govern the ball park in which they are now exercising important influence.

I have seen great damage done to the whole scientific community by the eminent scientist who, appearing before a congressional committee, made evident his general contempt for the individuals before whom he appeared, and who talked to them as he would to a group of school boys. Fortunately, in the years since the War, scientists have matured in this regard and this does not now occur.

We need now to go beyond this in our thinking. As scientists and engineers we nevertheless regard with admiration and respect the subtle functioning of a medical man in a difficult case, not relying upon the science which underlies his art, but relying upon the art itself, who rescues a patient from an obscure source of distress. We admire and respect also the artist who, knowing very little about the physics of color or of light reflections, produces a work of art that stirs emotions or revives long-forgotten memories. In the same way we need to learn to respect, in fact to admire, those individuals who are masters of the art of operating in the confused arena of the American political scene, especially when this subtle undefinable skill is joined with a broad altruism. In fact, if scientists are to have their full influence for the good of the country in the days to come, many of them will indeed need to learn to practice this difficult art.--VANNEVAR BUSH, Massachusetts Institute of Technology. (Excerpt from an address read at the 15th National Congress on the Administration of Research, San Juan, Puerto Rico, 10 Oct. 1961)



StereoZoom Microscopes show the most understandable images of the specimen you've ever seen. You see it magnified naturally, in three dimensions, upright and unreversed. You see it in depth, with the details of its structure in their true relationship.

...and zoom to <u>any</u> magnification from 3.5X to 120X

Just turn the zoom knob. That's all there is to it. Instead of a few arbitrary fixed powers you have an infinite number of repeatable magnifications throughout the entire range of the instrument. (Available from 3.5X to 120X.) See the specimen better than ever before... in magnifications you've never seen before!



BAUSCH & LOMB INCORPORATED 75922 Bausch Street, Rochester 2, N. Y.

Please demonstrate StereoZoom Microscopes.
 Please send Catalog D-15.

NAME, TITLE

PROFESSIONAL ...

ADDRESS

Made in America, to the world's highest standards.

Make Important Measurements Faster...More Precisely

With L&N Convenience-Styled Instruments

TO OBTAIN MEASUREMENTS OF TEMPERATURES & MILLIVOLTS

The use of this three-dial 8686 Portable Potentiometer is rapidly spreading in research laboratories. It features a central reading window ... where measured values appear as a row of digits plus a scale value ... for rapid reading of test results. This instrument has



a wide operating range of -10.1 to +100.1 mv and an accuracy of $\pm (0.05\%)$ of reading $+3\mu v$ without reference junction compensation; $\pm (0.05\%)$ of reading $+6\mu v$ with ref. jct. comp. Write for Data Sheet E-33(1a).



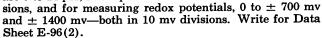
TO MAKE CHEMICAL ASSAYS BY COULOMETRIC ANALYSES

The Coulometric Analyzer meets the need for rapid, highly accurate quantitative analysis by providing a constant current ($\pm 0.05\%$) for coulometric titrations, a directdigital readout of micro-equivalent content, and a versatile cell-kit which speeds set-up

time for titrations and permits precise results. Standard solutions can be quickly titrated as prepared . . . no need to worry about shelf-life of standard solutions . . . no need for exacting preparation of standard solution normality. Analysis of dilute solutions is convenient and practical. Write for Data Sheet E-94(4).

TO OBTAIN DRIFT-FREE MEASUREMENTS OF pH AND REDOX

Only one initial calibration setting is required on the L&N Stabilized pH Indicator. Synchronous conversion of d-c input with amplification eliminates zero-drift. An electronic converter provides d-c feedback to stabilize gain. Ranges are 0 to 14 pH, in 0.1 pH divi-





TO MAKE CONTINUOUS CONDUCTIVITY MEASUREMENTS "ON-LOCATION"

This continuous indicating Conductivity Monitor is competely transistorized. It is provided with a linear scale calibrated 0 to 100 micromhos/ cm (scale reading is multiplied by cell constant). Lightweight, the Monitor is extremely convenient for check-

ing in the laboratory or on the process line. Exceptional design permits automatic or manual compensation . . . provides d-c output signal for recorder or other data-logging equipment. Write for Data Sheet E-95(3).

20 OCTOBER 1961

With L&N Automated Equipment

TO RECORD TEMPERATURE & MILLIVOLTS MEASUREMENTS

These compact, low-cost Speedomax[®] H Recorders are widely used in laboratories for measuring temperatures, millivolts, pH, gas chromatography, etc. With interchangeable ranges—50 for temperature and six for millivolt (0 to 1, 0 to 5, 0 to 10 mv, etc.)—



these instruments will record practically any variables encountered in research work with a limit of error of $\pm 0.3\%$ of span. Write for Data Sheet ND46-51 (100).



TO MAKE FAST, ACCURATE POLAROGRAPHIC ANALYSES

For analyzing metals, organics or biochemicals in solution, the combination of the L&N Electro-Chemograph® and Polarotron® is unmatched in accuracy and speed. The Electro-Chemograph provides: fast determination — one-second recorder balancing time

for full scale travel; minimum error—polarizing accuracy to 4 mv. The Polarotron facilitates time-saving operation; stable (reference) half-cell comes prepared for immediate use. Write for Data Sheet E-97(1).

TO RECORD TEMPERATURES WITH AN ACCURACY OF \pm 0.01 C

Invaluable in advanced research laboratories, this High Precision Speedomax G Recorder is used with L&N Resistance Thermometers for a variety of temperature measurements over a range of -190to +500 C with an accuracy of ± 0.01 C. An "automatic Muel-



 ± 0.01 C. An "automatic Mueller Bridge," this recorder is used in cryoscopic determinations of purity, in measuring boiling ranges of liquids and in general calorimetry, etc. Write for Data Sheet E-ND46(7).

> These are only a few of the modern, precise instruments that L&N provides for today's exacting research requirements. For further details, write to Leeds & Northrup Co., 4926 Stenton Ave., Philadelphia 44, Pa.



"Pioneers in Precision"



UNITRON offers an extensive line of Laboratory Microscopes & Accessories for Research, Industry and Education. Illustrated is a partial selection for biology, medicine, chemistry and related fields. UNITRON also has companion instruments for the metalworking industries.

Noted for optical quality... advanced optical and mechanical design... unique and convenient operational features ... long wearing construction ... attractive budget prices which include basic optics... these, together with years of proven instrument performance, are the reasons why ...

THE TREND IS TO UNITRON!

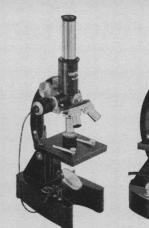
UNITRON

INSTRUMENT COMPANY . MICROSCOPE SALES DIV. 66 NEEDHAM ST., NEWTON HIGHLANDS 61, MASS.

Please rush UNITRON	N's Microscope Catalog 4-U-3
Name	
Company	and the second se
Address	
City	State

If METALLURGY is your field, UNITRON is your microscope

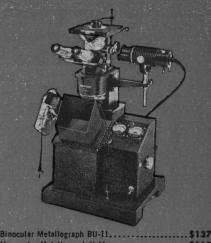




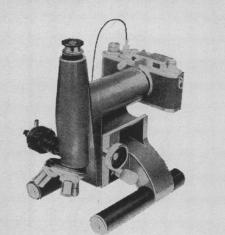
Model MMA.....\$149.



Model MMU.....\$287.



UNITRON'S Complete Laboratory Installation for Hig Temperature Metallography with Metallograph and HVO Control and Power Station.



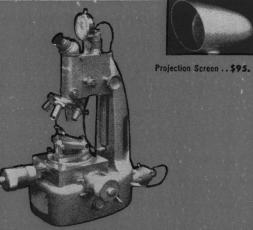
Model DMR Depth-Measuring Rollscope for examination of large or cylindrical surfaces.....\$445.

pic Model

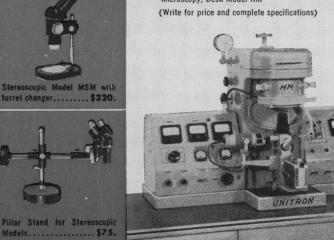
ereoscopic Model

SHL with revolving sepiece.....\$267.

tereoscopic



UNITRON'S Research Installation for High-Temperature Microscopy, Desk Model HM (Write for price and complete specifications)



UNITRON IS YOUR COMPLETE SOURCE FOR MICROSCOPES

to meet every metallurgical application . . . from low-power macro to high-power micro examinations, right on through to advanced research in high temperature studies of the new metals in the space age. And when it's time to balance your equipment budget against your needs, UNITRON prices will be among the best news of all.

TRY A UNITRON IN YOUR LAB ... FREE, FOR 10 DAYS

A salesman's demonstration gives you only about 30 minutes to examine a microscope ... hardly the best conditions for a critical appraisal. But, UNITRON'S Free 10-Day Trial allows you to use the microscope in your own lab and put it through its paces on your own particular problem. Use the coupon to ask for a no-obligation, prepaid trial. And if you want more details on these and other UNITRON Microscopes, use the coupon to request a complete catalog.

 HS-3 Vacum
Heating Stage for
150° C....\$025
 Image Working Dis-
tance Objective
F40X\$149.
 Image Working Dis-
tance Objective
F40X\$149.

 Image Working Dis-
tance Objective
from States
 Image Working Dis-
tance Objective
from States
 Image Working Dis-
tance Objective
from States

Austenite Grain Size Eyepieces: Turret-Type...\$76. Filar Micrometer Ke 10X......\$25. Eyepiece..\$69.50

1

1

CITY



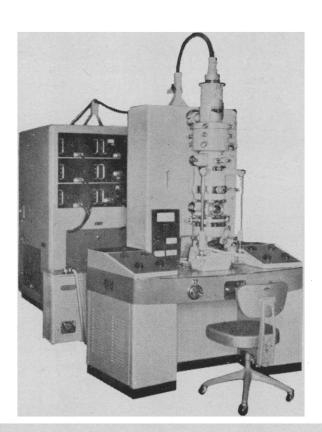
STATE

UNITRON

INSTRUMENT COMPANY • MICROSCOPE SALES DIV. 66 NEEDHAM ST. • NEWTON HIGHLANDS 61, MASS.

I want a FREE 10-day trial of Model Send me your catalog No.		
NAME	DEPT.	
COMPANY		
ADDRESS		

HITACHI Electron Microscopes



featuring the new HU-11

Hitachi, Ltd. of Japan, in advance of worldwide competition, announces the successful production of the HU-11, the latest in electron microscopes.

The new HU-11 is an enlarged, high efficiency electron microscope, guaranteed 8-10 Angstrom Unit resolution, capable of probing the very basic structure of matter. This is possible in the HU-11 because it is equipped with a chromatic aberration compensating lens system, a development uniquely Hitachi.

Other improvements include an enlarged specimen chamber facilitating handling of accessories, an exhaust system trap reducing contamination to a minimum (therefore eliminating the need to disassemble the column), increased exposure area of photography permitting recording of high resolution diffraction rays.

... and presenting the HS-6

Hitachi's outstanding HS-6, the permanent magnet electron microscope, is equipped with four lenses (condenser, objective, intermediary, projection) with a resolving power reaching 25 A.U. upwards and ensures an electron optical magnification continuously changeable from 2,000x to 20,000x.

The HS-6 is proving itself doubly invaluable photographically as an electron diffraction camera using an additional specimen stage and as the so-called "selected area" diffraction camera. (Camera chamber is loaded with 18 cassettes permitting 36 successive exposures.)

Simplicity of operation, mechanics and circuitry make the HS-6 the ideal instrument for researchers in the most sensitive medical and biological fields.



5-6

For more detailed information get in touch with ERB & GRAY SCIENTIFIC, INC. 854 S. Figueroa St., Los Angeles 17, Calif. Solution State State

Kodak reports on:

how a clever fellow can cheat himself ... f/1 lenses for 4.25 μ to 10 μ ... encouragement from Agnes Scott College



Mighty magnification

Forty bucks for a few rings and rods to put over the front of the new Kodak Retina Reflex III Camera ?*

A mite under, actually, at the camera shop. Also includes an auxiliary lens. All nicely fitted together. Called the Kodak Retina 1:1 Copying Kit. Switch the f/2.8 lens from the camera to the kit, snap the kit onto the camera, attach the auxiliary lens and the camera's lens hood, set the diaphragm between f/11 and f/22 and the distance scale at 5 feet. Snap, swish—just like that. Make pictures. Anything in the plane of the rectangular opening is focussed on the film same size. Depth of field at f/22 is 5.5 mm. When resulting slide is projected, magnification is mighty and can be useful for mensuration if a calibrating scale has been included in the picture. Handy for picturing platyhelminthes, coins, microcircuitry, the triumphant crystals of a new enzyme you have isolated. Kit also includes a slide holder and diffusion screen for making your own black-and-white duplicates of color slides.

If you can make this kit yourself for less than \$40, you are too clever a fellow to be working that cheap.

A sharp eye for infrared

The decision to announce at this time the availability of f/1*Irtran-2 Aspheric Lenses* has been reached in struggle against deeply rooted inhibitions. In the photographic film and paper trade we are habituated to a longer silence before the first blast of the trumpets. Infrared technology hates to wait, however, and puts a heavy load on the phone company's long lines.

These Irtran-2 lenses transmit usefully from 2μ to 14μ . Two focal lengths, 2-inch and 3-inch, are offered off the shelf. At f/1, we seem to have done well at providing high collecting-power for energy without undue sacrifice of sharpness. Sharpness was the goal. For both lenses, the minimum circle of confusion *computes* at less than .001" for any wavelength from 4.25μ to 10μ . The italics mark where we hurt.

Much care and a valuable ingenuity have been exercised in impressing our tenth-degree equation upon the concave side of these meniscus lenses, in grinding and polishing the spherical convex side, in placing the center of the spherical curvature on the axis of the asphere, in maintaining the

*Most versatile 35mm camera we make. Also works with Kodak Retina Reflex S and IIIS Cameras. Kit designed for f/2.8 models only.

center thicknesses at the 9.1 mm and 10.4 mm values respectively that the calculations assume, in the optical homogeneity of the Irtran-2 material. More than this we cannot claim. To the extent that the care and ingenuity have succeeded in making the calculations represent the actuality, the circle of confusion is less than .001". The customer's willingness to take a chance that we have hit it will, in good sense, depend on how badly his project needs a 2μ -14 μ infrared image of high definition and high aperture.

To demonstrate experimentally at those wavelengths that the circle of confusion is indeed that small is a task which we have simply been too busy to complete up to the time these words were written.

In the lead sulfide region, the sharpness does not compute to be as good as farther out in the infrared. Yet we have customers who use the lenses there and are happy with confusion-circle minima as large as .008".

In comparison with reflective optics hitherto used, Irtran-2 aspheres offer compactness and a wider field that doesn't even show any appreciable deterioration as far as 2° off axis. You do give up the perfect achromatism of reflective optics. In the 2-inch lens the minimum circle of confusion for 10μ radiation is located 2 mm beyond the minimum circle of confusion for 4.25μ radiation; in the 3-inch lens the separation is 3 mm.

We have said enough to establish our frankness and to indicate whether there is any need for you to burden the long lines to Rochester, N. Y., LOcust 2-6000, Extension 5166, which is one way to reach Eastman Kodak Company, Special Products Division. Bear in mind that Irtran-2 material has a hardness of 354 Knoop, is not at all brittle, withstands thermal shock and the solvent action of water, and can get very hot without losing transparency or giving off toxic fumes.

An isonitroso more or less

In 1958 we set out to make a certain nickel reagent we had read about. Our method failed. It hung three instead of two isonitroso groups onto a monomethylated cyclohexane ring. We meekly advertised that we had 5-Methyl-1,2,3-cyclohexanetrione Trioxime for sale as Eastman 7478 and hoped somebody would discover what *it* is a reagent for. (Some are amused by our candor in these matters.) The ad mentioned that in seeking the cause of our failure we had repeated our procedure on the unsubstituted ring and had similarly obtained 1,2,3-Cyclohexanetrione Trioxime, which we designated Eastman 7660.

The sad little sigh with which we closed the discussion spread out over the world. A friendly echo has now returned from Agnes Scott College, Decatur, Ga. Four sympathetic chemists there startle us by reporting that Eastman 7660 forms a very stable and spectrophotometrically convenient complex with cobalt at an optimum concentration range of 1 to 4 p.p.m.

Reading this (*Anal. Chem. 33*, 1096), we checked to make sure old 7660 was still there and were again astonished to find that the original batch had sold down to inventory minimum! We now have a new batch, a free abstract of the cobalt determination, and a feeling that purposeful planning serves chiefly to comfort the soul.

Nevertheless, List No. 42 of some 3900 Eastman Organic Chemicals we stock can serve some useful purpose in planning. For a copy or for the cobalt determination abstract, write Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).

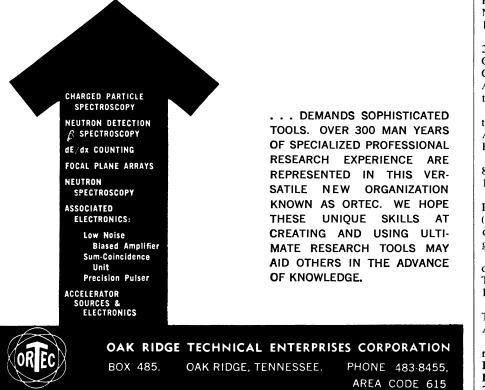
Price subject to change without notice.

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

20 OCTOBER 1961



THE UPWARD THRUST OF RESEARCH . . .



Meetings

Forthcoming Events

November

6-8. Chemical Engineering Div., Chemcal Inst. of Canada, Toronto, Ont. (CIC. 48 Rideau St., Ottawa 2, Ont.)

6-9. Atomic Industrial Forum-9th Hot Laboratories and Equipment Conf., Chicago. III. (O. J. Du Temple, American Nuclear Soc., 86 East Randolph St., Chicago)

8. American Acad. of Arts and Sciences. Brookline, Mass. (J. L. Oncley, 280 Newton St., Brookline 46)

8-11. Acoustical Soc. of America. Cincinnati, Ohio. (W. Waterfall, American Inst. of Physics, 335 E. 45 St., New York 17)

8-11. Institute of Management Sciences. San Francisco, Calif. (W. Smith, Inst. of Science & Technology, Univ. of Michigan. Ann Arbor)

8-11. Plasma Physics. American Physical Soc., 3rd annual, Colorado Springs. Colo. (F. Ribe, Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, N.M.)

9-10. Operations Research Soc. of America, 20th, San Francisco, Calif. (P. Stillson, 115 Grove Lane, Walnut Creek. Calif.)

9-11. Gerontological Soc., Pittsburgh. Pa. (R. W. Kleemeier, Washington Univ.. Skinker and Lindell. St. Louis 30, Mo.)

9-12. Pacific Coast Fertility Soc., Palm Springs, Calif. (G. Smith, 909 Hyde St., San Francisco 9, Calif.)

9-20. Photography, Cinematography, and Optics, 3rd intern. biennial, Paris, France. (Comité Français des Expositions, 15 rue de Bellechasse, Paris 7)

12-17. Bahamas Conf. on Medical and Biological Problems in Space Flight, Nassau, Bahamas. (I. M. Wechsler, P.O. Box 1454, Nassau)

13-14. Exploding Wire Phenomenon, 2nd intern. conf., Boston, Mass. (W. G. Chace, Thermal Radiation Laboratory, CRZCM, Geophysics Research Directorate, Air Force Cambridge Research Laboratories. Bedford, Mass.)

13-16. Magnetism and Magnetic Materials, 7th annual intern. conf., Phoenix, Ariz. (P. B. Myers, Motorola, Inc., 5005 E. McDowell Rd., Phoenix 10)

13-17. American Public Health Assoc.. 89th annual, New York, N.Y. (APHA, 1790 Broadway, New York)

13-17. Gulf and Caribbean Fisheries Inst., 14th annual, Miami Beach, Fla. (J. B. Higman, Marine Laboratory, Univ. of Miami, 1 Rickenbacker Causeway, Virginia Key, Miami 49)

13-18. European Conf. on the Control of Communicable Eye Diseases, Istanbul, Turkey. (World Health Organization, Palais des Nations, Geneva, Switzerland)

14–16. American Meteorological Soc., Tallahassee, Fla. (Executive Secretary, AMS, 45 Beacon St., Boston 8, Mass.)

14-17. Corrosion in Nuclear Technology, symp., Paris, France. (European Federation of Corrosion, Société de Chimie Industrielle, 28 rue St. Dominique, Paris 7°)

14-18. Puerto Rico Medical Assoc., Santurce. (J. A. Sanchez, P.O. Box 9111, Santurce)

15-17. Eastern Analytical Symp., New York, N.Y. (A. Rekus, EAS, Research Dept., Baltimore Gas & Electric Co., Pratt St., Baltimore, Md.)

15-18. Society of Naval Architects and Marine Engineers, annual, New York, N.Y. (W. N. Landers, SNAME, 74 Trinity Pl., New York 6)

16-18. American Psychiatric Assoc., Milwaukee, Wis. (J. D. McGucken, 756 N. Milwaukee St., Milwaukee 2)

16-18. Etiology of Myocardial Infarction, intern. symp. (by invitation), Detroit, Mich. (T. N. James, Section on Cardiovascular Research, Henry Ford Hospital, Detroit)

16-18. Southern Thoracic Surgical Assoc., Memphis, Tenn. (H. H. Seiler, 517 Bayshore, Blvd., Tampa 6, Fla.)

16-19. American Anthropological Assoc., Philadelphia, Pa. (S. T. Boggs, 1530 P St., NW, Washington, D.C.)

17-18. Southern Soc. for Pediatric Research, Atlanta, Ga. (W. G. Thurman, Dept. of Pediatrics, Emory Univ. School of Medicine, Atlanta)

17-31. National Soc. for Crippled Children and Adults, annual conv., Denver, Colo. (NSCCA, 2023 W. Ogden Ave., Chicago 12, Ill.)

19-22. International College of Surgeons, Western regional, San Francisco, Calif. (W. F. James, 1516 Lake Shore Drive, Chicago 10, Ill.)

22–27. Automation and Instrumentation, 5th conf., Milan, Italy. (Federezione delle Societa Scientifiche e Techniche di Milano, via S. Tomaso 3, Milan)

22-1. Radioisotopes in Animal Biology and the Medical Sciences, conf., Mexico City, D.F. (International Atomic Energy Agency, 11 Kärntner Ring, Vienna 1, Austria)

23-25. Central Assoc. of Science and Mathematics Teachers, Chicago, Ill. (J. Kennedy, Indiana State Teachers College, Terre Haute)

24–25. American Soc. of Animal Production, Chicago, Ill. (C. E. Terrill, Animal Husbandry Research Div., U.S. Dept. of Agriculture, Beltsville, Md.)

24–25. National Council for Geographic Education, Philadelphia, Pa. (L. Kennamer, Dept. of Geography, Univ. of Texas, Austin)

25-26. American College of Chest Physicians, annual interim session, Denver, Colo. (M. Kornfeld, ACCP, 112 E. Chestnut St., Chicago 11, Ill.)

26. Medical Aspects of Sports, 3rd natl. conf., Denver, Colo. (F. V. Hein, AMA Committee on the Medical Aspects of Sports, 535 N. Dearborn St., Chicago 10, Ill.)

26-1. American Soc. of Mechanical Engineers, winter, New York, N.Y. (L. S. Dennegar, ASME, 29 W. 39 St., New York, N.Y.)

26-1. Radiological Soc. of North America, annual, Chicago, Ill. (R. P. Barden, 713 E. Genesee St., Syracuse 2, N.Y.)

27–28. Agricultural Meteorology, 4th conf., St. Louis, Mo. (K. C. Spengler, American Meteorological Soc., 45 Beacon St., Boston 8, Mass.)

27-29. American Soc. of Hematology,





de Fonbrune Micromanipulator — Has Smooth, Uniform Pneumatic Movement



Improved de Fonbrune Micro-Forge With Binocular Body

Specifically developed for use in the fabrication of simple and intricate micro-tools of glass or metal under controlled conditions. Use of the de Fonbrune micro-forge is recommended with any type micromanipulator. The forge is now built with binocular stereoscopic microscope. With this modification, the image is observed erect not inverted — in three dimensions, an important factor in rapid, accurate work.

Affords new simplicity and flexibility for micro-studies in biological or chemical technics

The de Fonbrune micromanipulator has proved to be of great value in microstudies in many fields. In biology the instrument is used in cell dissection and isolation . . . micro-injection and operation on protozoa . . . pH studies on living cells . . . isolation and transfer of single bacteria, etc. It has proved equally serviceable in study of fibers and yeast cells, in investigating oils, rust deposits, colloidal, and other materials.

Manufactured under exclusive license of the French patents, the instrument consists of a manipulator and receiver. Use with any microscope . . . arranged for right or left hand operation. The microtool is mounted on the receiver; impulses from the manipulator are transmitted to the tool through sensitive pneumatic membranes. Within a range of 3 mm, the micro-instrument may be moved in any plane or angle by a single control. Ratio of displacement of control lever and micro-tool may be adjusted from 1:50 to 1:2500.

Write for prices and descriptive bulletin T114.

aloe scientific Division of Brunswick

General Offices: 1831 Olive, St. Louis 3, Missouri FULLY STOCKED DIVISIONS COAST-TO-COAST



annual, Los Angeles, Calif. (J. W. Rebuck, ASH, Henry Ford Hospital, Detroit 2, Mich.)

27-30. American Medical Assoc., Denver, Colo. (F. J. L. Blasingame, 535 N. Dearborn, Chicago 10, Ill.)

27-30. American Soc. of Agronomy, jointly with Crop Soc. of America, Council on Fertilizer Application, and Soil Science Soc. of America, St. Louis, Mo.

(ASA, 2702 Monroe St., Madison, Wis.) 27-30. Entomological Soc. of America, Miami, Fla. (R. H. Nelson, 4603 Calvert Rd., College Park, Md.)

29-1. Communication Wires and Cables, symp., Asbury Park, N.J. (H. Kingsley, U.S. Army Research and Development Laboratory, Fort Monmouth, N.J.) 29–1. Western Surgical Assoc., San

Francisco, Calif. (W. W. Carroll, 700 N. Michigan Ave., Chicago 11, Ill.)

30. American Geographical Soc., New York, N.Y. (C. W. Bastable, Columbia Univ., New York 27)

30-1. Conference on Graduate Medical Education, Philadelphia, Pa. (P. Nemir, Jr., Dean, Graduate School of Medicine, Univ. of Pennsylvania, Philadelphia)

30-1. Vehicular Communications, Minneapolis, Minn. (J. Kahnke, Minneapolis-Honeywell, Aero Div., 1541 Edgewater Ave., St. Paul 13, Minn.)

30-2. Purest Substances in Science and Technology, intern. symp., Dresden, Germany. (Sekretariat, Chemische Gesellschaft in der Deutschen Demokratischen Republik, Unter den Linden 68/70, Berlin W.8, Germany)

Company

Alexandria, Virginia



735 North St. Asaph Street

1. Symposium on Insulin, New York Diabetes Assoc., New York, N.Y. (New York Diabetes Assoc., 104 E. 40 St., New York 16)

1-2. Linguistic Circle of New York, 7th annual conf., New York, N.Y. (L. Urdang, Random House, Inc., 501 Madison Ave., New York 22)

2. International College of Surgeons, intern. executive council, Chicago, Ill. (H. E. Turner, 1516 Lake Shore Dr., Chicago 11)

2. New York State Registry of Medical Technologists, annual seminar, New York, N.Y. (S. H. Keeling, 1719 Midland Ave., Syracuse, N.Y.)

2-7. American Acad. of Dermatology and Syphilology, annual, Chicago, Ill. (R. R. Kierland, Mayo Clinic, Rochester, Minn.)

3-6. American Inst. of Chemical Engineers, New York, N.Y. (F. J. Van Antwerpen, AICE, 345 E. 47 St., New York 17)

4-6. Institute of the Aerospace Sciences, Aerospace Support and Operations, natl., Orlando, Fla. (R. J. Kotowski, 318 Virginia Dr., Melbourne, Fla.)

4-8. International Colloquium on Ionic Bombardment, Bellevue, France. (Natl. Scientific Research Center, 15 Quai Anatole France, Paris 7°, France)

4-9. Mathematics Instruction at Secondary and University Levels, Inter-American conf., Bogota, Colombia. (M. Alonso, Div. of Science Development, Pan American Union, Washington 6)

4-9. World Federation of Neurology, Problem Commission of Tropical Neurology, Buenos Aires, Argentina. (P. Bailey, Natl. Inst. of Neurological Diseases and Blindness, Bethedsa, Md.) 4-16. Inter-American Conf. on Educa-

tion and Economic and Social Development, Santiago, Chile. (U.S. National Commission for UNESCO, Dept. of State, Washington 25)

4-16. Latin American Phytotechnical Meeting, 5th, Buenos Aires, Argentina. (U. C. Garcia, Organizing Committee, Rivadavia 1439, Buenos Aires)

5-7. Building Research Inst., Washington, D.C. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

6-7. UNESCO Intern. Non-Governmental Organizations on Extension of Intern. Collaboration in Education, Science and Culture to Africa, Paris France. (Place de Fontenoy, Paris 7°)

6-8. Electrical Furnace Steel Conf., 19th, American Inst. of Mining, Metallurgical and Petroleum Engineers, Pittsburgh, Pa. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

6-8. Latin-American Congr. of Pathological Anatomy, 3rd, Medellín, Colombia. (A. C. Henao, Laboratorio de Anatomía Patológica, Rua Botucatu 720, São Paulo, Brazil)

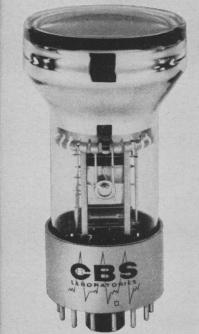
6-8. Conference on Document Copying by Photography, London, England. (A. J. O. Axford, Ozalid Co., Longston Rd., Loughton, Essex, England) 6-8. National Institutes of Health Symp.

on Neuroendocrinology, Miami, Fla. (A.



20 OCTOBER 1961

CBS TYPE 7818 PHOTOMULTIPLIER



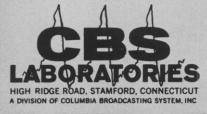
For Gamma-Ray Spectrometers, Flying Spot Scanners, and Photometric Instruments

Sensitive to the blue region of the spectrum, this new 3-inch diameter, 10-stage, end-on tube has a plano-concave faceplate to insure uniform sensitivity across its face. Focusing is accomplished by means of a separate electrode to optimize photoelectron collection and to improve resolution.

The tube's linear multiplier structure provides short transit-time spread and fast rise time; shock and vibration specifications of the rugged multiplier structure are guaranteed by CBS.

The 7818 is one of CBS' complete line of photomultipliers; a catalog of detailed specifications is available on request.

Engineers and Physicists: If you are experienced in electron optics or electronics research and development we invite you to investigate our employment openings. An Equal-Opportunity Employer:



V. Nalbandov, 102 Animal Genetics, Univ. of Illinois, Urbana)

6-12. American Acad. of Optometry, Chicago, Ill. (C. C. Koch, 1506-08 Foshay Tower, Minneapolis 2, Minn.)

6-16. Food and Agriculture Organization of the U.N. World Health Organization, Nutrition Conf. for the Far East, 5th, Hyderabad, India. (Intern. Agency Liaison Branch, Office of Director General, FAO, Viale delle Terme di Caracalla, Rome, Italy)

6-16. Food and Agriculture Organization of the U.N., Far East Meeting on Animal Production and Health, 3rd, Bangkok, Thailand. (Intern. Agency Liaison Branch, Office of Director General, FAO, Viale delle Terme di Caracalla, Rome, Italy)

7-8. Symposium on Sintered High-Temperature Oxidation-Resistant Materials, London, England. (S. C. Guilan, Powder Metallurgy Joint Group, Inst. of Metals, 17 Belgrave Sq., London)

7-9. American Chemical Soc. Southwest-Southeast regional meeting, New Orleans, La. (P. D. Accardo, California Chemical Co., Oronite Div., Belle Chasse, La.)

7-9. New York Acad. of Sciences Conf. on the Cervix, New York, N.Y. (W. R. Lang, Jefferson Medical College, Philadelphia, Pa.)

7-9. Texas Acad. of Science, Galveston. (D. E. Edmondson, Mathematics Dept., 115 Bendect Hall, Univ. of Texas, Austin 12)

8. Food and Agriculture Organization of the U.N., Advisory Group on Training in Home Economics and Social Work, Rome, Italy. (Intern. Agency Liaison Branch, Office of Director General, FAO, Viale delle Terme di Caracalla, Rome)

8-9. Symposium on Plasma Membrane, New York, N.Y. (A. P. Fishman, New York Heart Assoc., 10 Columbus Circle, New York 19)

8-9. American Rheumatism Assoc., interim session, Washington, D.C. (F. E. Demartini, 622 W. 168 St., New York 32)

8-9. Association for Research in Nervous and Mental Diseases, annual, New York, N.Y. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

8-10. American Psychoanalytic Assoc., New York, N.Y. (D. Beres, 151 Central Park W., New York 23)

9-10. Academy of Psychoanalysis, New York, N.Y. (J. H. Merin, 125 E. 65 St., New York 21)

10-13. American Phytopathological Soc., Biloxi, Miss. (G. A. Zentmyer, Dept. of Plant Pathology, Univ. of California, Riverside)

11-15. Agricultural and Public Health Aspects of Radioactive Contamination in Normal and Emergency Situations, technical seminar, The Hague, Netherlands. (Food and Agriculture Organization of the U.N., Intern. Agency Liaison Branch. Office of the Director General, Viale delle Terme di Caracalla, Rome. Italy)

11-15. Symposium on Organization of Agricultural Research, Muguga, Kenya. (Commission for Technical Cooperation in Africa South of the Sahara, Pvt. Mail Bag 2359, Lagos, Nigeria)

11-16. Ionospheric Soundings in the In-



Type 2300—invaluable for those laboratory situations where a single or multiple heat source is needed, yet space and money are scarce. Ruggedly built to withstand hard, continuous usage. Takes less than nine minutes to reach 370°C top temperature (reserve power at 370°C is 46%). Perforated stainless steel case . . . well ventilated . . . longlife heating element . . . cast aluminum top. Stepless control automatically compensates for fluctuations in line voltage and ambient temperatures. Easily read control dial. 3 9/16" dia top plate . . . 3³/₄" height. 115v a-c. Price complete with 5' cord and 3-prong plug \$1.5.00



THERMOLYNE CORPORATION (formerly Thermo Electric Mfg. Co.) 568 Huff St., Dubuque, Iowa

tern. Geophysical Year/Intern. Geophysical Cooperation-1959 Symp., Nice, France. (A. H. Shapley, URSI World-Wide Soundings Commission, Central Radio Propagation Laboratory, Natl. Bureau of Standards, Boulder, Colo.)

12-14. Association for Computing Machinery, Eastern joint computer conf., Washington, D.C. (B. Oldfield, I.B.M. Corp., 326 E. Montgomery, Rockville, Md.)

12–15. American Soc. of Agricultural Engineers, Chicago, Ill. (J. L. Butt, ASAE, 420 Main St., St. Joseph, Mich.)

12-19. Latin American Congr. on Microbiology, 2nd, San Jose, Costa Rica. (J. de Abate, Apartado 1404, San Jose)

13. American Acad. of Arts and Sciences, Brookline, Mass. (J. L. Oncley, 280 Newton St., Brookline 46)

15-16. Oklahoma Acad. of Science, Stillwater. (D. Buck, Northern Oklahoma Junior College, Tonkawa)

17-18. International Congr. of Comparative Pathology, 9th, Paris, France. (L. Grollet, Comité International Permanent des Congrès de Pathologie Compareé, 63 Avenue de Villiers, Paris 17°)

19-23. Inter-American Congr. of Psychology, 7th, Monterrey, Mexico. (G. M. Gilbert, Psychology Dept., Long Island Univ., Brooklyn 1, N.Y.)

22–29. Plant Tissue and Organ Culture, intern. symp., New Delhi, India. (P. Maheshwari, Univ. of Delhi, Delhi)

26–28. History of Science Soc., annual, Washington, D.C. (J. C. Greene, 1121 Iowa Ave., Ames, Iowa)

26-31. American Assoc. for the Advancement of Science, annual, Denver, Colo. (R. L. Taylor, AAAS, 1515 Massa-chusetts Ave., NW, Washington 5)

27-29. American Folklore Soc., Cincinnati, Ohio. (T. P. Coffin, 110 Bennett Hall, Univ. of Pennsylvania, Philadelphia 4)

27–29. American Geophysical Union, 1st Western natl., Los Angeles, Calif. (A. N. Sayre, U.S. Geological Survey, Washington 25)

27-29. American Economic Assoc., New York, N.Y. (J. W. Bell, AEA, Northwestern Univ., Evanston, Ill.)

27-29. American Physical Soc., Los Angeles, Calif. (K. K. Darrow, 538 W. 120 St., New York 27)

27-29. Western Soc. of Naturalists, Eugene, Ore. (I. A. Abbott, Hopkins Marine Station, Pacific Grove, Calif.)

Station, Pacific Grove, Calif.) 27-30. Institute of Mathematical Statistics, annual, New York, N.Y. (D. C. Riley, American Statistical Assoc., 1757 K St., NW, Washington 6)

28-29. Northwest Scientific Assoc., Spokane, Wash. (E. J. Larrison, Univ. of Idaho, Moscow)

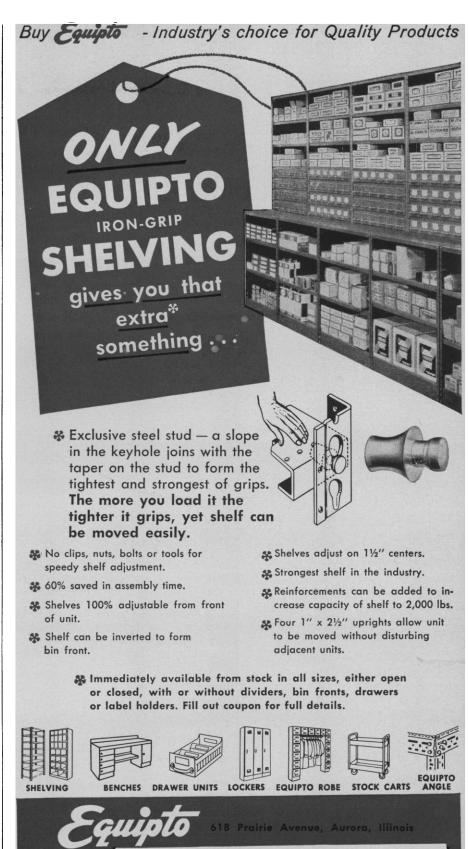
28–29. American Chemical Soc., Div. of Industrial and Engineering Chemistry, Newark, Del. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

28-29. Linguistic Soc. of America, annual, Chicago, Ill. (A. A. Hill, Box 7790 University Station, Austin 12, Texas)

28-30. Archaeological Inst. of America, Detroit, Mich. (L. A. Campbell, 5 Washington Square N., New York 3)

28-30. Phi Delta Kappa, Bloomington, Ind. (R. S. Merkel, Indiana Central College, Indianapolis 27)

20 OCTOBER 1961



1	2	4	1

send me your Reference Manual No. 487. Also free book-

ZONE

STATE

let "HOW TO SOLVE YOUR STORAGE PROBLEMS".

Please have layout engineer call.

NAME

FIRM

CITY

STREET