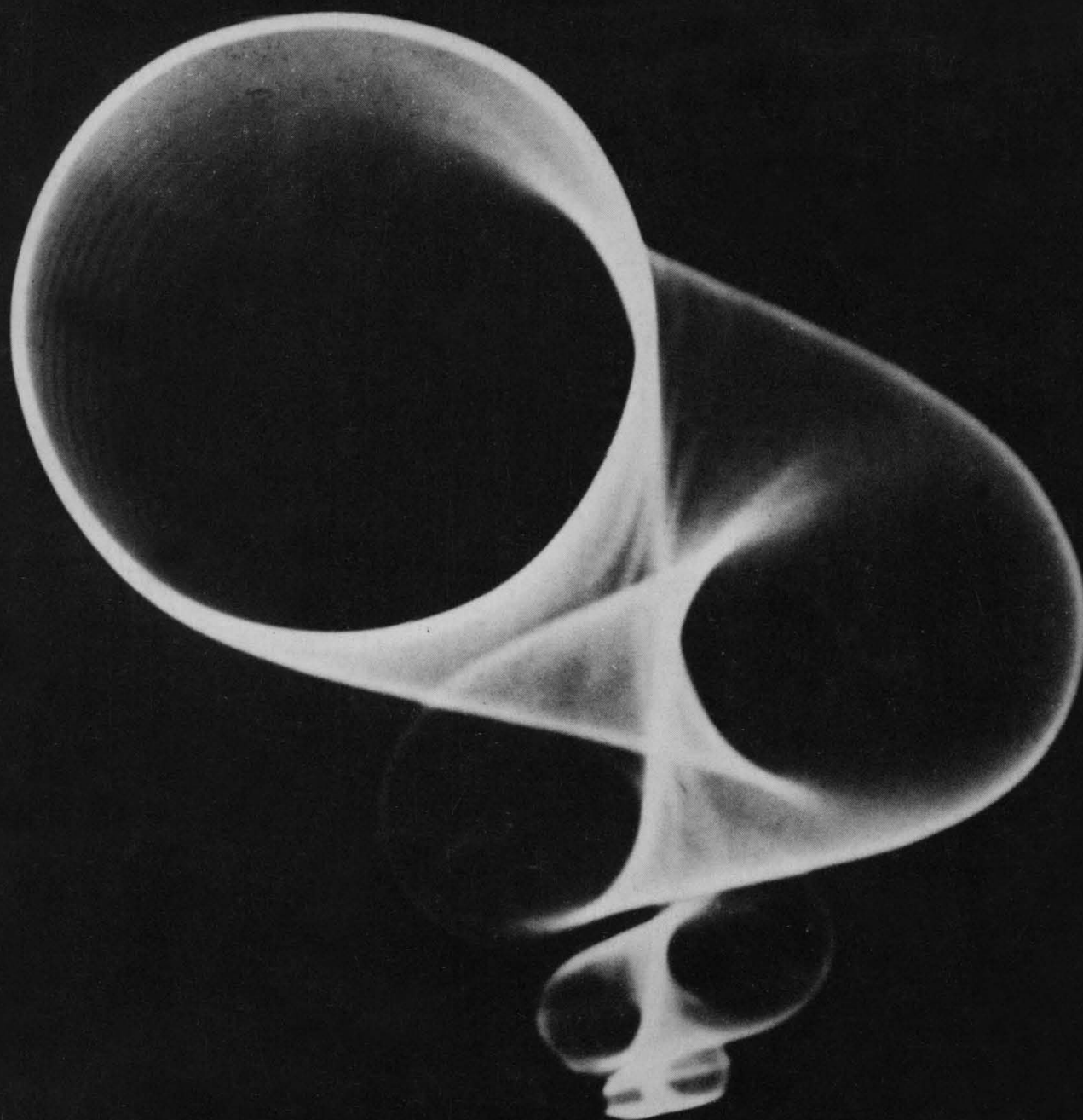


SCIENCE

12 March 1965

Vol. 147, No. 3663

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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on the subject of *Imagination* . . .

- *Imagination* stimulated Christopher Columbus in his belief that the world is round . . .

- It was *imagination* that led Copernicus to postulate that the earth rotates daily on its axis and that the planets revolve around the sun . . .

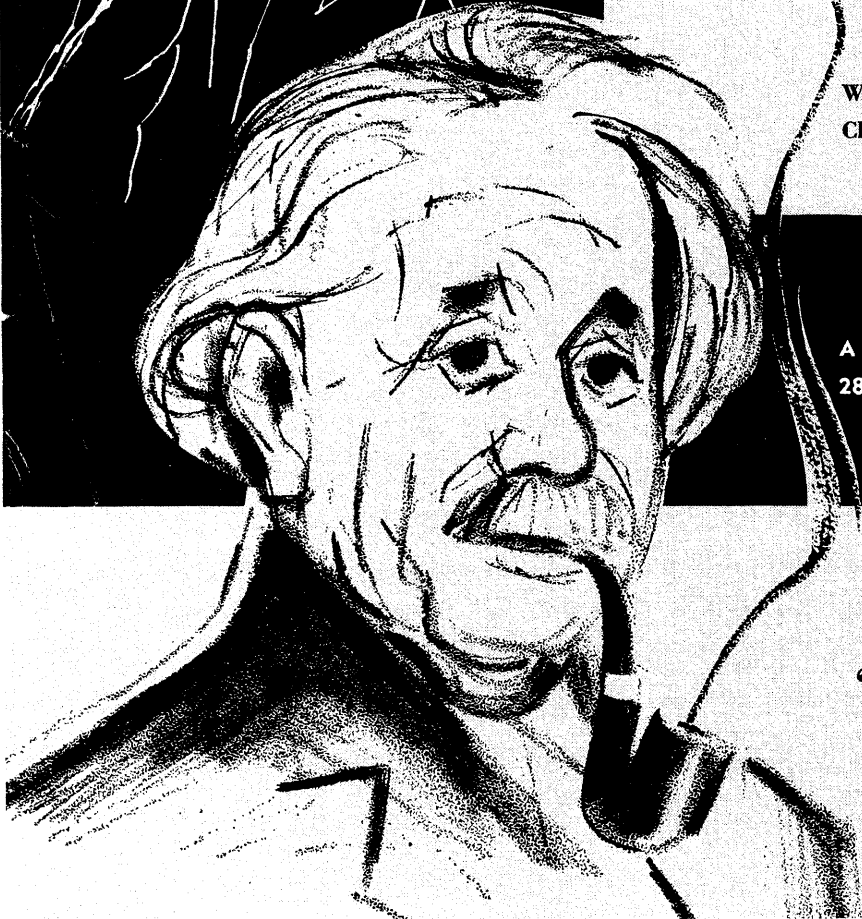
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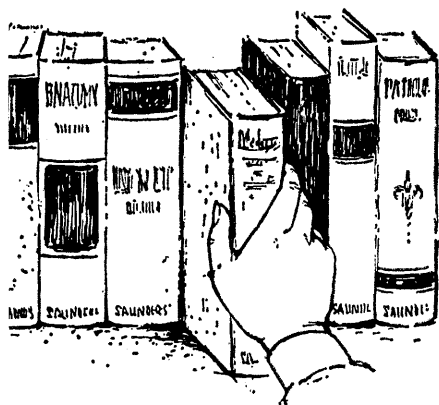
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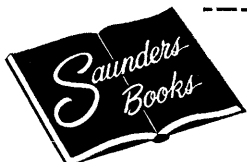
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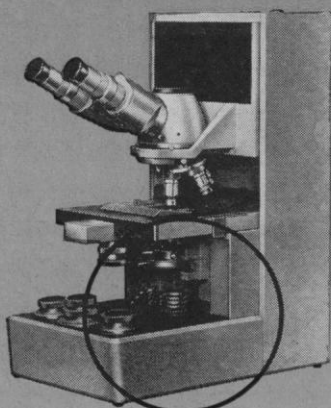
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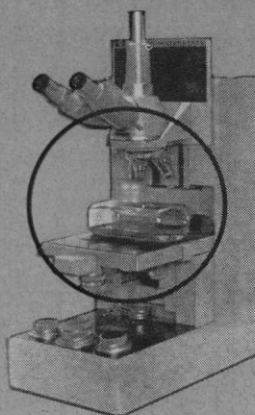
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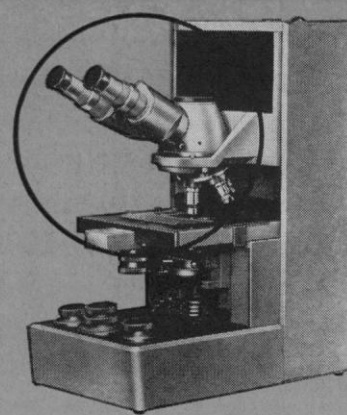
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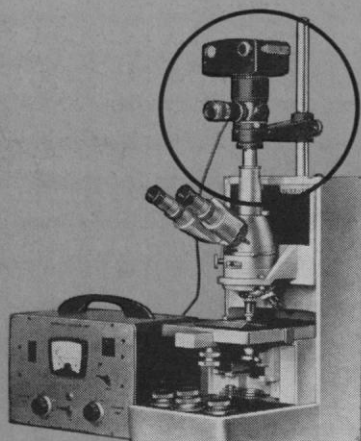
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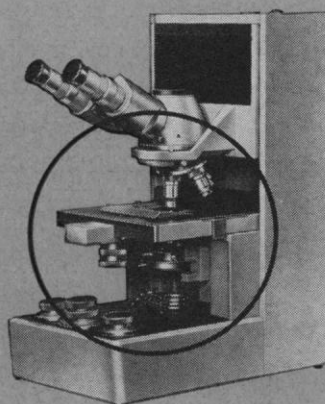
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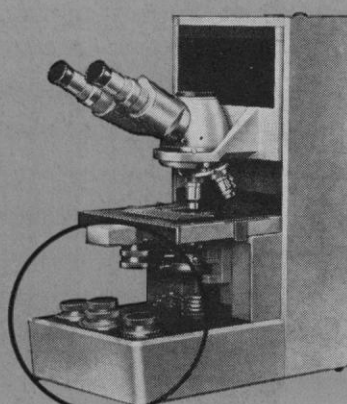
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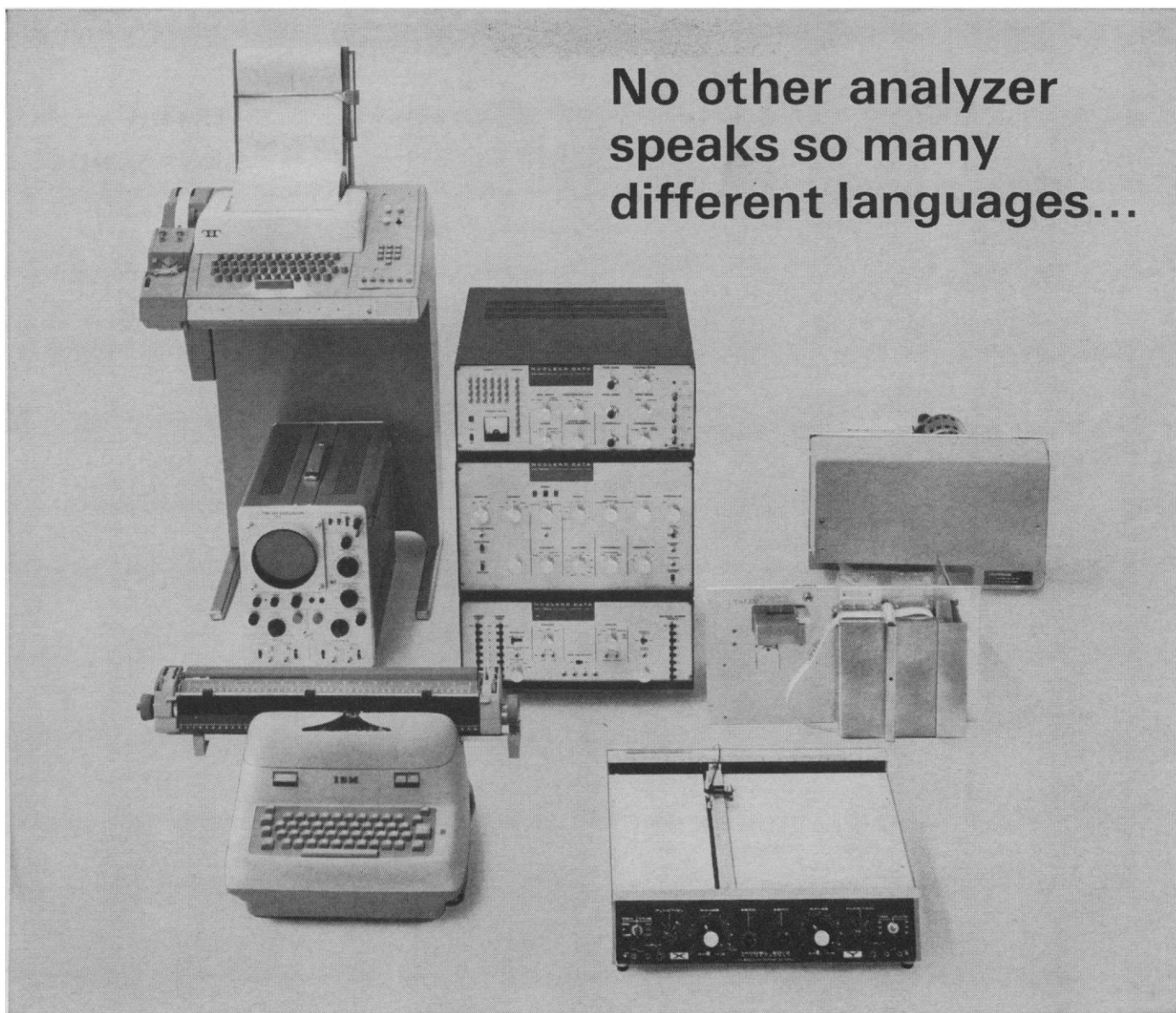
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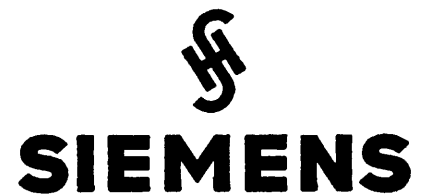
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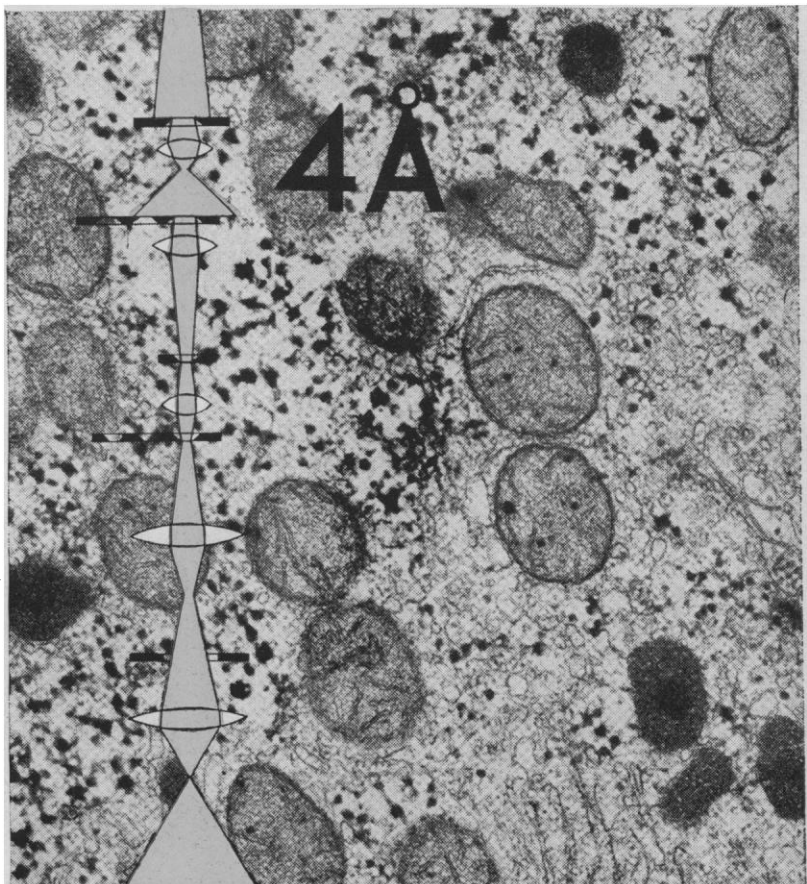
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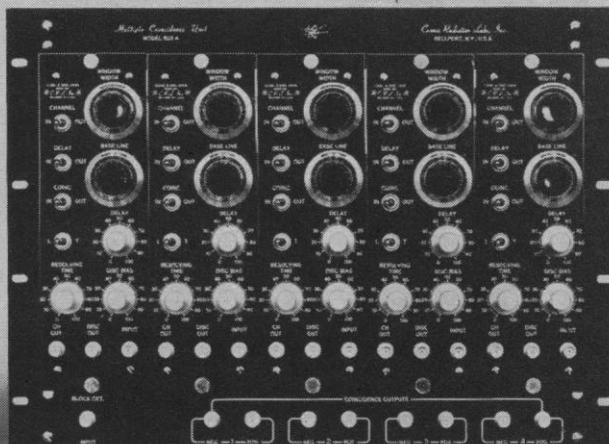
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Extendable block circuitry can be used to prevent the counting of those events that may have been distorted by previous closely occurring events at the detector or any of the intervening circuits. A much more active source may therefore be counted without spectrum distortion.

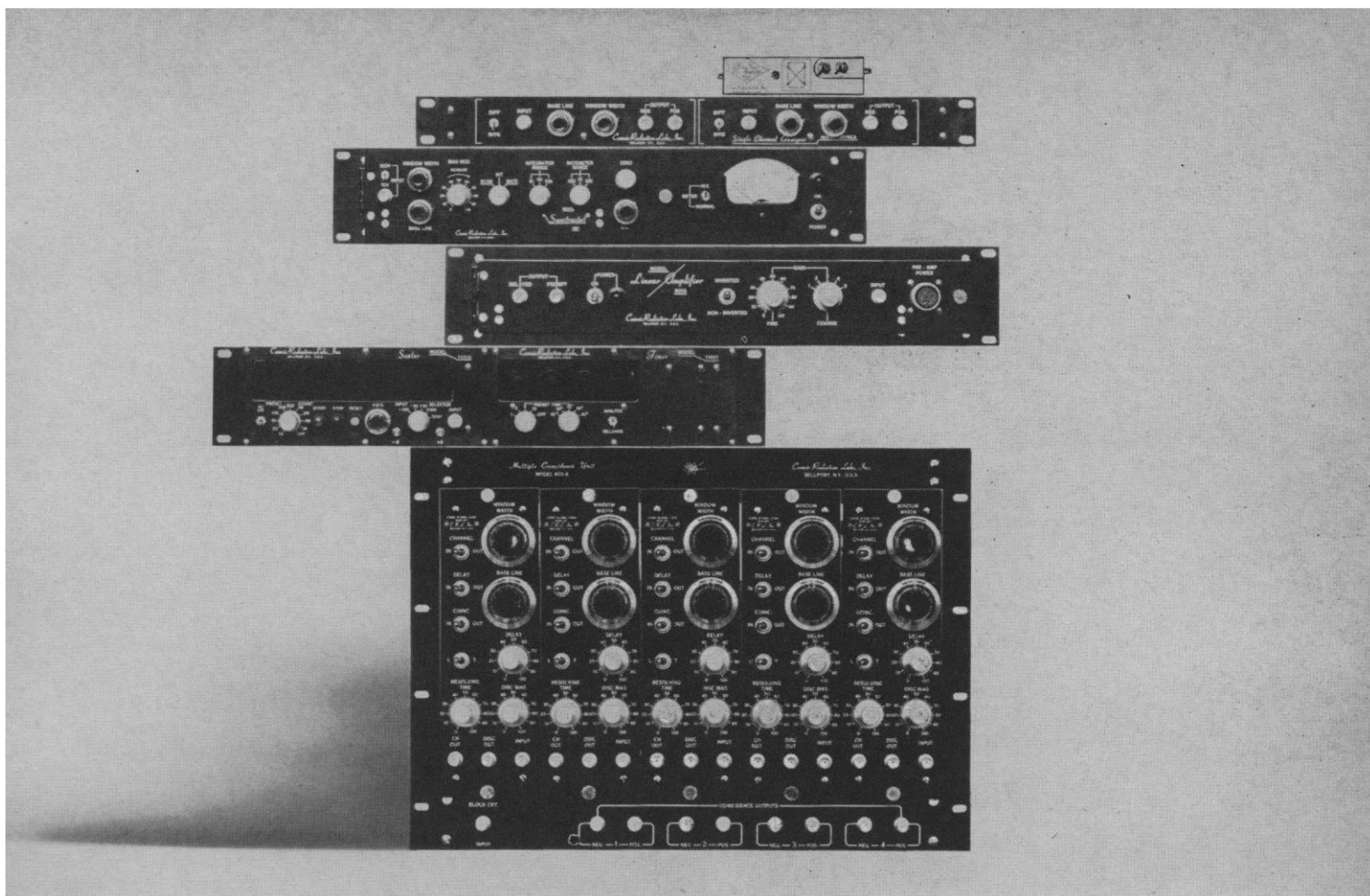
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The Cosmic Model 802-B Plug-In Unit can be used in place of the Model 801-B as supplied in the basic unit. The 802-B,



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- Instruments and techniques developed under Project IMPS (Instrumentation Methods for Physiological Studies) funded by NSF, sponsored by the University of California, Berkeley
- Ideal lab adjunct to classroom material created by BSCS program

Introducing IMPScope, an inexpensive instrument designed for use by students in secondary schools and colleges to aid them in the study of a large range of physiological phenomena in living organisms.

With IMPScope, your students will be able to investigate in the laboratory such electrophysiological phenomena as the activity of the heart, brains, muscles, and nerves. With the accessory package (which is EVA-3-1) frog neurocardiography, nerve action potentials, finger plethysmograph, and the vector basis of electrocardiography can be studied. Simple transducers, to be available later, will provide a muscle mechanograph, pneumograph, ballistocardiograph, phonocardiograph, phonomyograph, and a display of pulse pressure waveforms.

The Heathkit model EV-3 IMPScope and its associated equipment, including the sourcebook, were developed in conjunction with project IMPS, supported by the National Science Foundation and conducted by Mr. Norman N. Goldstein, Jr. at the University of California, Berkeley. Mr. Goldstein, also is the author of the unique sourcebook containing extensive laboratory experiments.

IMPScope updates and deepens the teaching of contemporary biology to stress the use of instruments as data gathering extensions of the senses . . . experiments which deal almost exclusively with live organisms and tissues . . . and the problem-solving type of laboratory approach with emphasis on quantitative summaries. Such material makes possible the introduction of instrumentation early in science teaching, thus underscoring the advantages and limitations of scientific instruments. For a complete discussion of biology instruction and instruments, see: Goldstein, N. N., Jr., "Science Teaching in An Age of Instrumentation," the *SCIENCE TEACHER (NSTA)*, Vol. 29, No. 6, Oct. 1962. Goldstein, N. N., Jr., "Instrumentation and The Teaching of Biology," the *AMERICAN BIOLOGY TEACHER (NABT)*, Dec. 1963.

The IMPScope, designed to be built by the uninitiated in electronics to further their understanding of instrumentation, consists of a high differential amplifier driving a slow sweep, long persistence 5" screen oscilloscope that is capable of displaying bioelectric potentials down to 200 microvolts. A stimulator is built-in which has variable rate, duration, and voltage. A selection of secondary transducers is available for transforming physiological activity into the correct electrical signal for display on the scope screen. The scope graticule is illuminated for photography purposes. Rear panel connectors are provided for external stimulator sync, extending built-in stimulator duration, and vertical signal output. The scope package includes a complete set of human EKG electrodes with leads and a lab. sourcebook. An accessory package includes a nerve chamber, vector dolly, plethysmograph, frog electrodes, and instructions.

Add a new dimension to your teaching . . . add the Heathkit IMPScope to your laboratory requirements for each student. Order now for prompt delivery or write for further details.

Kit EV-3, scope, 19 lbs. \$160.00
 Factory Assembled EVW-3, scope, 19 lbs. \$250.00
 Kit EVA-3-1, Accessory package, 3 lbs. \$35.00
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HEATH COMPANY, Dept. 37-3
Benton Harbor, Michigan 49023

In Canada: Daystrom Ltd., Ontario, Canada

☐ Please send information on Heathkit IMPScope & FREE 1965 Heathkit Catalog.



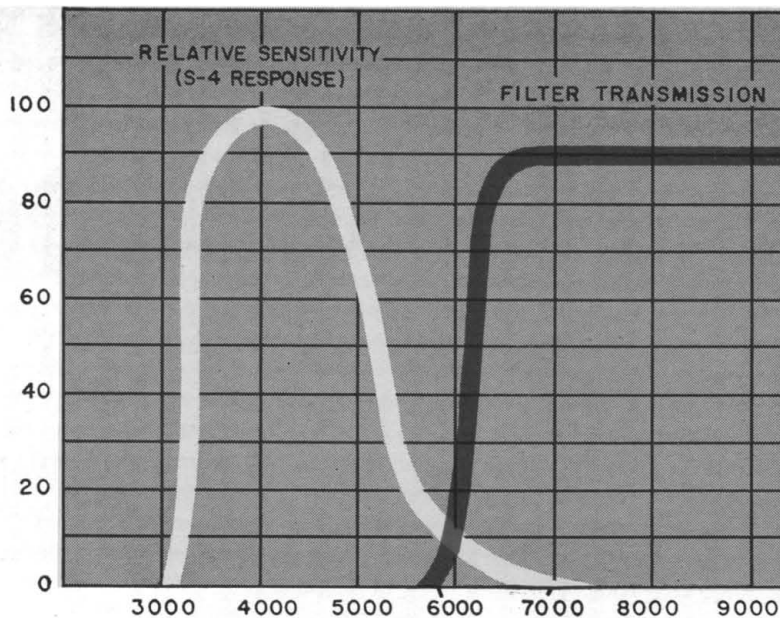
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Prices & specifications subject to change without notice.

EK-164



*The anode current comprising the "white" portion of this ratio is measured with a tungsten light source operated at a color temperature of 2870°K. The anode current comprising the "red" portion of this ratio is measured under conditions identical with the "white" measurement except that the light input is transmitted through a specially selected red filter as shown above.

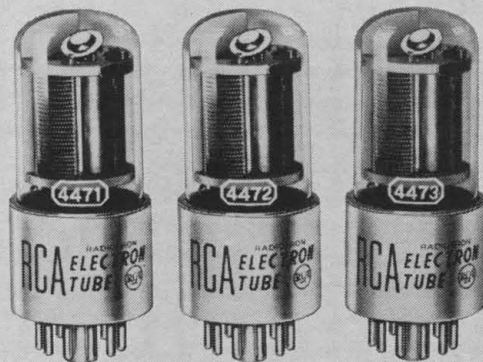
Red-to-White* Ratio* Controlled Above 5800 Angstroms

Now! RCA introduces three new photomultipliers with sensitivity ratings controlled above 5800 angstroms. A particularly desirable characteristic for radiation detection and measurement in the red region of the spectrum, this specified "red-to-white" ratio* is 5% or greater for RCA-4471; and 7% or greater for RCA-4472 and 4473. The 4471 and 4472 have all the desirable features and characteristics of the 931A as well as a higher luminous sensitivity rating, while the 4473 has all the desirable features and characteristics of the 1P21 as well as a higher luminous sensitivity rating. The 4471 and 4472 are unilaterally interchangeable with the 931A and the 4473 is unilaterally interchangeable with the 1P21.

Recommended for critical applications for detecting and measuring extremely low levels of light, these three RCA photomultipliers are excellent for use in such applications as flame, spark, and arc spectroscopy; in color printing processes; and in flying spot scanners.

Complete data are available from your RCA representative. See him about these and other RCA light-sensitive devices. Or, for information on specific types, write: RCA, Commercial Engineering, Section C116Q-2, Harrison, N.J.

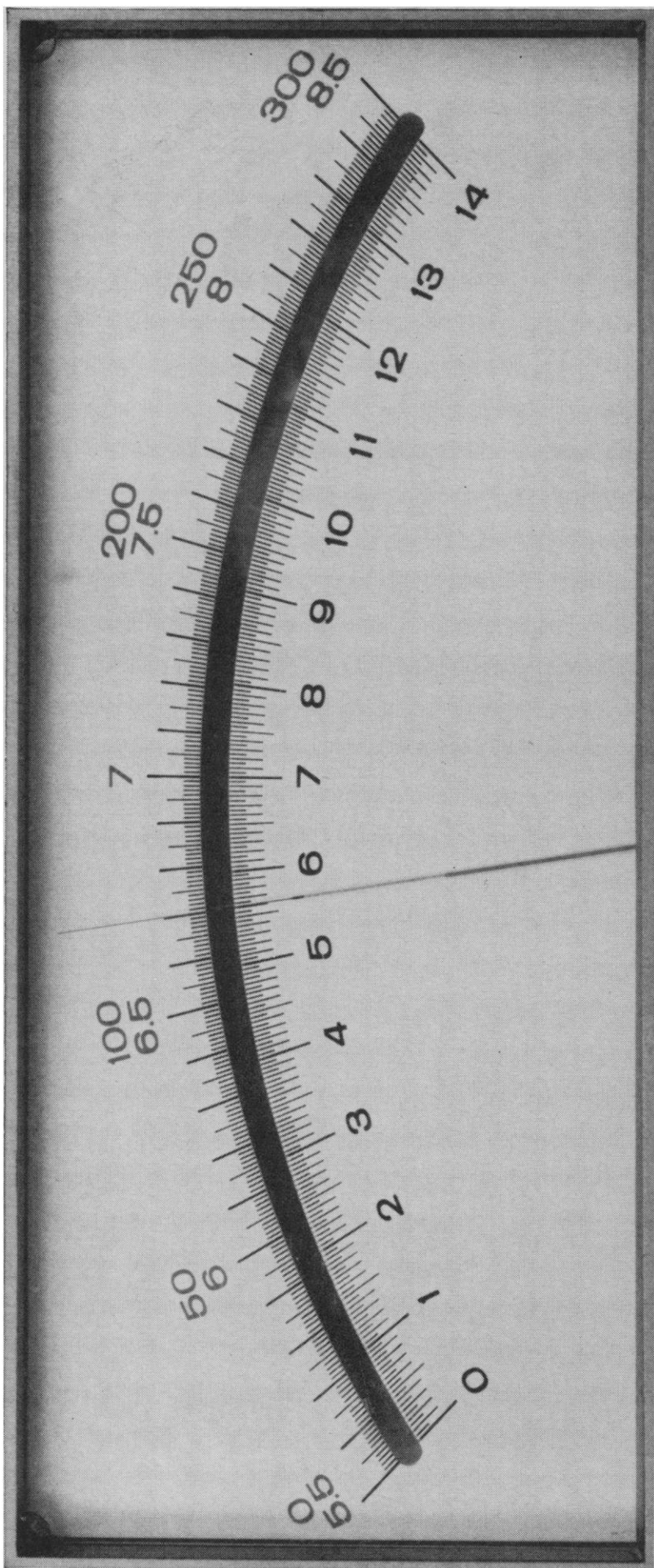
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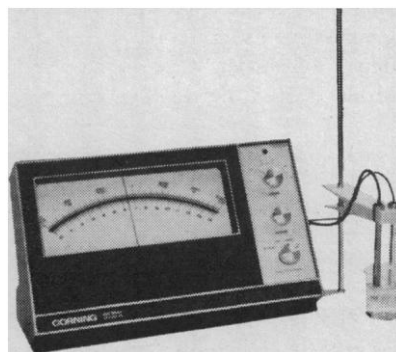


The Most Trusted Name
in Electronics



Divisions on the Model 10 meter scale, shown here actual size, are 0.05 pH on 0-14 range, 0.01 pH on 3-pH unit expanded-scale range. Repeatability is better than ± 0.005 pH; relative accuracy on expanded scale is ± 0.01 pH.

*Take a long look
at the new standard
in pH readability*



New CORNING® Model 10 Expanded- Scale pH Meter

Its taut-band meter is 10" long. That lets us put more scale divisions on it, yet keep them big for easy, precise reading.

You can measure 0-14 pH, 0 to ± 1400 mv, or expand any 3 pH units or 0 to ± 300 mv across the entire scale.

All controls are on one front panel. Push the function knob for the 0-14 scale. Pull it to expand any 3 pH units. Read directly for the most frequently used 5.5 to 8.5 pH range on expanded scale; any 3-pH-unit span can be accommodated.

The Model 10 is exceptionally stable. Its solid-state circuitry is designed to take full advantage of the low-drift stability you get in CORNING pH Electrodes with Triple-Purpose Glass Membrane and in CORNING Reference Electrodes.

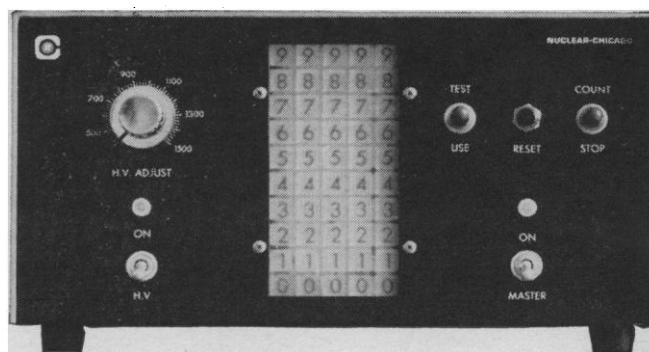
Price? Just \$485, complete with accessory kit that includes the unique CORNING electrodes.

Send for Bulletin SI-10 that details all the Model 10 design advances that mean ease of operation and dependability in your lab. Scientific Instruments Dept. 10, Corning Glass Works, 11 Blackstone St., Cambridge, Mass. 02139.

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SCIENTIFIC INSTRUMENTS

One to grow on.

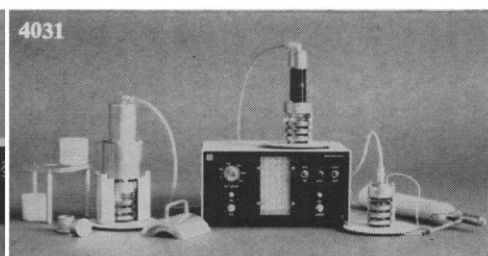
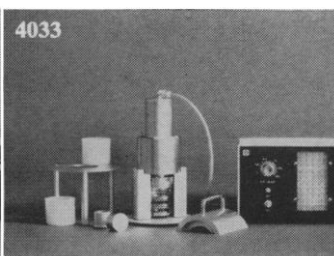
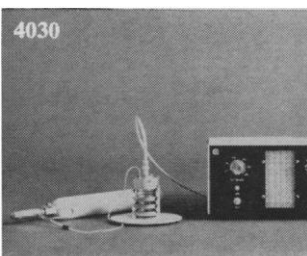
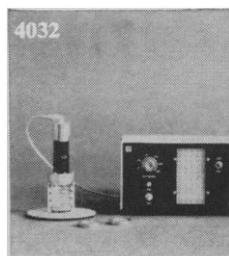
Nuclear-Chicago's *new* Model 8770 is a transistorized, direct-reading scaler designed for classroom use. It can be used with all types of radiation detectors and has an all-decade, 10-line readout of up to 99,999 counts. It's highly sensitive and has a resolving time of only 10 microseconds. The built-in high-voltage supply is continuously variable from +400 to +1500 volts. All controls are located on the front panel. The Model 8770 Scaler is a basic, precision instrument for radiation-counting experiments and demonstrations, especially when used in one of the Nuclear-Chicago counting systems described below. Model 8770 Scaler alone, \$350.



Four to learn from.

Four *new* radiation-counting systems for classroom and laboratory use are also offered by Nuclear-Chicago. These systems are based on the Model 8770 Scaler and encompass the fundamental methods of detecting and measuring radiation. Each system is composed of the Model 8770 Scaler, the appropriate detector system, and all the necessary components including:

dual timer for preset and elapsed time control of scaler; absorbers and sample pans; solid- and liquid-state sources; and our new Autoradiography Kit for introductory radiation studies. The 4032 Geiger System and the 4030 Gas-Flow System also include manuals detailing 33 experiments and a manual of instructor's notes containing helpful teaching aids.



Model 4032 Geiger Laboratory System

An efficient, end-window, Geiger-tube system for counting many soft-beta isotopes, such as C-14, as well as gammas, hard alphas, and betas. In addition to the components listed above, this system also includes sample preparation set, detector with stand, and C-14 beta source. Complete system, \$695.

Model 4030 Gas-Flow Laboratory System

For counting soft betas from isotopes such as C-14 and Na-22. Detector uses continuously replenished counting gas for greater stability and efficiency than sealed Geiger tube. Also includes detector with stand, sample preparation kit, one tank of Q-GAS® with pressure regulator, and C-14 source. Complete system, \$795.

Model 4033 Scintillation Laboratory System

For high-efficiency counting of gammas, as well as alphas and betas. Can be set up for planchet-counting or well-counting of solid or liquid samples. Also includes detector with NaI(Tl) gamma crystal and interchangeable alpha and beta crystals, detector stand, two Marinelli re-entrant beakers, two-piece lead shield for crystal and sample holder, and alpha, beta, and gamma sources. Complete system, \$995.

Model 4031 Alpha, Beta, Gamma Laboratory System

Consists of all of the items included in the other three systems for Geiger, gas-flow, and scintillation counting. The most complete, versatile, precise system for classroom demonstrations, experiments, and even for graduate work. Complete system, \$1295.

More to explore with.

Also *new* from Nuclear-Chicago: the Model 4011 Basic Demonstration Laboratory System. Includes everything you need for studies of Geiger-Müller counting, cloud-chamber phenomena, and basic experiments such as plant and animal radioactivity uptake. Complete 4011 System, \$299.

Full information on all of these components and systems is contained in our new four-page brochure, *Nuclear Science Laboratory Systems for Education*. Please write for your copy.



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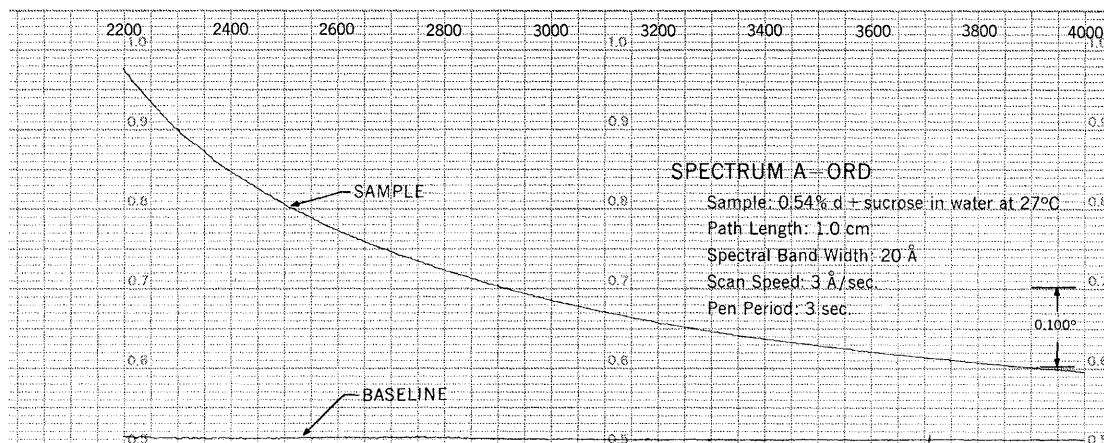
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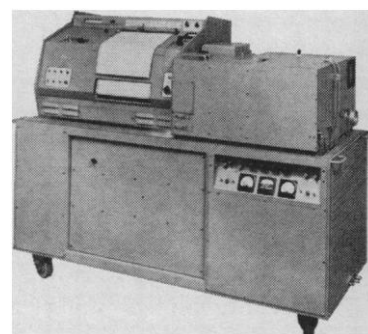
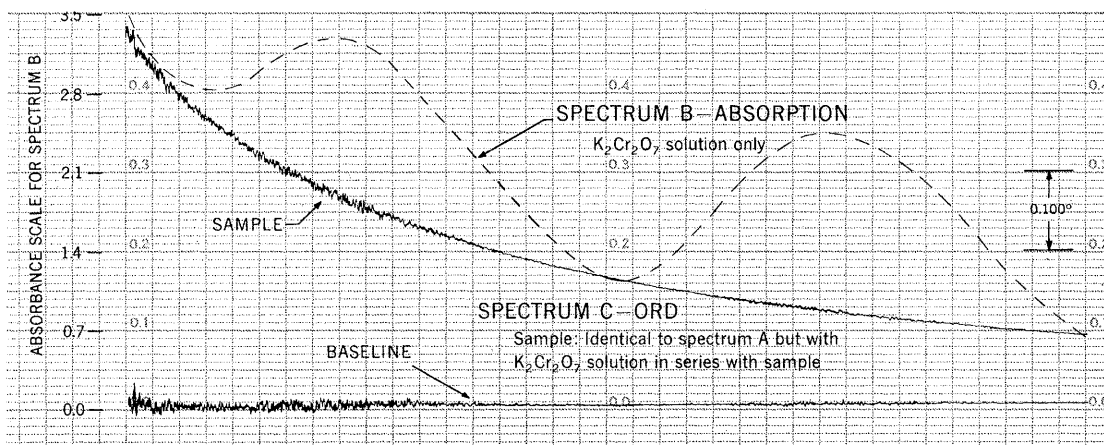
NUC-C-5-210

These products are also available from leading distributors of scientific apparatus. Prices shown are for United States and Canada.

Take full advantage of ORD technique... WITH CARY MODEL 60 SPECTROPOLARIMETER



The comparison spectra, A and C, show a sucrose sample recorded under different absorbance conditions. Spectrum C demonstrates the ability of the CARY 60 to provide valid dispersion data in regions of high total absorbance, so often a critical need. Note that except for the expected increase in noise due to increased absorbance, the original dispersion spectrum is accurately reproduced. Sucrose was chosen because it gives a simple one term Drude curve on which deviations are easily seen.



See CARY MODEL 60 at
FASEB Conference, April 10-14.

Make your own analysis of Model 60 performance. A portfolio of ORD spectra for a variety of samples is available by writing for Data File E501-35.

The CARY 60 provides the capability to utilize the ORD technique fully: Its high resolution precisely defines peaks and troughs, minimizes effects of rotation from adjacent bands, provides sharp spectra for more accurate peak-to-trough measurements. High sensitivity permits measurement of very dilute samples. Excellent stability (baseline drift less than 2 millidegrees per 8 hours) assures that precision is maintained even over long periods.

Maximum versatility is achieved with controls that provide operator freedom to utilize superior instrument performance over a variety of sample conditions in either static or kinetic applications.

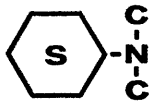
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INSTRUMENTS

UV-VIS/IR/Raman Recording Spectrophotometers • Spectropolarimeters • Vibrating Reed Electrometers and Amplifiers

Eastman Briefs

FOR MARCH



N,N-Dimethylcyclohexylamine

Form.....liquid
Color.....water white
Distilling range, 760 mm.....157-160°C.
Assay, by gas chromatography.....99%

This is an excellent catalyst for the manufacture of polyurethane foams. It is used as an intermediate in rubber accelerators. The reaction products with halomethyl compounds may be used as a treatment for textiles to enhance shrink resistance, water repellency, and softness.

Eastman Chemical Products, Inc.

Kingsport, Tennessee

B18



1,4-Cyclohexanebis(methylamine)

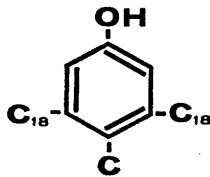
Form.....clear liquid
Isomer content.....40% cis, 60% trans
Boiling range, 760 mm.....239-244°C.
Purity.....99%

This diamine is versatile: it mixes with water and organic solvents; it reacts with atmospheric CO₂ to form a carbonate insoluble in the parent amine; it should also interest urethane chemists.

Eastman Chemical Products, Inc.

Kingsport, Tennessee

B31



2,6-Dioctadecyl-p-cresol

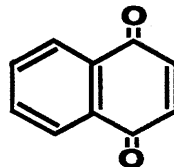
Form.....viscous liquid
Color.....very slightly yellow
Solubility.....soluble in most non-polar solvents

This effective non-volatile antioxidant for polypropylene and other systems now has FDA clearance for use in polyolefins which are used for packaging certain types of foods. (Federal Register, 29, No. 184, 13104, Sept. 19, 1964.) It is lawful for use in adhesives under Federal Food Additive Regulation 21 CFR 121.2520.

Eastman Chemical Products, Inc.

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B58



1,4-Naphthoquinone

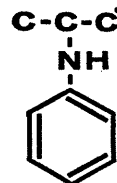
Form.....red brown solid
Melting point.....125-126°C.
Purity.....95%

Keep the resonating quinoid system intact and you have a useful dyestuff intermediate. Be a little more energetic and you can end up with something that licks tar spot, black spot and powdery mildew.

Eastman Chemical Products, Inc.

Kingsport, Tennessee

B59



N-Isopropylaniline

Form.....light yellow liquid
Boiling point.....206°C.
Assay, by gas chromatography.....98%

What with acrylic fibers creating new interest in cationic dyes, you could try this in synthesizing azo and triphenylmethane types. Look at it, too, as a pesticide or rubber chemical intermediate.

Eastman Chemical Products, Inc.

Kingsport, Tennessee

B63

Chemicals Sales Development Dept.

Eastman Chemical Products, Inc.

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B18 ☐ **B31** ☐ **B58** ☐ **B59** ☐ **B63** ☐

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Title

Company

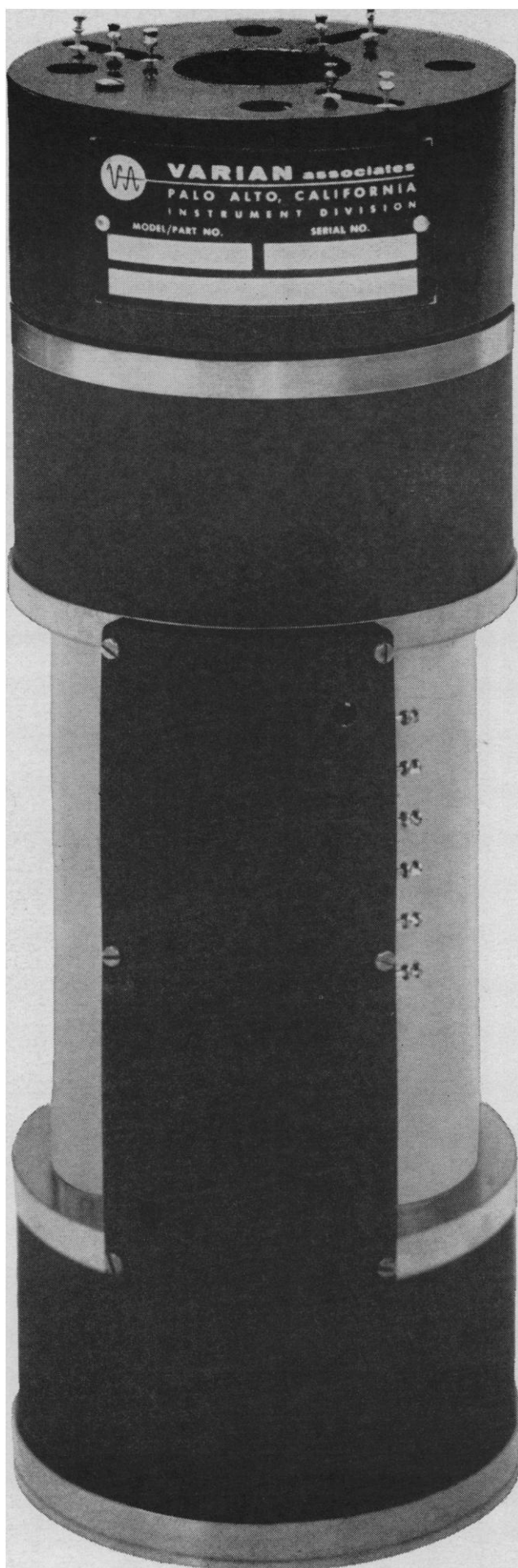
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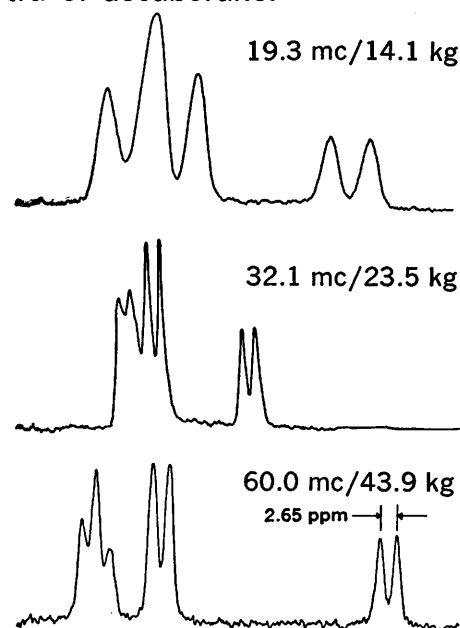


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Varian has a line of superconducting solenoids that offer interesting possibilities for wide-line NMR.

They produce up to 60 kG fields homogeneous to a few ppm over the sample volume.

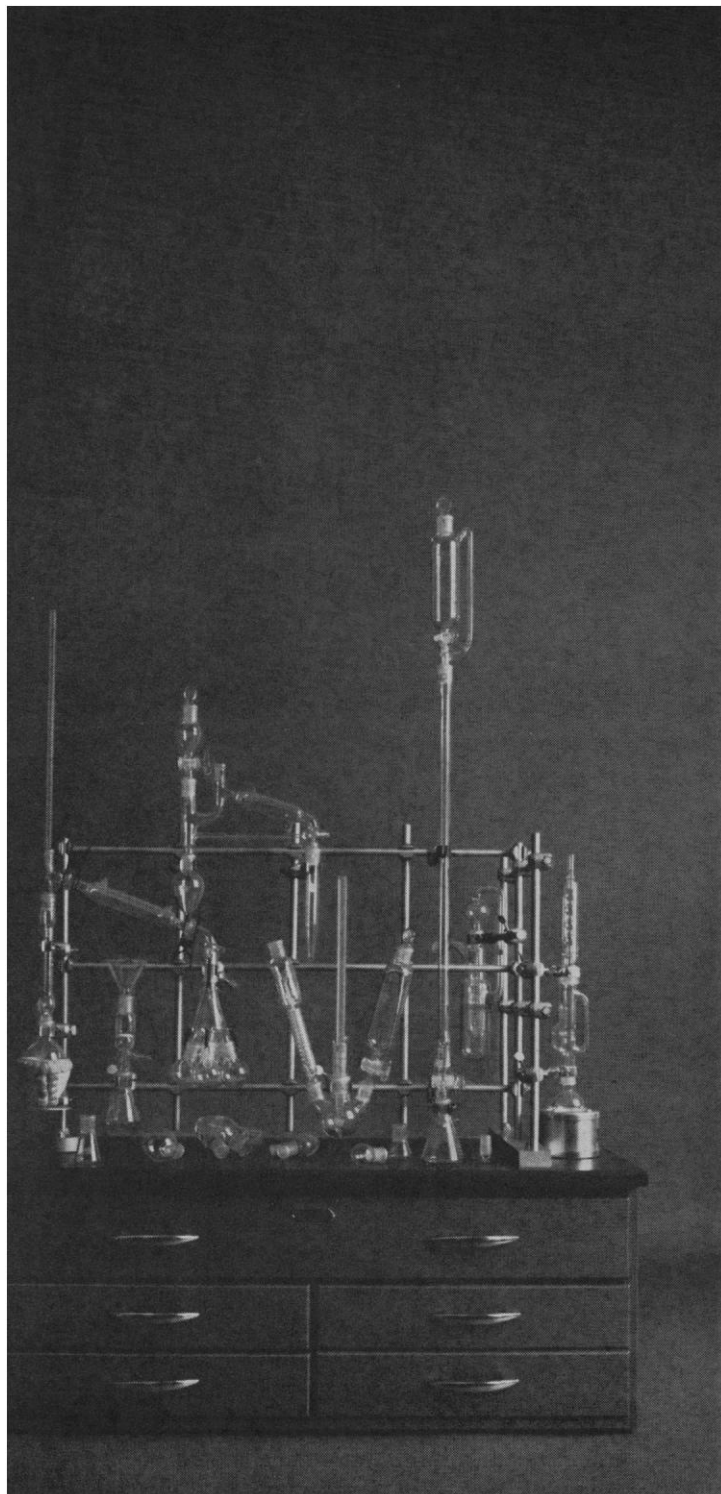
The greater chemical shift obtained with increasing field is illustrated by these three spectra of decaborane:



If this starts you thinking about what **you** could do with this solenoid (like studying oxygen-17, phosphorus-31, boron-11, or Knight shift in non-ferrous metals), drop us a line. We'll be glad to help.

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ANALYTICAL INSTRUMENT DIVISION
PALO ALTO, CALIF. □ ZUG, SWITZERLAND



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Give our bantam-ware semi-micro kit only 2.5 square feet of bench space and it will do anything required of a complete organic laboratory—with smaller quantities and reduced reaction time.

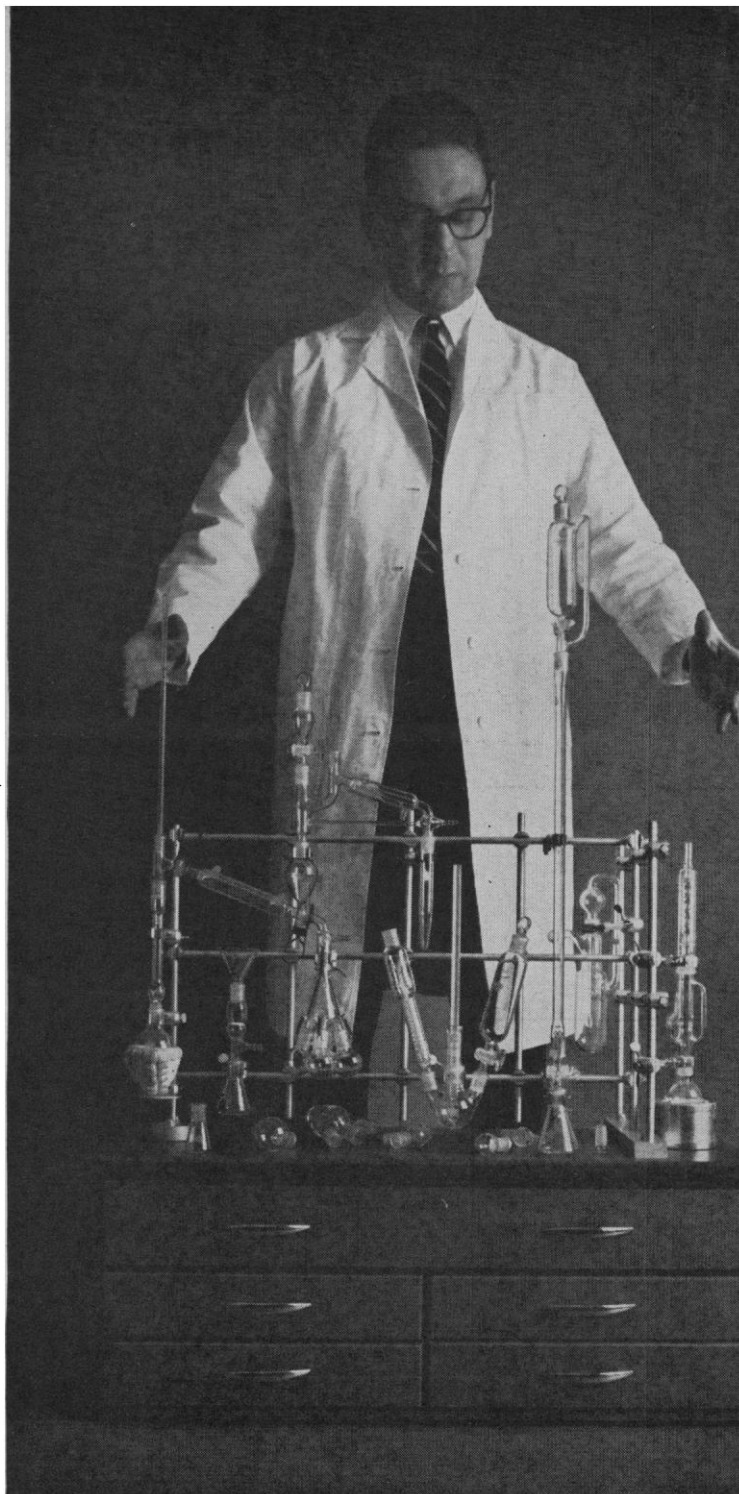
Each kit contains all the apparatus necessary for fractionation; steam, atmospheric, and vacuum distillation; chromatographic analysis; extraction; filtration; reflux; and separation. bantam-ware is convenient—the work area is at chest and eye level, easy to watch and make adjustments. And, when not in use, all components store neatly in the cabinet base.

To all the benefits of semi-micro scale

experimentation, we've added something big—Kontes quality.

bantam-ware glassware is designed to avoid troublesome product-catching bulbs and pockets beneath the ground joints. All components are proportioned for gradual bends and even glass distribution. Unnecessarily long travel paths and wetted surfaces have been eliminated to conserve costly chemicals and give maximum yields. Outer walls of $\frac{1}{4}$ inch joints are uniformly cylindrical. Butt seals are generously radiused. Glass support rods are used at all potential points of stress.

Kits are available with or without



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Teflon* stopcock plugs and spherical joints ($\frac{1}{8}$ inch) on inclined condenser connections. Each of four available bantam-ware kits contains equipment for supporting, clamping, agitating, heating.

There's one more point. The kit components are completely interchangeable with our entire bantam-ware line of over 300 items.

For complete information and prices, request Catalog TG-20 b-w.

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The Radiometer pHM28

offers high quality, stability and adaptability for future expansion of applications at low cost. With 0.02 pH reproducibility on a large mirrored and folded scale (0-10, 6-14 pH), it can be used for pH measurement, titration or control applications such as redox and dead stop end point titrations (Karl Fischer). Provision is made for connecting external recorders.

A matching control unit (Model TTT11) converts pHM28 to an automatic titrator or pH controller, and electrodes are available for many applications to match the convenient and integral electrode stand.

There are many other features—ask for literature today.

PRICE \$350.00



Model pHM28

pHM28/TTT11

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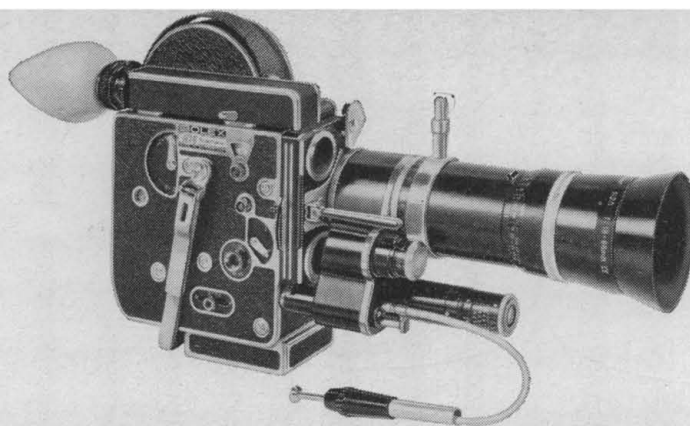
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Take the Bolex H-16 Rex with our Vario-Switar 86EE automatic electric eye zoom lens (shown above). It's the only 16mm electric eye zoom camera made. And for press and TV commercial production there's nothing like it. We realize you can read a light meter and change f/stops. But say you're shooting a parade. And just as you're zooming in on some dignitary the sun goes in. What do you do—take a new reading and readjust? Not with the 86EE. You just keep shooting automatically. Anything from wide angle to telephoto. And automatic loading and spool ejection speedup loading, too.

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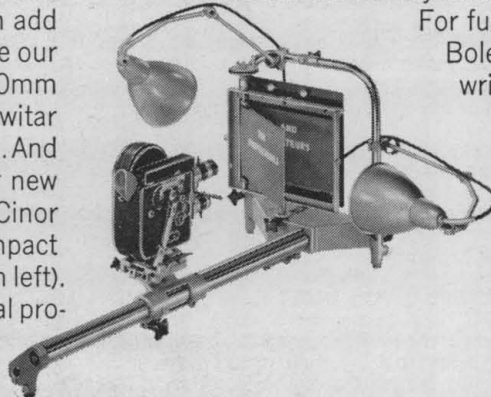
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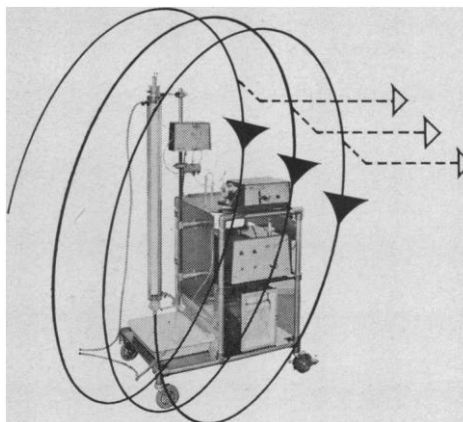


Division of Matheson Co. Inc., Norwood (Cincinnati) Ohio, E. Rutherford, N.J.

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RECYCLING CHROMATOGRAPHY

NEW INSTRUMENTATION FOR A NEW TECHNIQUE* IN CHROMATOGRAPHIC SEPARATION



The ReCyChrom is equally applicable for preparative and analytical separation of mixtures of large-sized or of small-sized molecules. These molecules do not have to be electrolytes and restrictions on the type of buffer used are less than with other types of chromatography. Components within a narrow range of molecular sizes, usually not resolved on simple gel filtration columns, are separated in the ReCyChrom by allowing the sample to pass repeatedly through the bed, thereby multiplying its effective height many times. Separated fractions and uninteresting or disturbing parts of the effluent may be bled out of the stream after any cycle without interrupting the separation of the remaining components.

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One unique advantage of recycling chromatography is the need for columns of only moderate length. Columns in two standard lengths, 60 cm and 100 cm, both with 32 mm bore are available at present. The range of sample volumes accommodated by these columns depends greatly on the nature of the sample. For simple desalting opera-

tions or for separation of peptides and amino acids from proteins, a sample of up to 150 ml is not unusual, whereas for purity controls of radioactively tagged concentrated preparations, quantities down to 1/100 of this volume are feasible. Sample application by pipette is eliminated. The pump sucks sample through a selector valve with a holdup of 150 μ l—a reproducible and non-critical method.

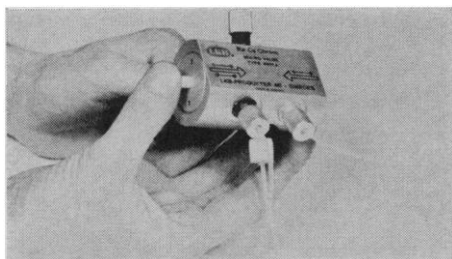
The four main components of the ReCyChrom, namely, a separation column, a peristaltic pump, a selector valve and a flow analyzer are available separately for incorporation into other instrument setups. The specially constructed columns with adjustable plungers at both ends can be sealed completely to eliminate the pressure of water head and permit liquid flow in either direction. Closed system operation and ascending flow maintains even packing and prevents the flow rate from falling off with use, even when beds of material with low mechanical strength (gels) are used.

LKB's specially designed peristaltic pump has a very high flow constancy—0.5% over a period of a week—and a continuously variable pumping rate from 0-390 ml/hr.

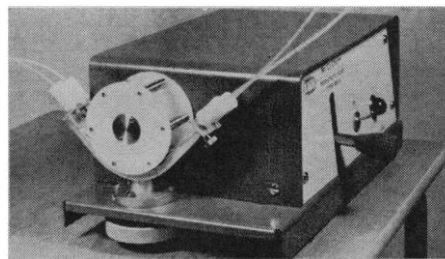
A choice of three flow analyzers, cooling jackets, terminal box, connections and a cart comprise the remainder of the assembly.

Request literature file 4900S-3 for details.

*According to J. Porath and H. Bennich



The simple push of a button on the Selector Valve alters the flow circuit from injection or bleeding to recycling.



The Peristaltic Pump has many other uses when not in service for the ReCyChrom.



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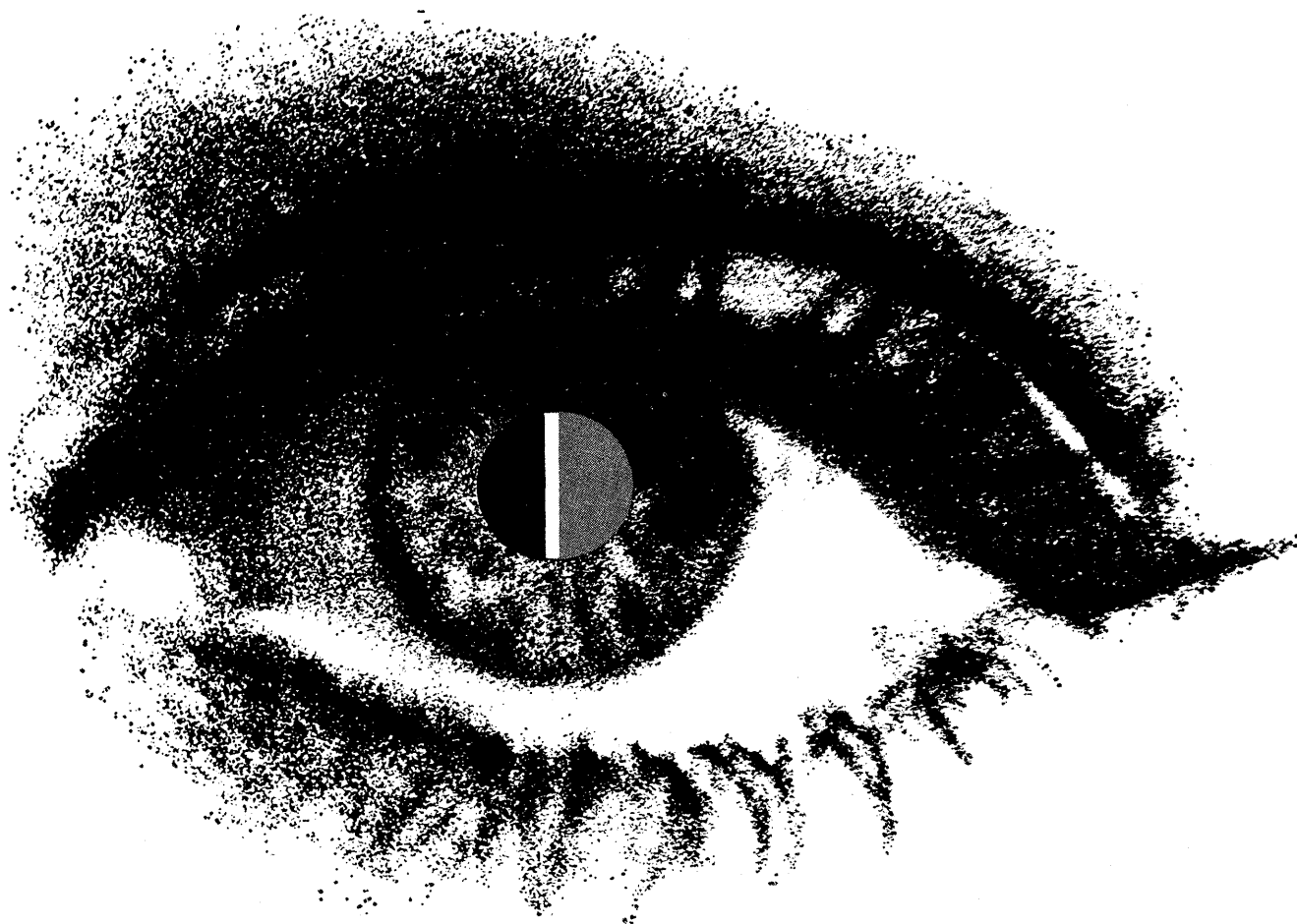
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Two new automatic models available

The 8641 Mark I Precision offers three ranges between 775-2800 C. The 8640 High Precision Laboratory Model offers four ranges between 775-5800 C.

Plus a new Single Adjustment Manual Pyrometer

Recognizing the need for improved performance in those applications where manual pyrometers will still be used, L&N has also developed the 8630-Series. This new manual pyrometer utilizes a solid state

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Glas-Col Ponchos and mantles shown fitted on Corning-Q.V.F. flasks of (l. to r.) one, 200 and 100-liter capacities. Poncho garment worn by model was hand crafted in Cusco, Peru.

PROCESS HOT FLAMMABLES WITH SEALED-IN
SAFETY...WITH THE NEW GLAS-COL

PONCHO*

the safety shield that seals the flask into the heating mantle



WHAT IT IS: The Poncho is a spun aluminum safety shield for use with Glas-Col high-wattage heating mantles. The Poncho/Mantle method of high temperature processing of flammable liquids is unequalled for safety . . in the lab . . or in all-glass plants where growing use of large Q.V.F. glass flasks has made ultimate safety an absolute *must*.

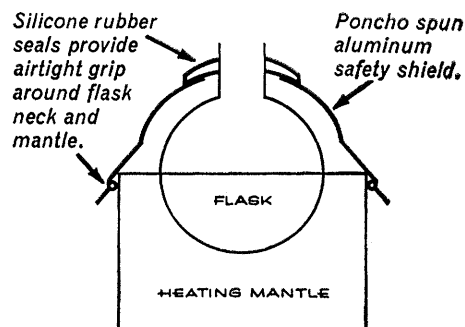
WHAT IT DOES: The Poncho protects mantles from spillover, flasks from falling objects, personnel from flying glass in cases of implosion or explosion. And it serves as an efficient heating top.

PROOF: To prove its safety, we fit a glass flask and Glas-Col quartz heating mantle with a Glas-Col Poncho safety shield . . brought to 650°C at full wattage . . then drenched it with ether, acetone, gasoline. *We could not produce a fire.*

REASON: The Poncho actually *seals* the flask *into* the mantle, greatly reducing fire hazards. Nitrogen purging further reduces danger when using flasks 12 liters and larger.

Write for descriptive **Poncho Bulletin** . . which includes facts on Glas-Col's new *Splash Guard** designed for smaller, low-wattage mantle and flask protection. Poncho/Mantle combinations available for flasks 500 ml to 200 liters, single or multiple neck.

Trademark Reg. U.S. Patent Office. U.S. Patents 2,231,506; 2,739,220; 2,739,221 and 2,282,078. *Patents pending.



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the specialized needs of**

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TECHNICAL MEASUREMENT CORPORATION



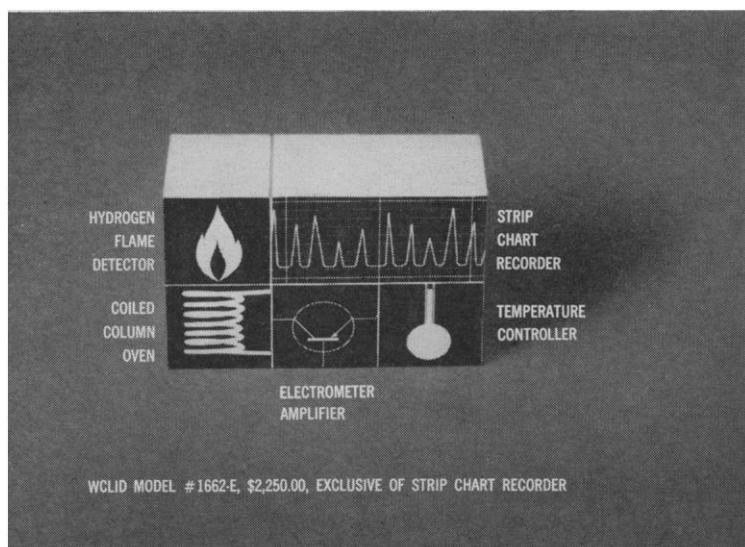
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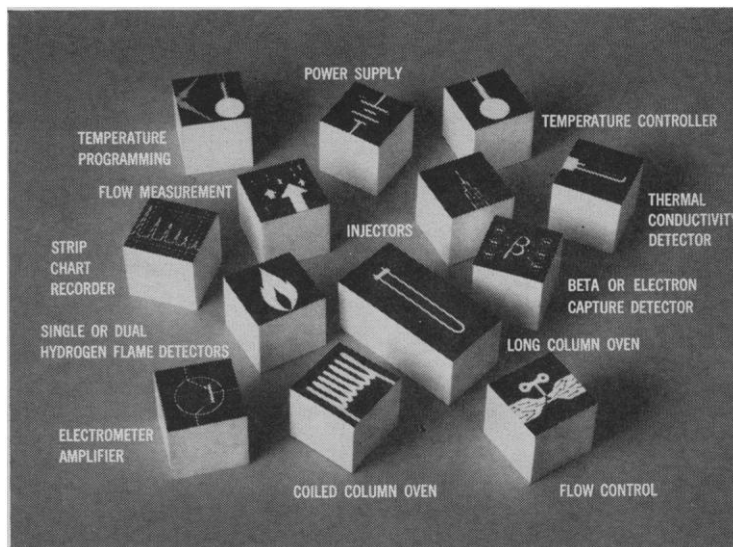
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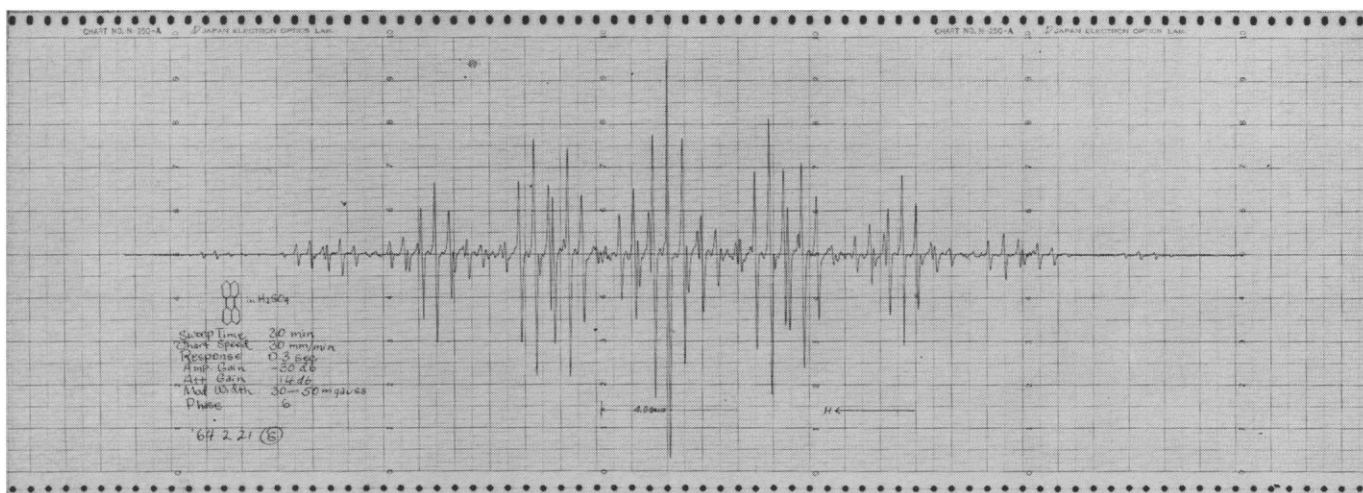
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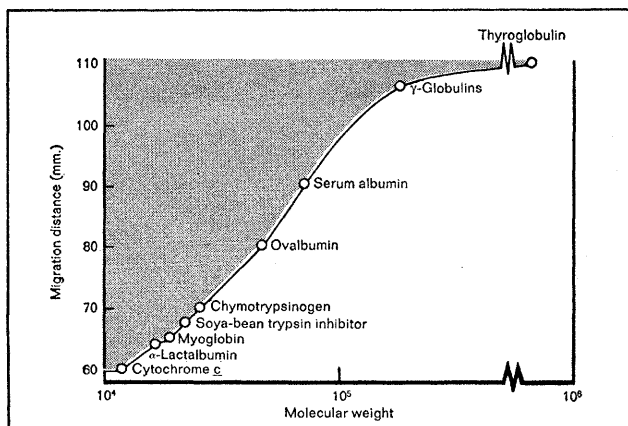
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(Andrews, P., *Biochem. J.* (1964) 91,222, by permission of the author.)

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Sephadex Type	Fractionation Range (MW)*
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*Determined for polysaccharides.

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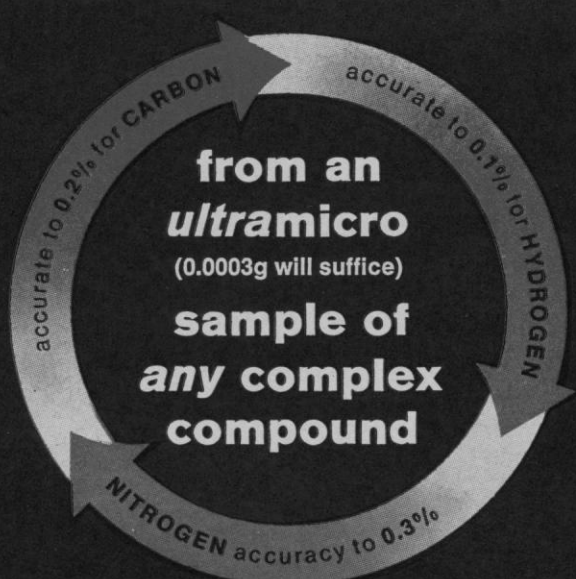


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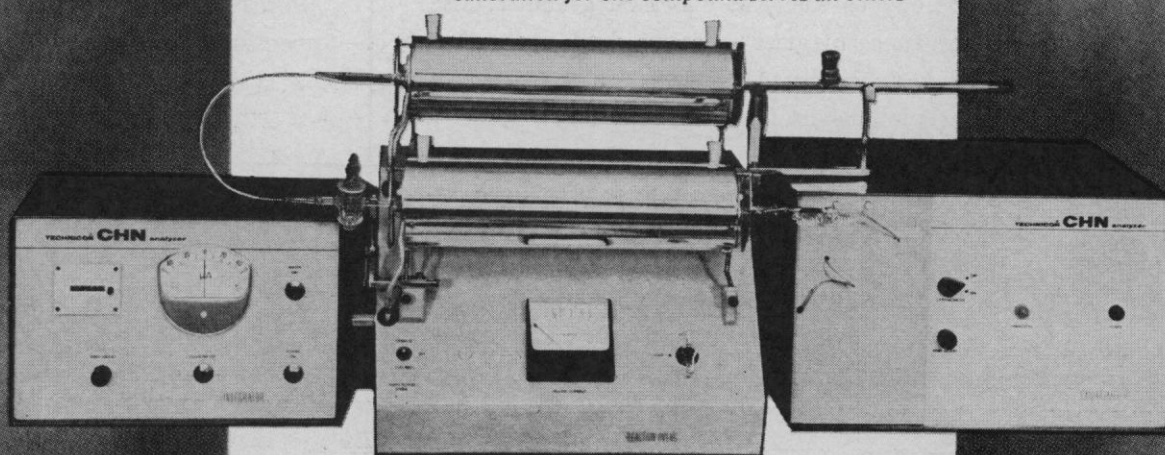
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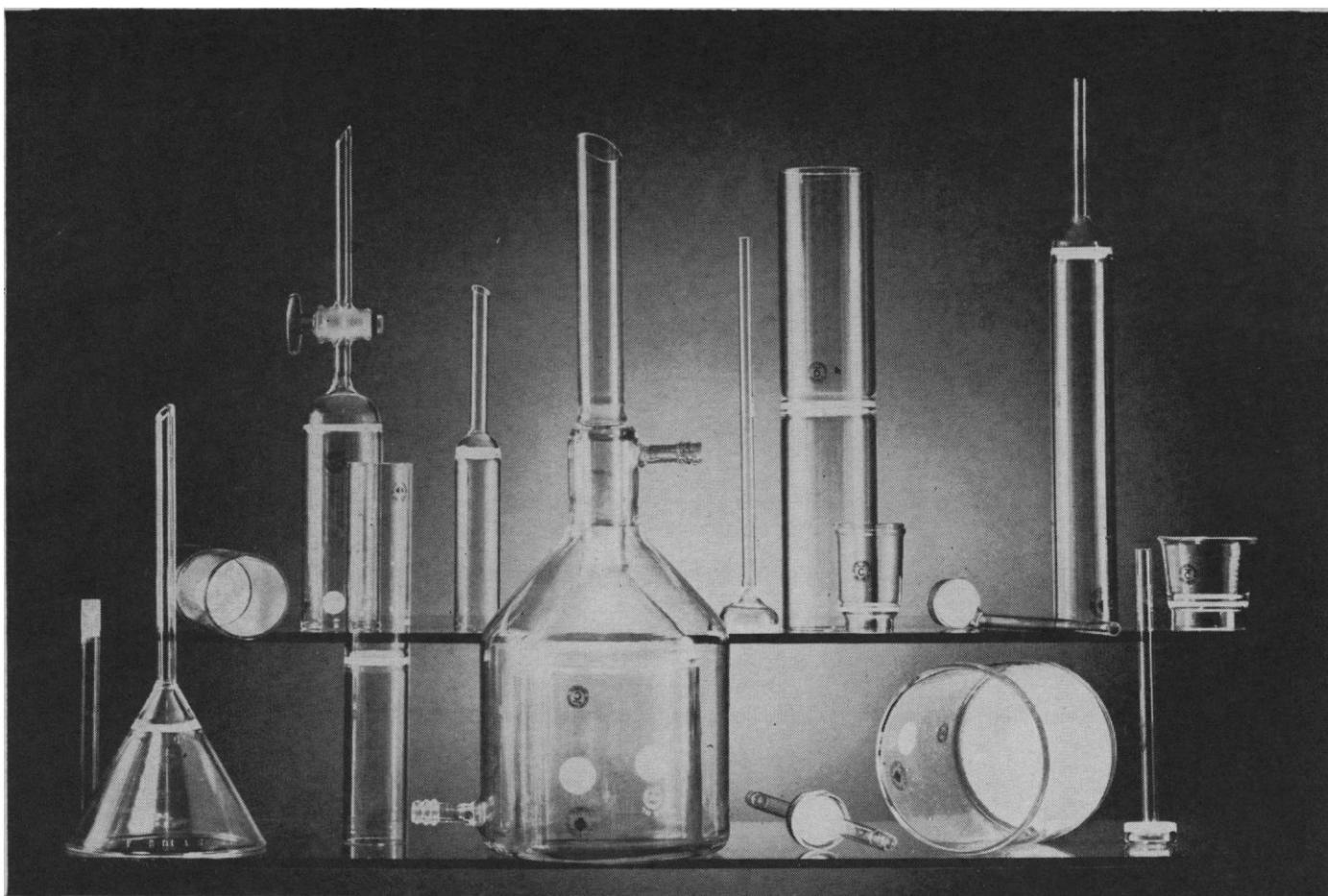
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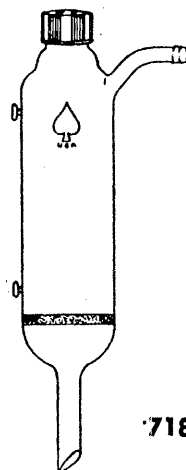
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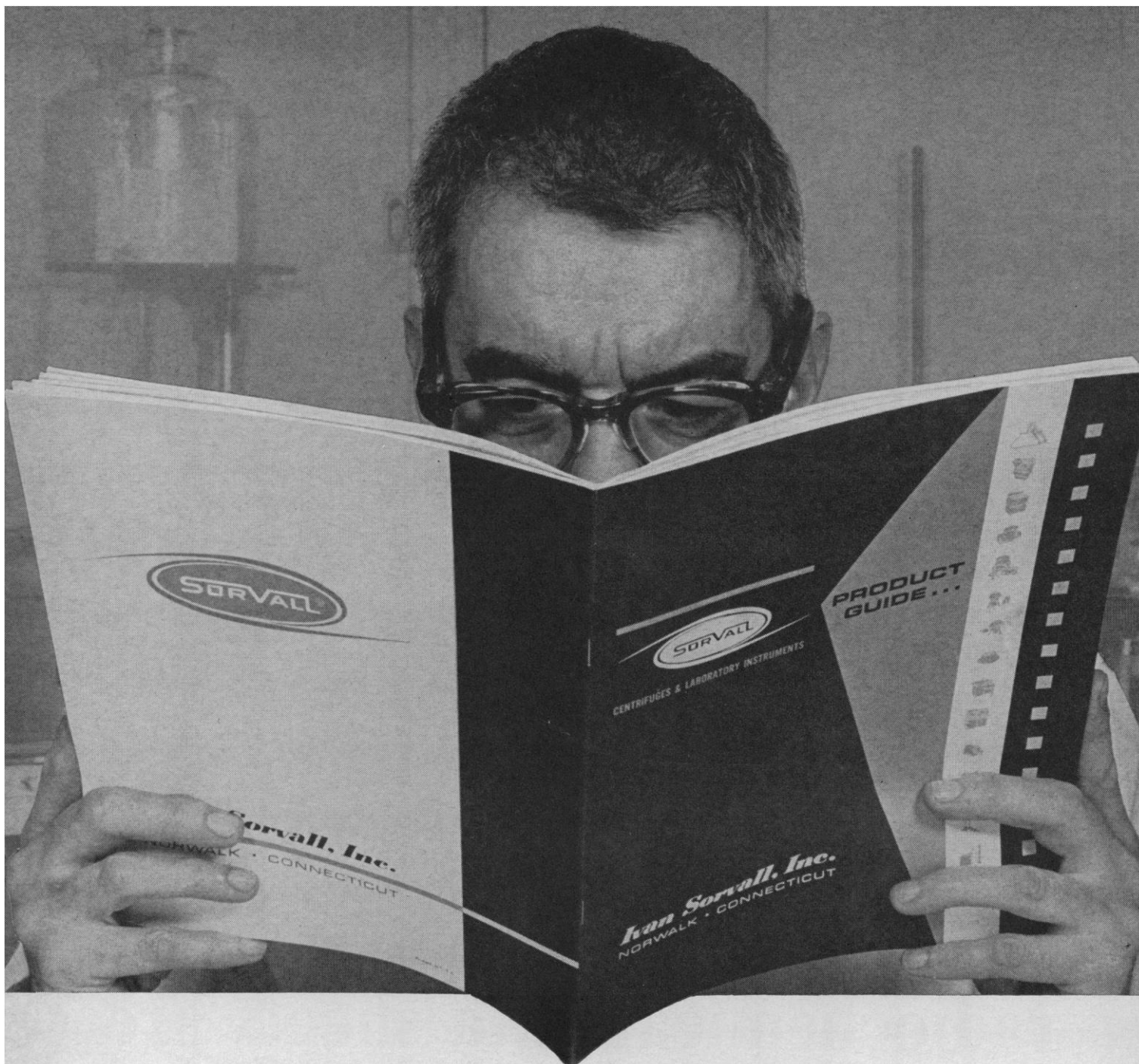
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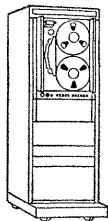
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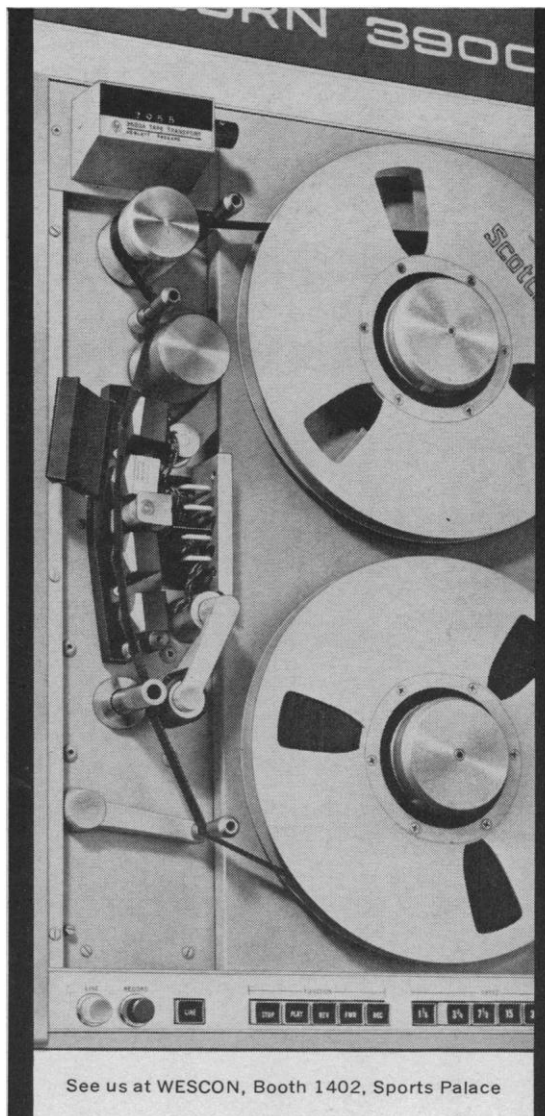


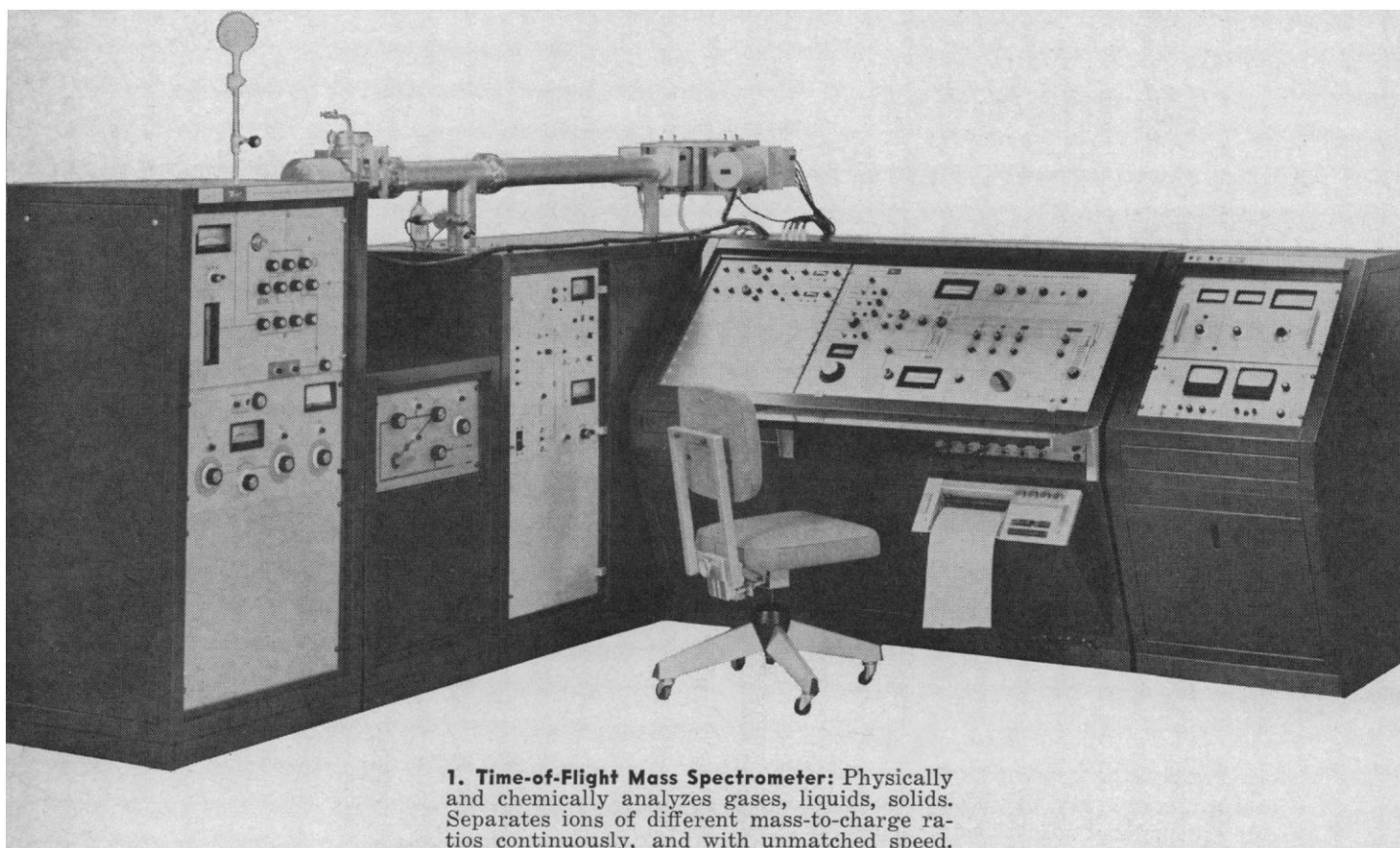
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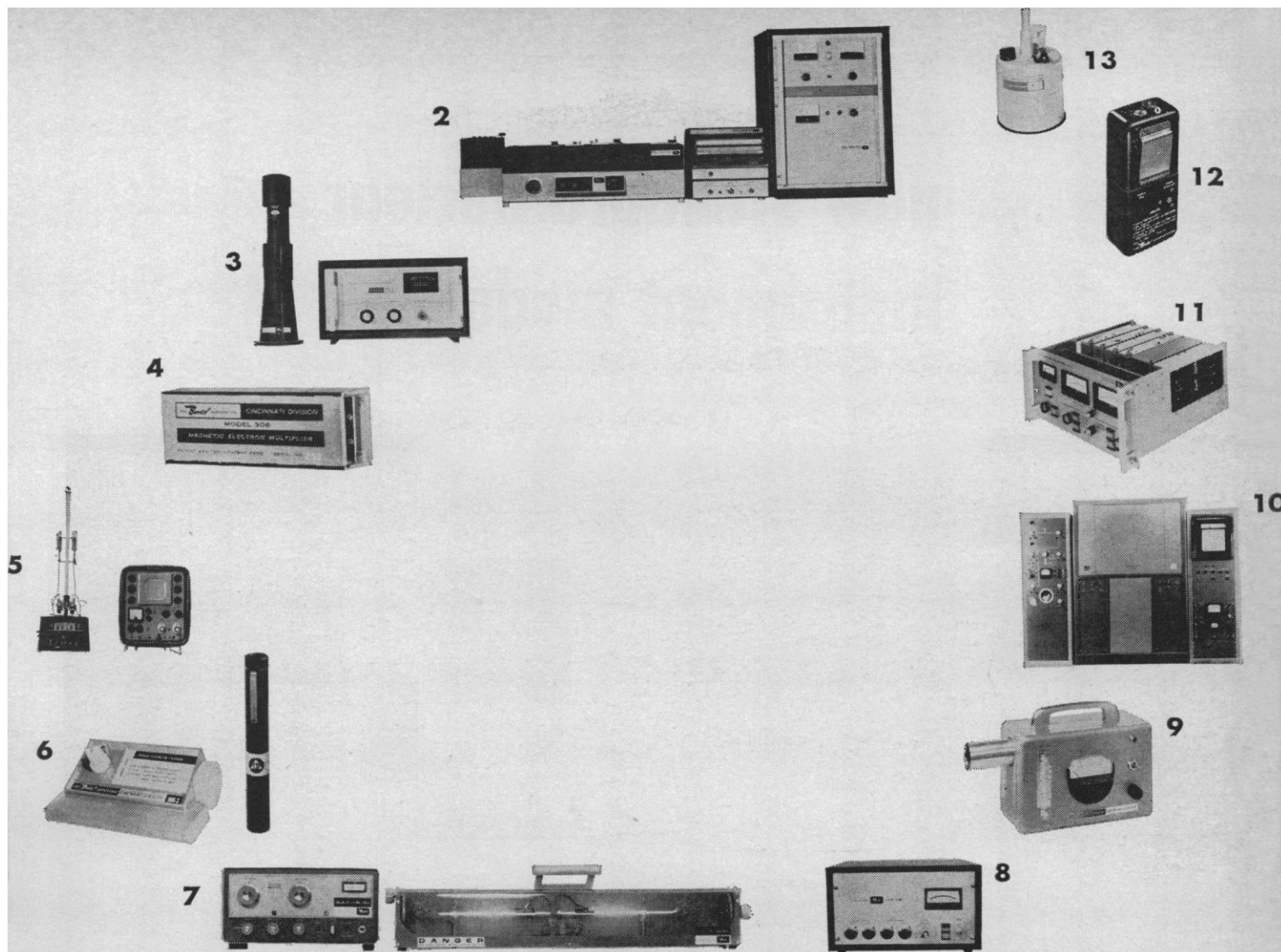
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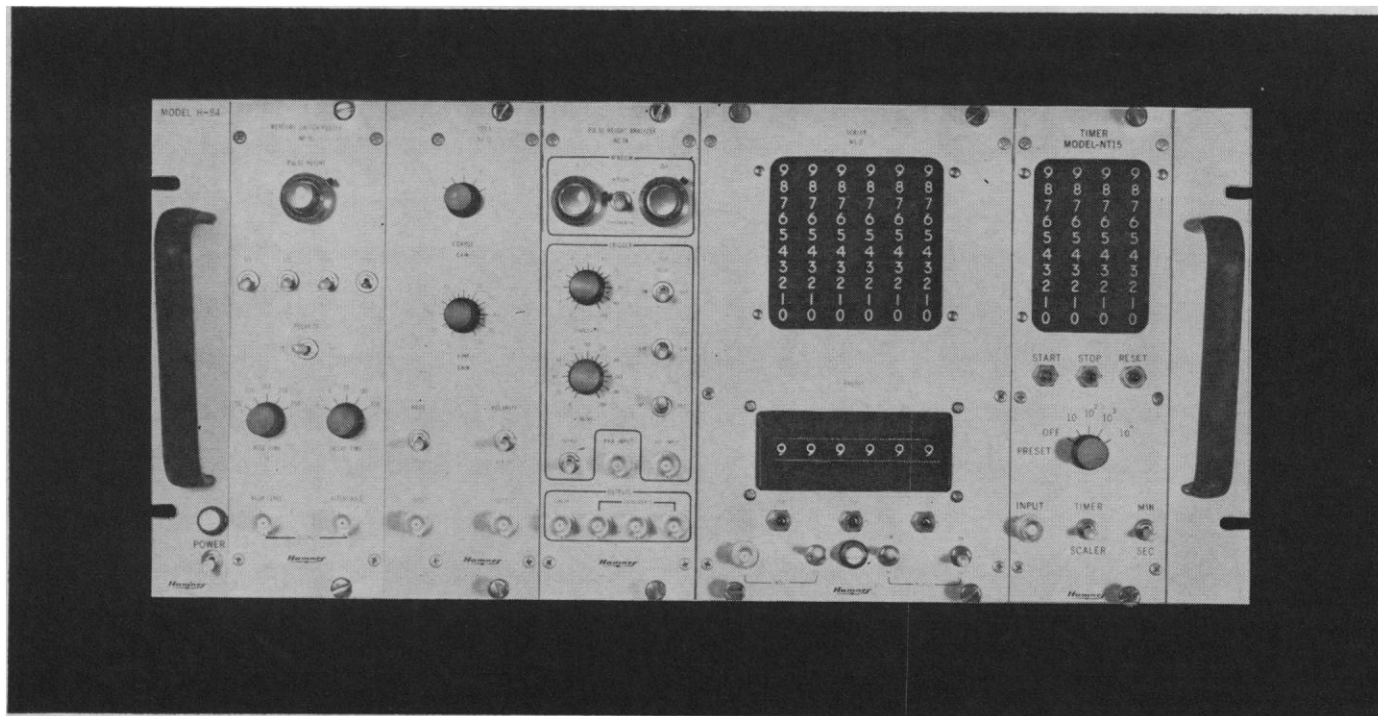
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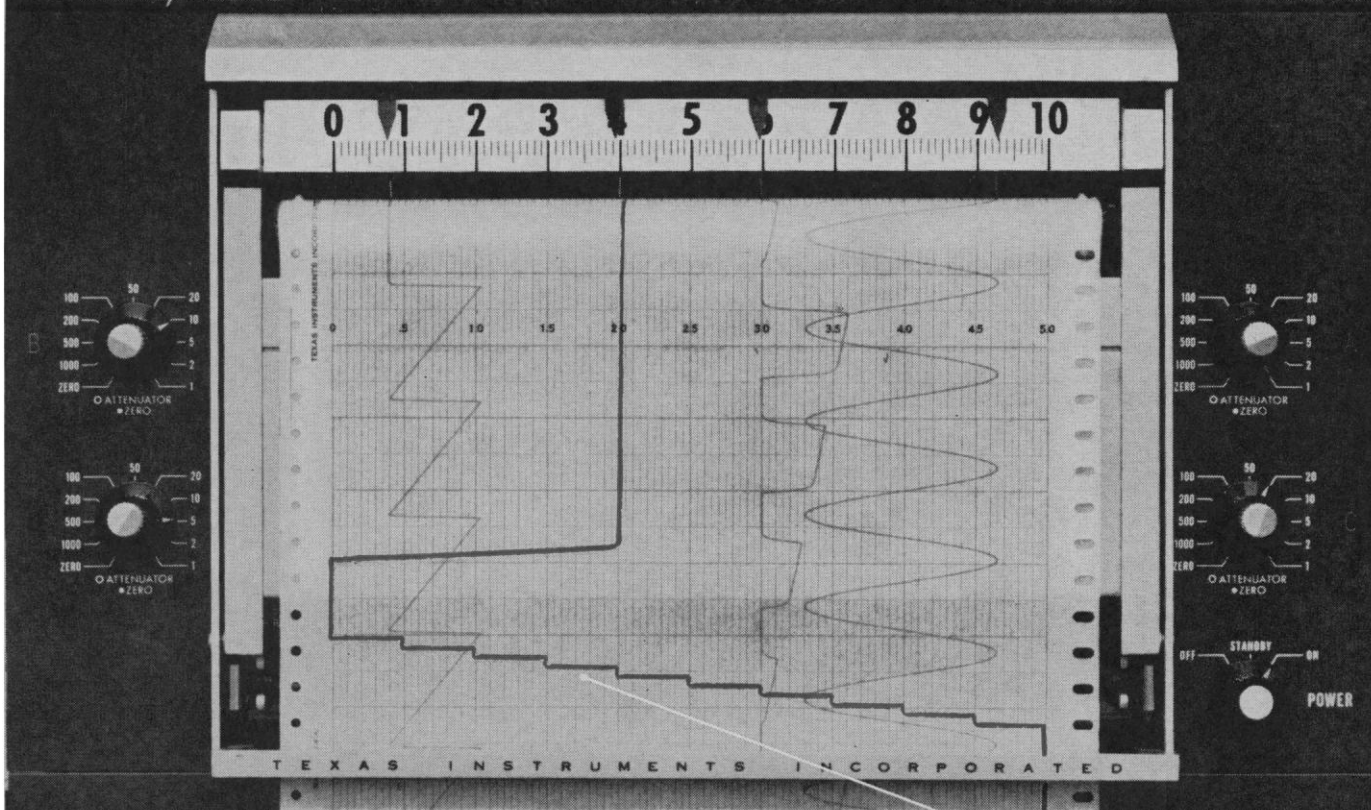
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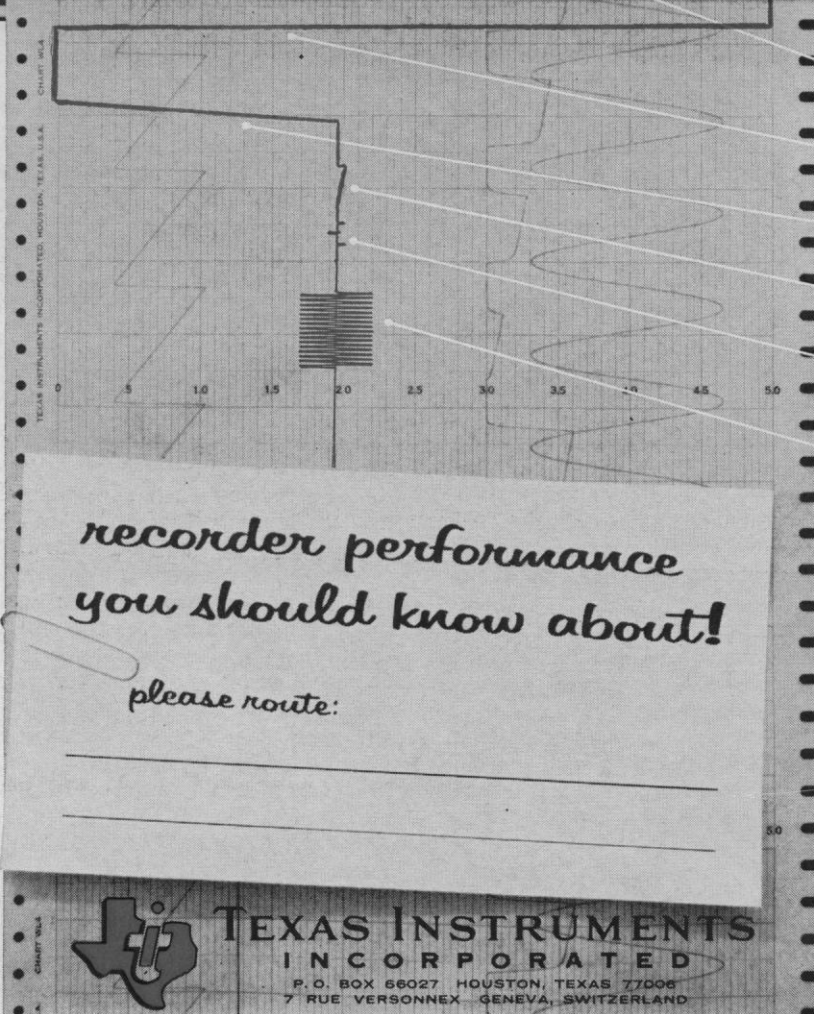
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servo/riter® II recorders are available with 1 to 6 pens, in portable and flush-mounting models, with wide or narrow charts. Choice of inputs, ranges, chart speeds, accessories, almost any combination—you name it.



- trace with 10% steps shows better than 1/4% accuracy
- trace shows 0.4 sec response at chart speed of 12 in./min.
- ramp illustrates linearity of low noise, infinite resolution system
- you can actually detect 0.1% steps
- test shows no discernible deadband — sensitivity better than 0.05%
- a potentiometric recorder with frequency response: 5 cps at 10% full-scale



Night crew in the Gamma counting factory

Counting large quantities of Gamma emitting samples has never been this easy—until now! And it has never been this accurate, with such constant low backgrounds. This instrument—the Nuclear Data Gammamaster—does the job automatically, while nobody is watching. You might be preparing new samples, or you might be home sleeping. Sure beats taking the time to count radioactive samples manually.

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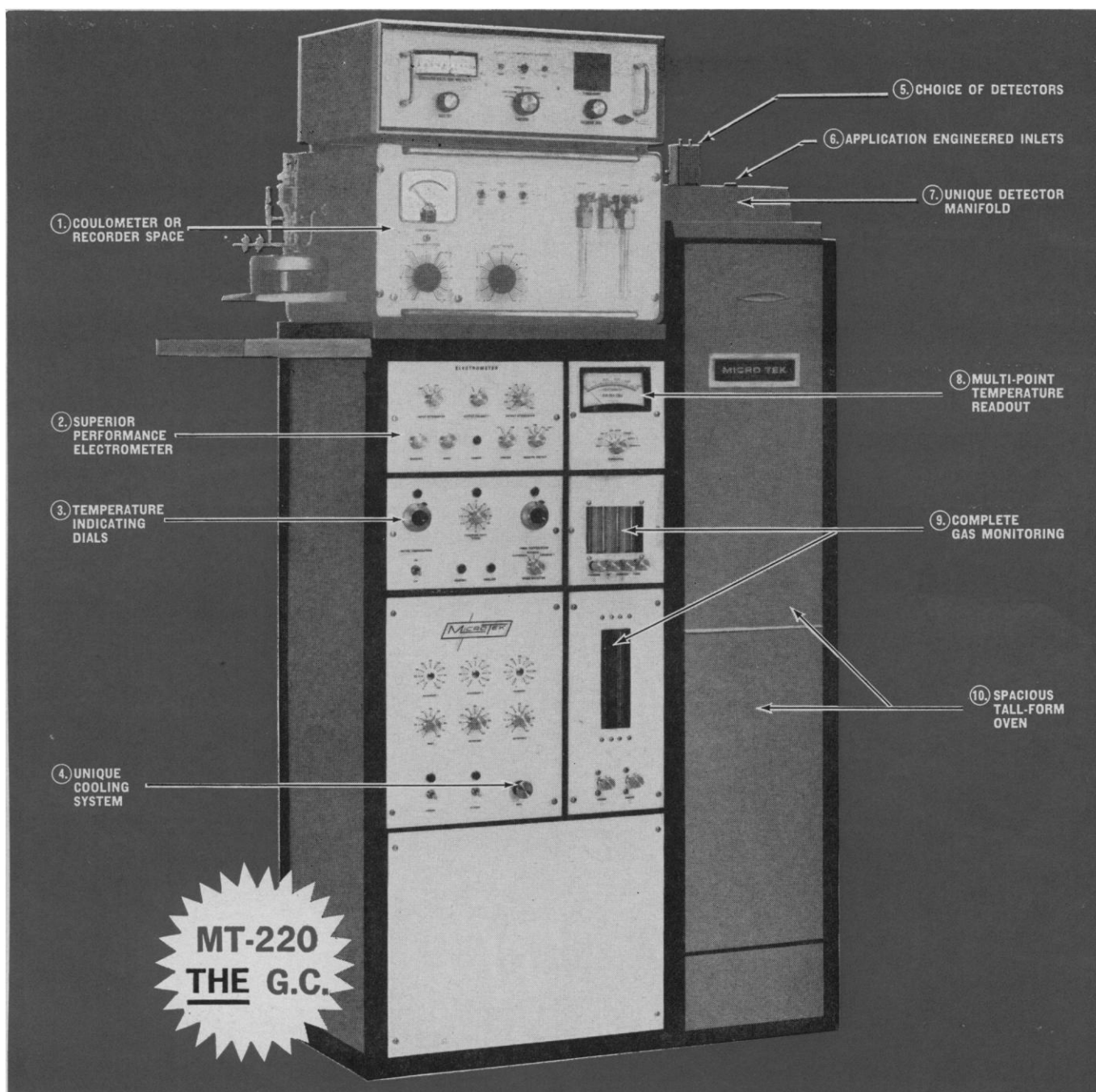
nated. Another feature: a removable sample rack that makes loading easier and faster, because you can be loading one rack on the bench while the other one is working for you in the Gammamaster. This technique also reduces decontamination problems.

Whatever your sample size and numbers (ours is the only system which accommodates over 100 samples), whatever isotope you're using, whatever its level of radioactivity, we can provide instruments versatile enough to accommodate your requirements. Nuclear Data is your best and most reliable source of counting systems for automatically handling either Beta or Gamma samples.

A good place for us to get acquainted is Booth F18 at the Federation Meeting in Atlantic City in April. Here's a suggestion: bring a sample that we can use to demonstrate true constant low background.

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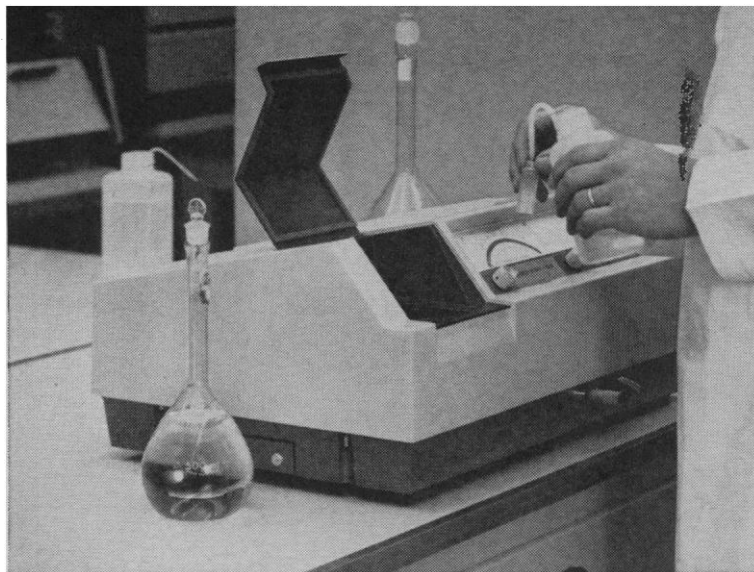
- ⑤ Accommodates four detectors with choice of seven including flame ionization, microcoulometric, or electron capture. **New** specific Series Flame (thermionic) detector for P or Cl.
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- ⑧ Temperature readout for 7 heated points of interest.

- ⑨ Two or four carrier gas channels metered and controlled. Flow metering of all detector gases including scavenger and split gases.
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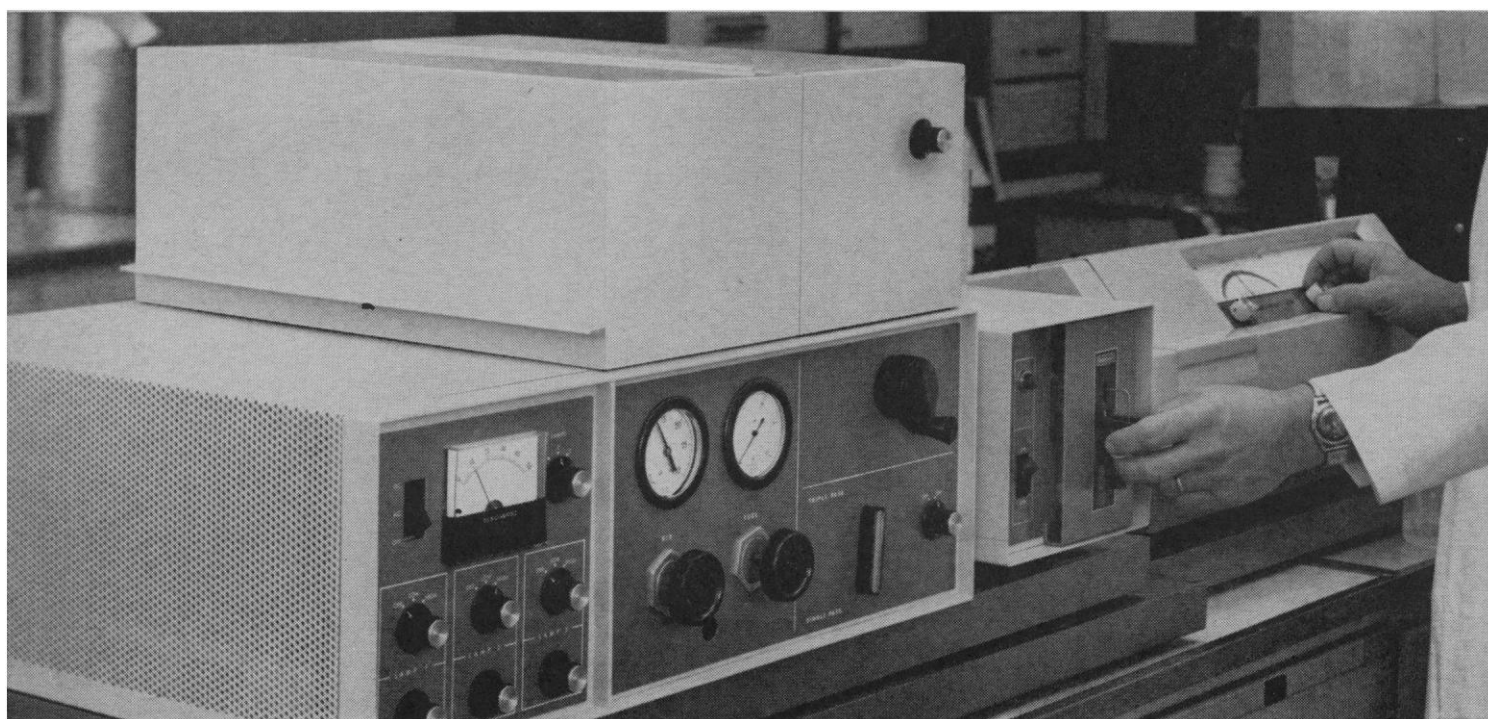
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Linde Cryobiology NEWS

REPORT NO. 5 FROM UNION CARBIDE CORPORATION, LINDE DIVISION

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

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

A paper by Sokolski et al. (1) discussed the preservation of *Lactobacillus leichmanii* in liquid nitrogen for direct inoculum in the vitamin B₁₂ assay. Complete recovery of viable cells was obtained when the suspensions were rapidly frozen by direct immersion in liquid nitrogen and then rapidly thawed by agitating in a 40°C water bath. Assay results on a number of test materials indicated good correlation between freshly prepared suspensions and frozen suspensions stored 3 months in basal medium.

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

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

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

New Products from LINDE

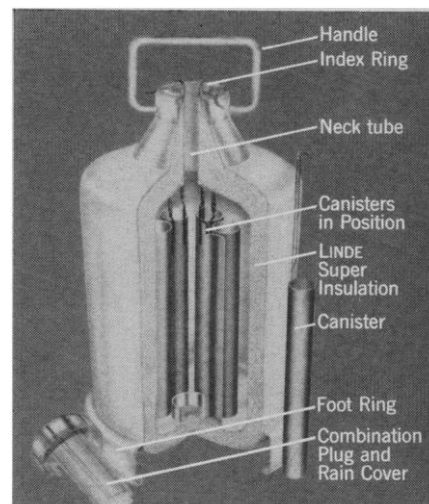
Our new LR-10A-6 portable refrigerator is designed both for economical shipping and small quantity storage of biological specimens. It will hold six canisters with a capacity of 115 cu. in. and has a minimum holding time of 3 weeks at -196°C between refills of liquid nitrogen. Lightweight, rugged, vibration-and-shock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

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

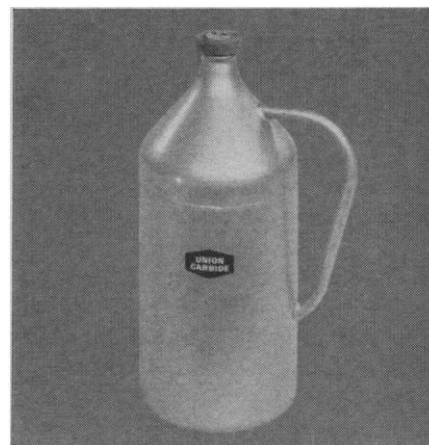
Complete Liquid Nitrogen Capabilities

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

We also provide technical service from knowledge gained over years of leader-



LR-10A-6 Liquid Nitrogen Refrigerator



LD-4 Liquefied Gas Container

ship in cryogenics, backed up by nationwide delivery of liquid nitrogen.

For data, write to Union Carbide Corporation, Linde Division, Dept. SC32, 270 Park Avenue, New York, N. Y. 10017.

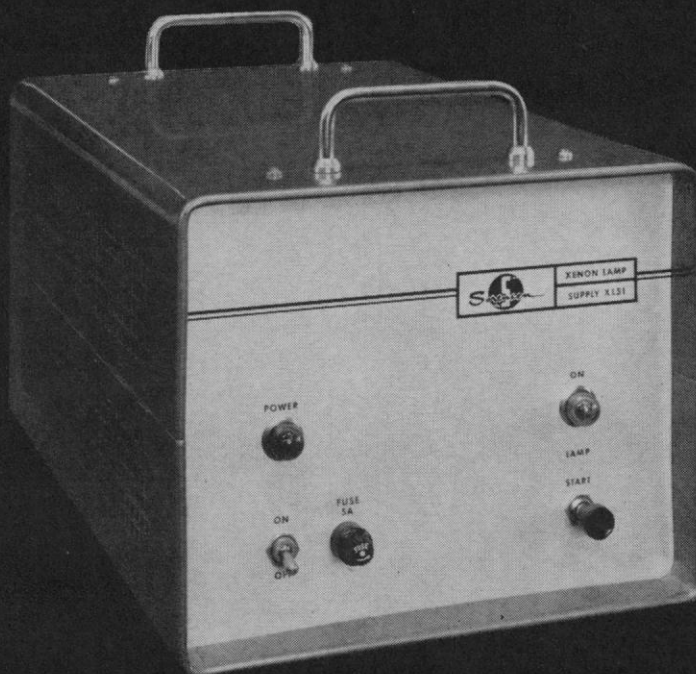
(1) Sokolski, W. T., Stapert, E. M., Ferrer, E. B., and Hanka, L. J., *Bact. Proc.*, RT4, 1964. (2) Stapert, E. M., Sokolski, W. T., Kaneshiro, W. M., and Cole, R. J., *Bact. Proc.*, RT5, 1964. (3) Djerassi, I. and Roy, A., *Blood XXII*, 703-717, 1963. (4) Cohen, H. and Rowe, A. W., *Transfusion* 3,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

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CRYOGENIC PRODUCTS

Now...a xenon lamp power supply with **NO** spark gaps or relays



Sorensen's new XLS-1 xenon lamp power supply

The new Sorensen XLS-1 xenon lamp power supply assures high reliability and no lamp downtime by using a pulse ignition circuit instead of relays and spark gaps. These supplies deliver constant current ($\pm 1\%$), with line voltage variation of 100-130 VAC or 200-260 VAC.

The precise light stabilization produced by the Sorensen XLS-1 power supply permits use of the xenon arc lamp in many applications. Some of these are: spectrometers, precision optical systems, spectro-phosphorimetry, spectro-projection systems, solar simulation, spectro-photography and modulated light communication systems.

Other advantages of Sorensen's XLS-1 are: Long lamp life due to minimum starting energy • Conservatively rated • Short circuit protection • Input and output physically and electrically isolated • Ambient temperature range 0-40°C • Portable...simple to operate.

ELECTRICAL SPECIFICATIONS

Input: For model XLS-1A voltage is 100-130 VAC single phase, Current 4A AC maximum; Frequency 60 CPS $\pm 1\%$ • For model XLS-1B, frequency is 50 CPS $\pm 1\%$ • For model XLS-1C, frequency is 50 CPS $\pm 1\%$, input voltage is 200-260 VAC single phase, and current is 2A AC maximum.

Output: Voltage (starting) 20 KV (starting energy less than 0.5 joules); Voltage (operating) 20 VDC $\pm 3v$; Current (operating) 7.5 ADC; Current regulation better than $\pm 1.0\%$ for input voltage changes of 100-130 VAC or 200-260 VAC (available with regulation better than 0.5% total at additional cost); Current ripple less than 10% peak to peak, less than 3.5% RMS (available with ripple less than 5% peak to peak and 1.75% RMS at additional cost); Short circuit protection assured. Automatic recovery upon removal of the short circuit with no damage to the power supply; Ambient temperature range 0-40°C.

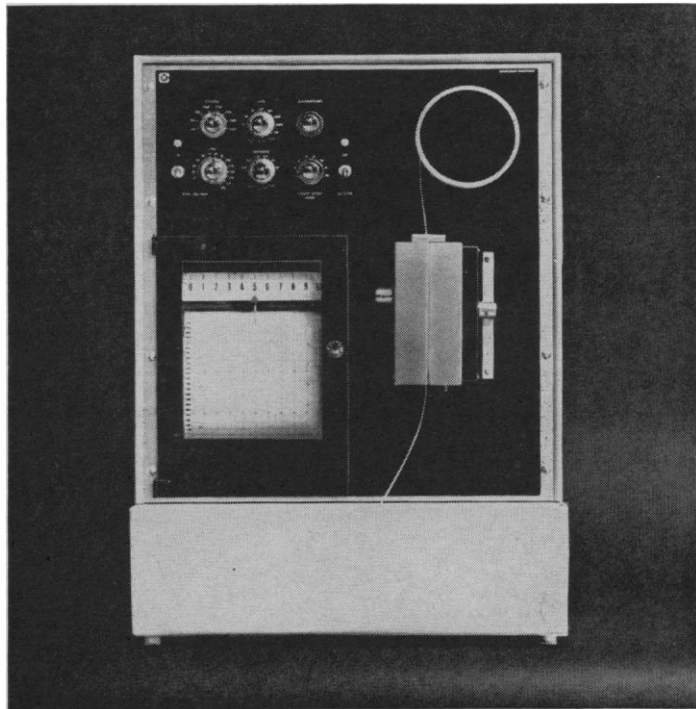
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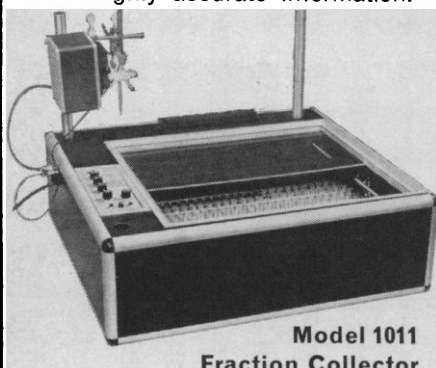
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Model 1011
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Time, drop, or volumetric operation. Time range 0-100 minutes in increments of 1/10 minute. Drop range 0-1000 drops in each tube. 400 standard test tube capacity. 8 removable stainless steel trays. Glass dust cover. 2 digital indicators. Available with Model 1012 Refrigeration unit.



Model 1063-OD
Automatic Multi-Channel Ultra-Violet Analyzer

Presents recording at three different wave lengths. Provides a recording of the ratio of the optical density of

the effluent at two of these wave lengths. Space-saving design. Completely transistorized. Detection system completely self-contained and light shielded.



Model 880D
Dual Channel Low Background Autoscanner

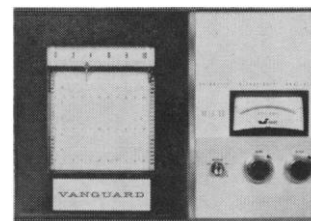
Each channel has independent range and time constant selectors. Recorder provides two 5" charts on one 10" strip. Can examine simultaneously intense and weak areas of radioactivity. Completely transistorized. Better than 2% accuracy on all ranges. Adaptable to direct digital quantitation.



Model 885 Glass Plate Scanner for Thin Layer Chromatography

Extends the range and operates in conjunction with the Autoscanner. Assays TLC glass plates with greater accuracy and sensitivity. Sits on top of Model 880. Provides 2 pi window-

less detection for tritium, carbon-14, sulphur-35 and other beta-emitting radioisotopes.



Model 1056-OD Automatic Ultra-Violet Analyzer

Provides chart recording of the optical density of the effluent from a chromatographic column. A plane diffraction grating monochromator enables the operator to select any wave length from 200 millimicrons into the visible spectrum. Completely transistorized. Detection system self-contained and light shielded.

Model 1000
Volumetric Fraction Collector

Completely self-contained and transistorized. Compact design. Model 1000 for volumetric control. Model 1010 for time-drop control.



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AUTOMATED NITROGEN ANALYZERS for micro samples; for larger samples

For Micro Samples

Now in use in hundreds of laboratories, the automated Coleman Model 29 Nitrogen Analyzer is providing rapid, exact results for an almost unlimited range of materials.

From foods to fertilizers, from plastics to petroleum derivatives, from biological materials to organic intermediates, the instrument is supplementing or replacing both the manual Dumas and the Kjeldahl methods.

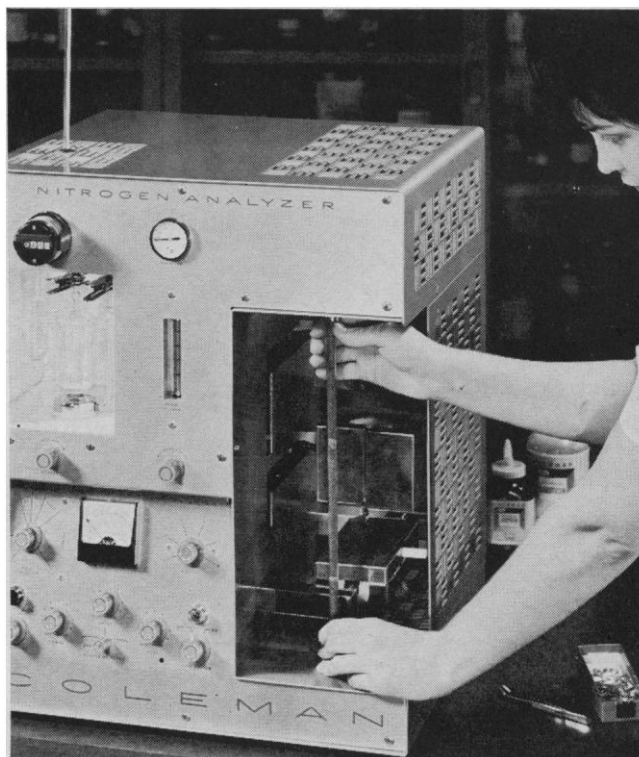
A special extraction technique, announced in a recent issue of ANALYTICAL CHEMISTRY, permits the instrument to be used for trace analysis with materials containing as little as 20 ppm nitrogen.

Operation of the instrument is simple. The operator is required merely to weigh and install the sample, to actuate the instrument, and 8 minutes later, to read and record nitrogen volume from a digital counter.

Thus, an analyst without extensive training in microchemistry can produce excellent results in both routine investigations and in research.

Condensed Specifications:
Sample . . . any material that pyrolyzes at temperatures up to 1000° C.
Sample size . . . from 5 to 50 milligrams, generally.
Operating cycle . . . 8 minutes.
Accuracy . . . results correspond to theory $\pm 0.2\%$ nitrogen.
Readout . . . digital counter in microliters.

Ask for Bulletin SB-291



For Larger Samples

Specially designed to meet requirements of materials that require extensive sample preparation before a representative sample can be obtained, the Coleman Model 29A accepts samples up to 500 milligrams. Even larger samples of inorganic materials are analyzed without difficulty.

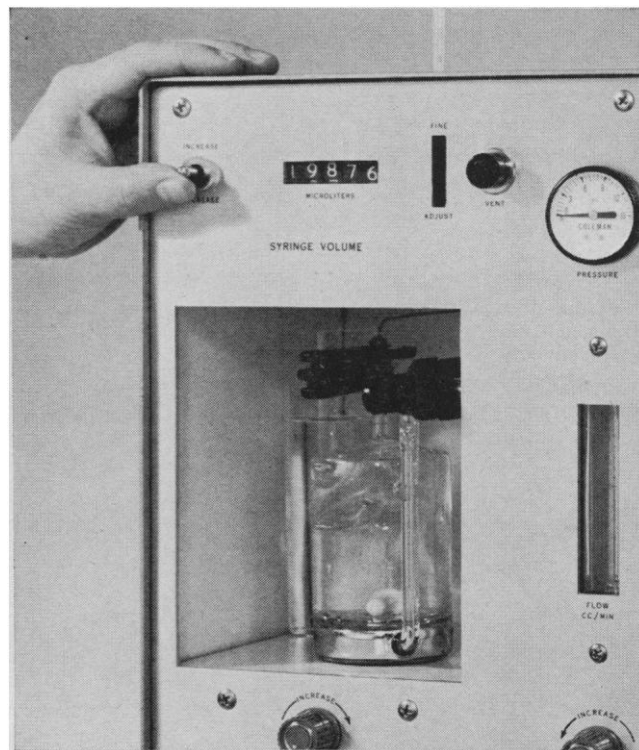
The instrument is finding wide application in laboratories working with such diverse materials as foods, feeds, grains, soils, fertilizers, milk products, and biological materials.

To accept the larger samples, the instrument incorporates an expanded combustion system, extended combustion cycle, and a larger, modified nitrometer for measurement of the greater volumes of nitrogen. The measurement operation is speeded by a reversible electric motor in the precision syringe-and-micrometer screw adjustment.

The Model 29A minimizes the work formerly required in preparing samples of non-homogeneous materials for microanalysis.

Condensed Specifications:
Sample . . . any material that pyrolyzes at temperatures up to 1000° C.
Sample size . . . 50 up to 500 milligrams; up to one gram or more for inorganic materials.
Operating cycle . . . 12 minutes.
Accuracy . . . results correspond to theory $\pm 0.2\%$ nitrogen.
Readout . . . motor-driven digital counter.

Ask for Bulletin SB-291



COLEMAN INSTRUMENTS CORPORATION • MAYWOOD, ILLINOIS 60154



AUTOMATED ELEMENTAL ANALYZERS for direct oxygen; for carbon-hydrogen

For Direct Oxygen Determination

The Coleman Model 36 Oxygen Analyzer is an automated combustion instrument for the direct determination of oxygen content in liquid and solid materials. Direct determination provides results which are independent of the errors associated with determination by difference.

The instrument automatically performs a modified version of the Unterzaucher method for direct oxygen. The use of a special platinized carbon catalyst permits conducting the procedure at 180° C. below the conventional procedure; this improves reproducibility and lengthens component life.

Automatic operation—performing repetitive operations in exactly the same manner, delivers data faster, easier and with considerably more precision than manual methods.

The instrument is ideal for applications in pharmaceutical, rubber, plastics, organics and petroleum research and control laboratories as well as in academic research.

Condensed Specifications:
Sample . . . any material that pyrolyzes at temperatures up to 900° C.
Sample size . . . from 2 to 30 milligrams.
Operating cycle . . . 21 minutes.
Accuracy . . . results correspond to theory $\pm 0.3\%$ oxygen.
Readout . . . gravimetric.

Ask for Bulletin SB-292



For Carbon-Hydrogen Analysis

An instrument for the laboratory determination of carbon and hydrogen, the Coleman Model 33 automatically performs the accepted Pregl method. It provides great advances in speed, precision, and convenience over the manual method by exactly reproducing the essential conditions of the analysis.

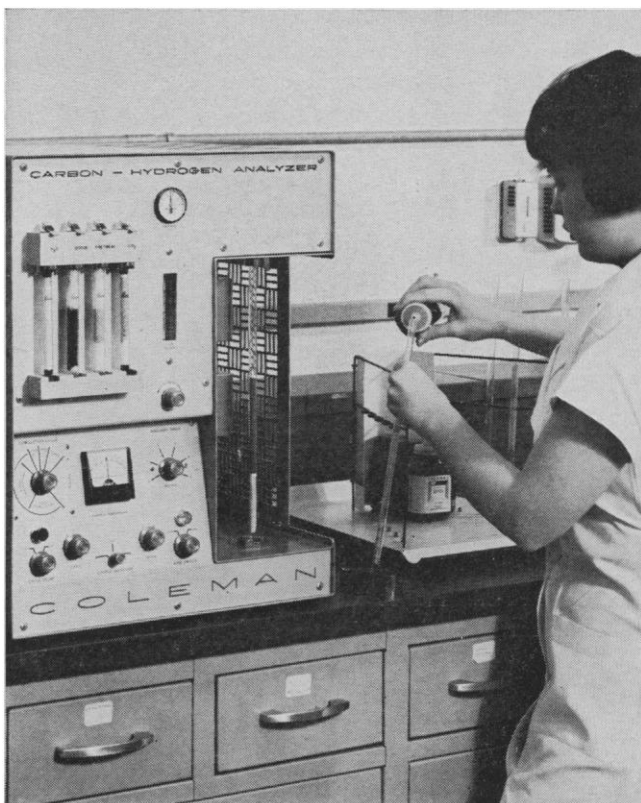
In operation, the instrument burns a micro sample in an atmosphere of high-purity oxygen, separating the sample into its elemental constituents. Hydrogen is converted to water; carbon is converted to carbon dioxide. These compounds are absorbed in separate absorption tubes and the values easily calculated after differential weighing of the absorption tubes.

The instrument makes complete determinations of carbon and hydrogen within an 8-minute operating cycle. Routine analyses can be completed at the rate of 4 to 5 per hour.

The Coleman Model 33 is valuable in research and product control laboratories is working with a wide variety of materials including pharmaceuticals, petroleum, heavy chemicals, plastics and organics.

Condensed Specifications:
Sample . . . any material that pyrolyzes at temperatures up to 1000° C.
Sample size . . . 2 to 50 milligrams.
Operating cycle . . . 8 minutes.
Accuracy . . . results correspond to theory $\pm 0.2\%$ carbon, $\pm 0.2\%$ hydrogen.
Readout . . . gravimetric.

Ask for Bulletin SB-273



COLEMAN INSTRUMENTS CORPORATION • MAYWOOD, ILLINOIS 60154

Almost an electrometer? The new all-silicon Model P2A Differential Operational Amplifier edges one decade closer to the electrometer range than the famous Philbrick Model P2, at no increase in cost.

DESCRIPTION

The new Philbrick P2A can be used as an electrometer to measure currents less than 10^{-12} amperes routinely, yet it exhibits unusual voltage stability. Briefly, it is an all-silicon, solid-state, high gain differential operational amplifier with no inherent common mode error and with fully floating input. Model SP2A is a plug-in amplifier with the same circuit as the P2A but has the additional benefit of guarded inputs. The P2A is mounted in a die-cast aluminum case measuring $4\frac{1}{8}" \times 1\frac{3}{8}" \times 1\frac{1}{8}"$. Model SP2A is wired on an etched-circuit glass board with 15-terminal gold-nickel edge connectors and shielded by an exoskeletal nickel-plated steel case measuring $3\frac{3}{8}" \times 1\frac{1}{2}" \times 2\frac{3}{8}"$.

CHARACTERISTICS:

TYPICAL INPUT OFFSET
CURRENT $< 10^{-12}$ amp.

INPUT IMPEDANCE (to common)
 $> 10^{12} \Omega$

CURRENT NOISE $< 10^{-13}$ amp.

OUTPUT 2 ma at ± 10 V

TYPICAL VOLTAGE OFFSET
(0°C to 65°C) 3 mV

DELIVERY From Stock

PRICE \$227.00 each (1-4)

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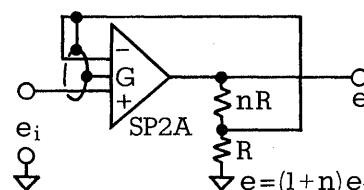


PHILBRICK

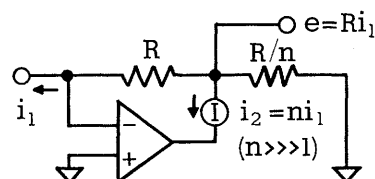
SALON des COMPOSANTS ELECTRONIQUES

APPLICATIONS

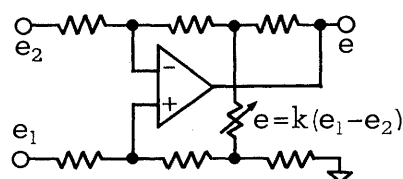
Models P2A and SP2A may be used with virtually any gain in the measurement of voltage or current from high impedance sources, as integrators or sample-and-hold circuits having exceptional holding ability, as wide-range logarithmic amplifiers, for precise differential amplification and for many other applications. Some examples:



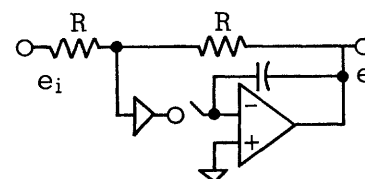
FOLLOWER-AMPLIFIER



CURRENT AMPLIFIER
CURRENT-TO-VOLTAGE TRANSDUCER



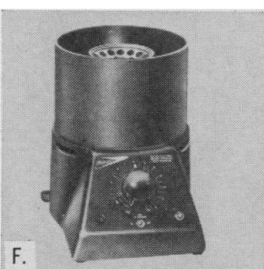
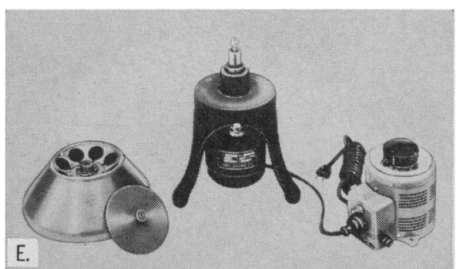
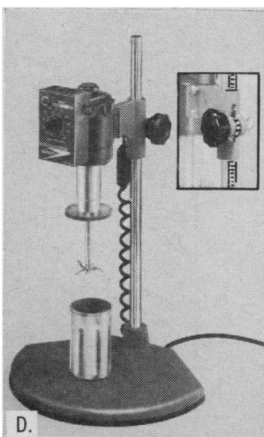
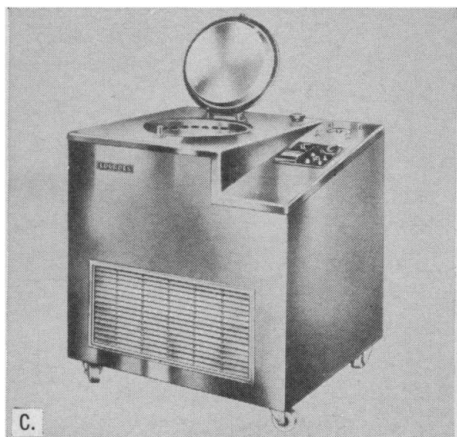
ADJUSTABLE-GAIN SUBTRACTOR



TRACK-AND-HOLD CIRCUIT

it's a big world

The continents draw closer together every day in this technological era, and communications are swift as sound. But it is still a big, wide world and Lourdes is in every corner of it! From Tokyo to Paris, from Sydney to Reykjavik, Lourdes Instruments are there . . . serving the needs of science and industry with precision.



A. Model A "Betafuge", Automatic Superspeed Refrigerated Centrifuge accommodates thirteen interchangeable rotors, including 3300 ml. (6 x 550 ml.) capacity rotor at 14,000 x G; 400 ml. (8 x 50 ml.) rotor at 40,000 x G; temperature control range — 20°C to +40°C.

B. Model LCA-2, Non-refrigerated automatic centrifuge, spins 3300 ml. (6 x 550 ml.) capacity rotor at 10,000 x G; 400 ml. (8 x 50 ml.) at 30,000 x G.

C. Model VA-2 "Vacufuge" Automatic Ultraspeed Vacuum Refrigerated centrifuge spins 3300 ml. (6 x 550 ml.) capacity rotor at 33,000 x G; 1500 ml. (6 x 250 ml.) capacity rotor at 65,000 x G. Temperature control range — 20°C to +40°C.

D. Model MM-1, Multi-Mix featuring solid state speed control and a ratchet and gear mechanism. Sealed homogenizing within stainless steel containers, mason jars, centrifuge bottles, and tubes.

E. Model AX super-speed centrifuge; forces to 34,800 x G; separate RPM-RCF calibrated transformer.

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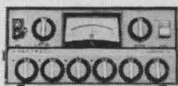
Rather, it was to consolidate this division into the scientific instruments manufacturing facilities where Visicorder oscillographs (and tiny precision galvanometers) are being made, along with advanced laboratory magnetic tape systems and other data acquisition and analysis equipment. We certainly agree with Colorado's claim of having an exceptional climate for this type of manufacturing.

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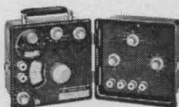
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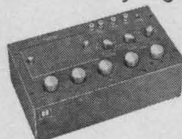
See NBS Bulletin, Vol. 4, p. 121, about these high-precision laboratory resistors. Limit of error will not exceed $\pm 0.005\%$; measurement resolution is ± 10 parts



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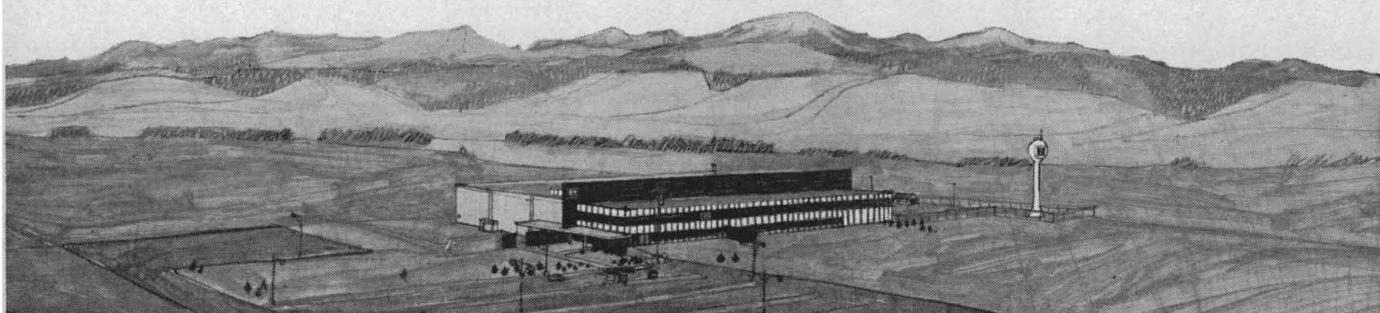


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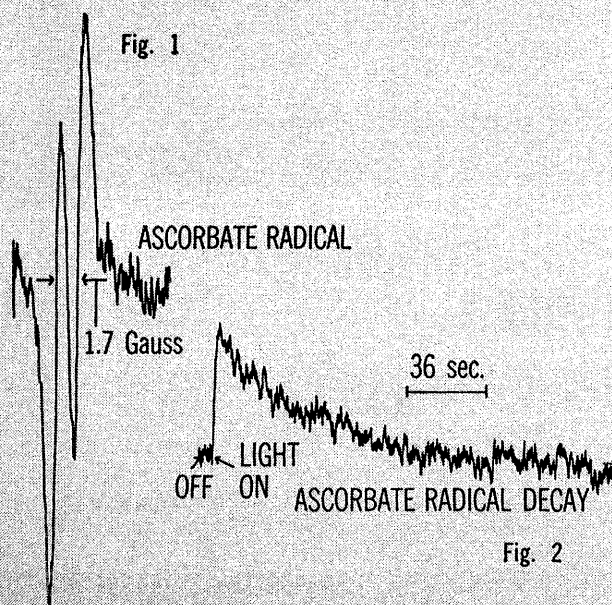
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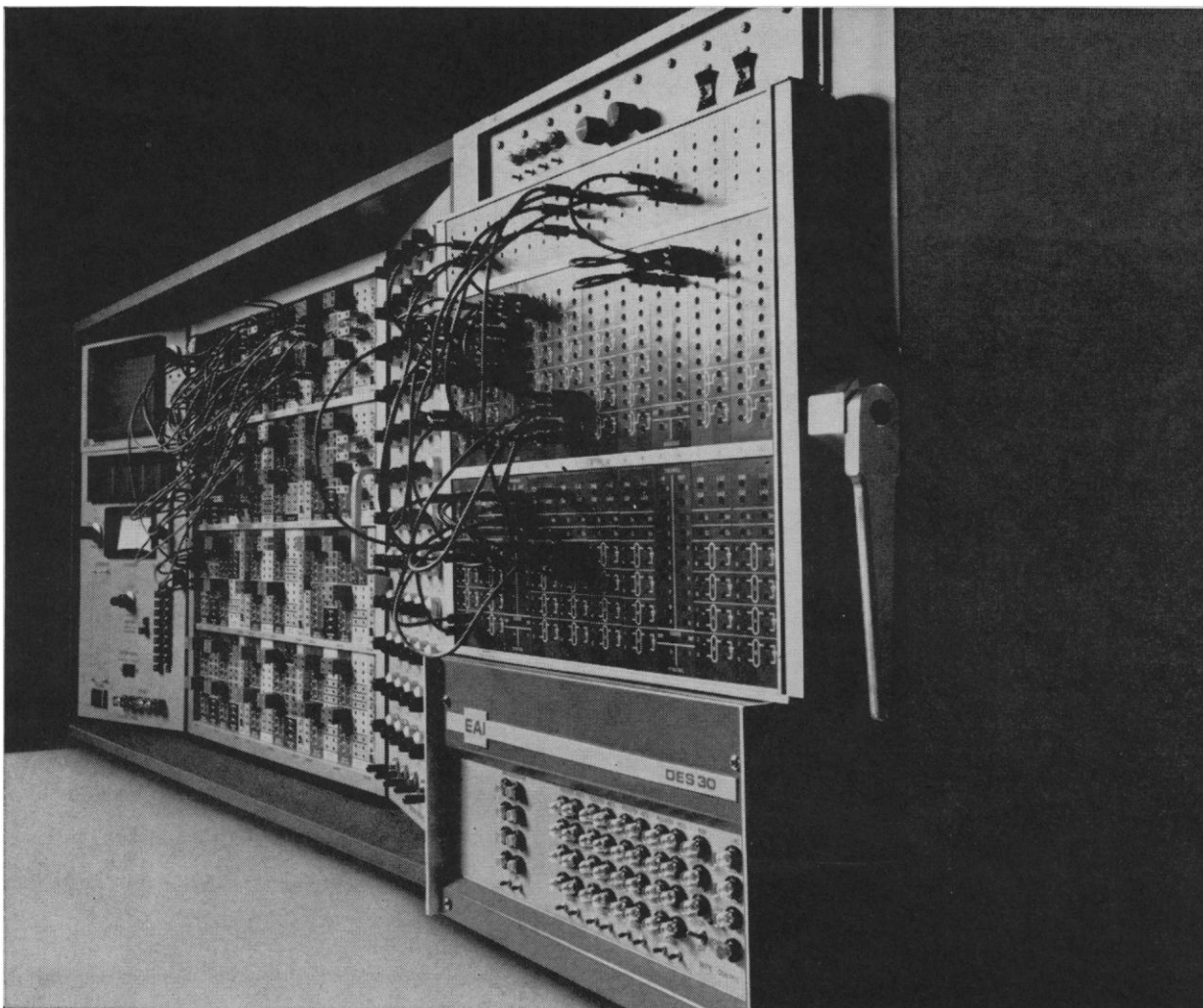
MONITORING ASCORBATE LEVELS IN BLOOD SERA



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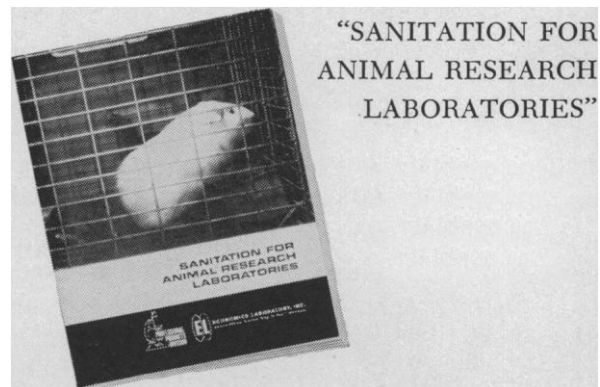
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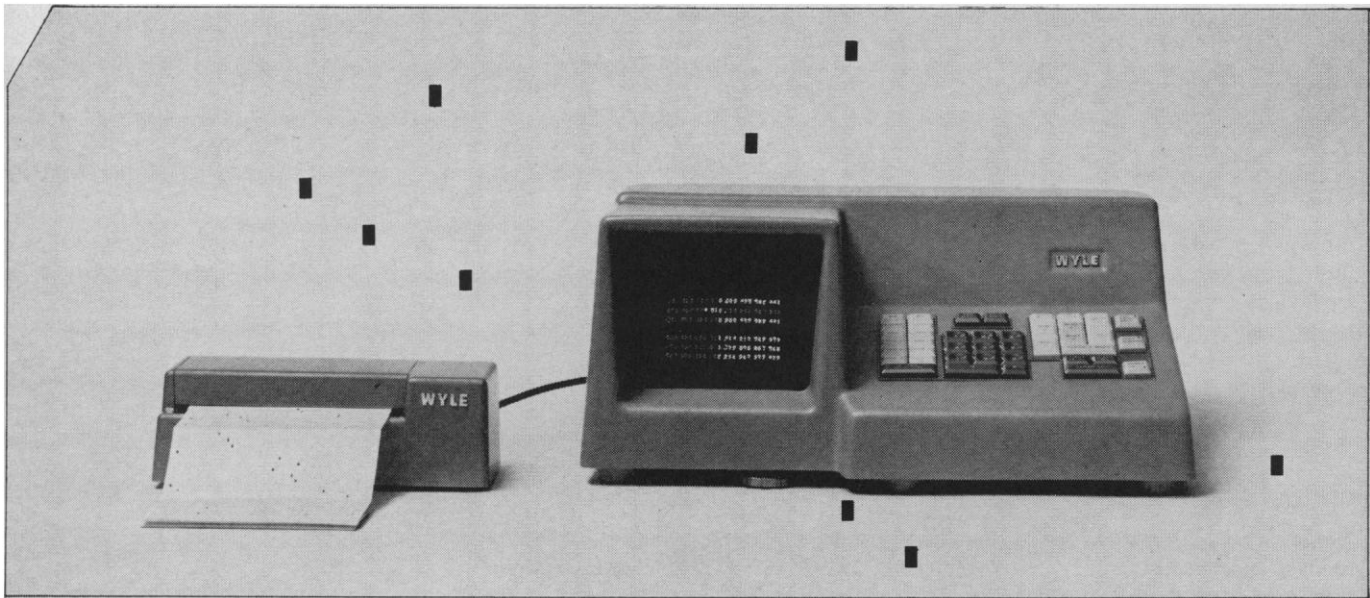
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000 070 000 000 000 495 582 441	Accumulator Register
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000 000 000 001 732 090 807 568	Storage Register 2
000 000 000 002 236 067 977 499	Storage Register 3

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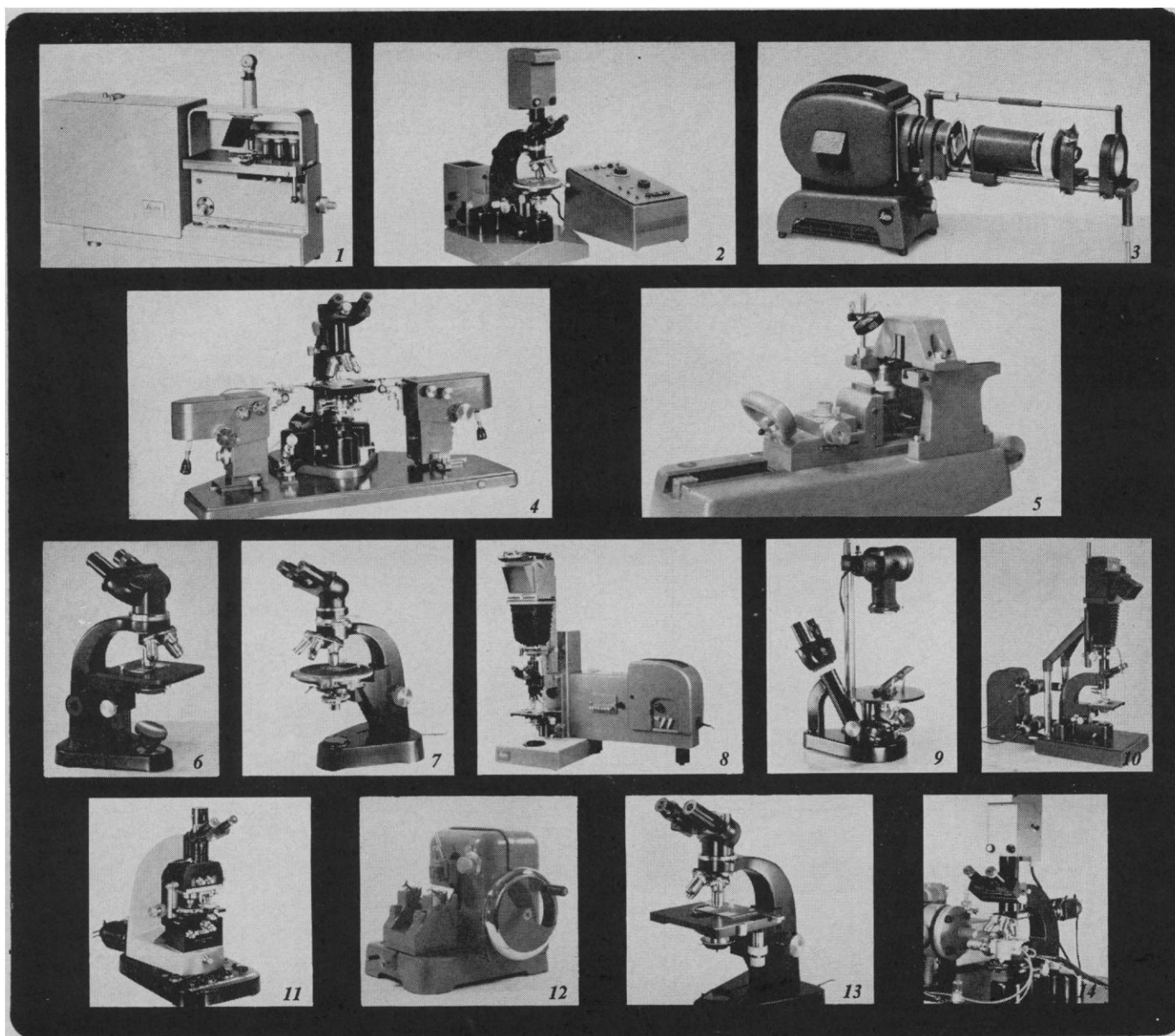


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Natural Beauty and Conservation

Science and technology have led to an affluent society, a population explosion, and a concentration of our people in urban areas. But while the number and concentration of human beings has increased, the quality of living has in some ways diminished. The affluence that provides so many automobiles brings with it air pollution and great parking lots in the form of expressways. Water pollution has robbed us of much potential recreation and simple pleasure; once-beautiful rivers now are little better than open sewers. Disposal of the solid waste of cities is a noxious and growing problem. Discarded automobiles increasingly litter our countryside as low prices for scrap make them practically worthless.

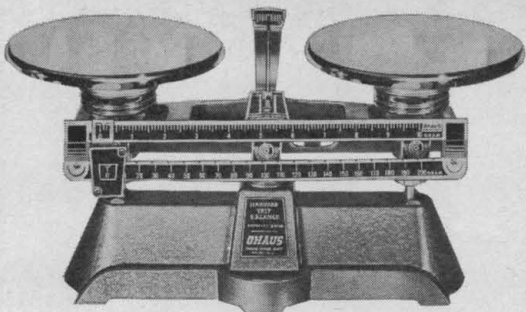
President Johnson emphasized his concern about these matters in a recent White House message on natural beauty. Recognizing that most of our population resides in urban areas, Mr. Johnson devoted part of his message to a call for improving the beauty of cities. He wrote of the contrasting effects of ugliness and beauty on man's spirit. Perhaps he wrote from a background of personal experience, for many who live in the nation's capital find great pleasure in its numerous vistas. Most cities are not so fortunate as Washington. They are constructed on an ugly pattern, and so they will remain, though the dreariness may be relieved somewhat if the President's recommendations for an Open Space Land Program are implemented. This program would provide matching grants to help urban areas obtain land to serve as open space. In addition, city governments would be helped to acquire and clear areas to create parks and playgrounds.

Part of the President's message was devoted to the countryside. He recommended the establishment of 12 additional national parks. All who have enjoyed the existing parks will support the needed legislation. President Johnson sounded another welcome note when he stated that he is taking steps to encourage a national system of trails. These would include abundant trails for walking, cycling, and horseback riding in and close to our cities.

Another part of the message was devoted to water pollution. In principle, the problems of sewage and industrial wastes can be controlled by legislation. There are other problems of pollution that were not mentioned in the report and that are of scientific interest. The task of revitalizing Appalachia is complicated by the pollution of water there by acid mine water. When exposed to air, sulfides in coal are oxidized, and sulfuric acid is produced. A more subtle kind of pollution occurs in rivers like the Potomac. The clear effluent from a treatment plant provides a rich source of nutrients (fixed nitrogen, potassium, and phosphate) for algae. On sunny days, a great algae bloom occurs in the slow-moving river. Often cloudy days follow, and the algae consume more oxygen than they evolve. The water can become anaerobic; fish die, and the river may become much like a sewer.

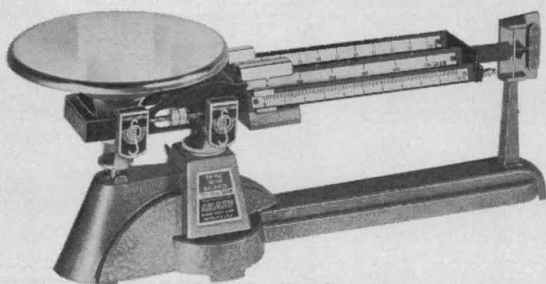
The President proposes only limited action on the problem of air pollution; a modest \$24 million is budgeted for air pollution programs. In addition, he has promised to discuss with automobile manufacturers means of reducing pollution from liquid-fueled vehicles.

The problems involved in improving the quality of life are difficult; some are almost insoluble. It is good to find that the matter is getting top-level attention.—PHILIP H. ABELSON



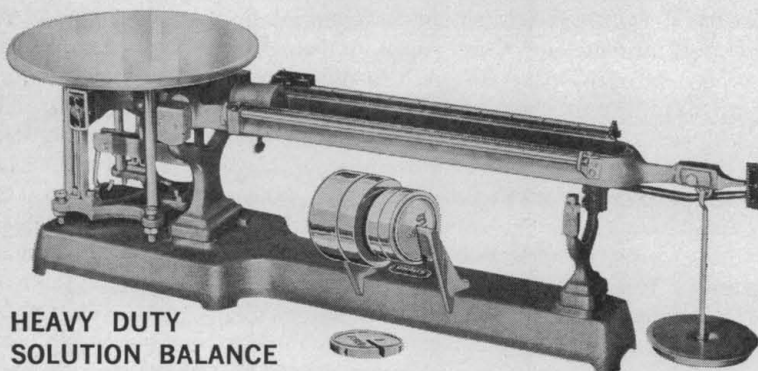
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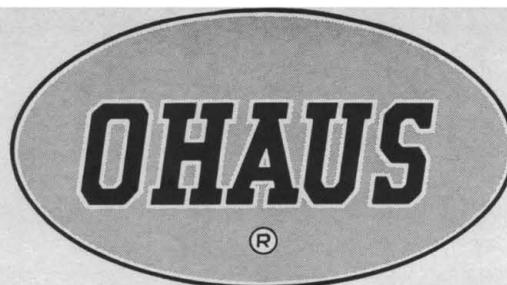


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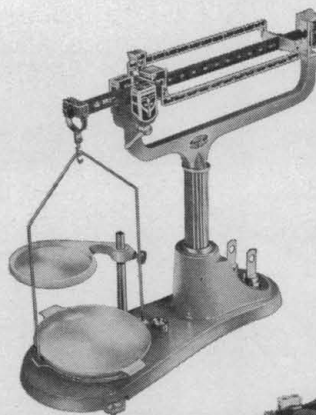
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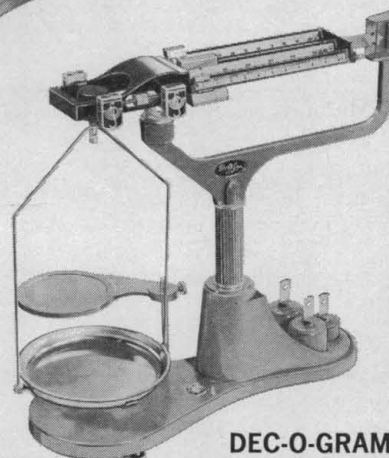


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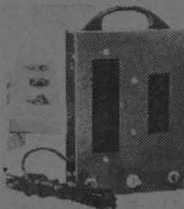


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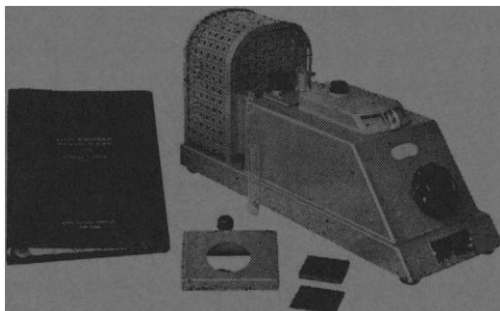
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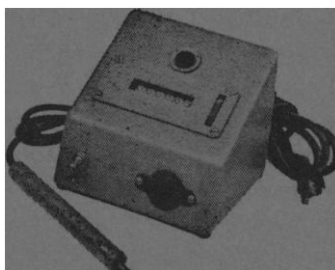


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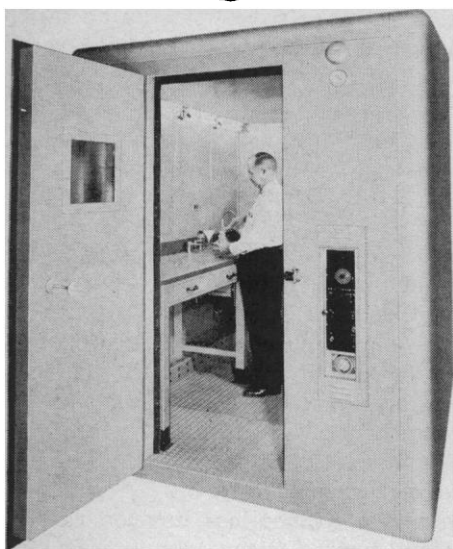
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cyclic azo compounds"; R. Gompper, "Synthesis of heterocycles from ketene acetals and related compounds"; Salo Gronowitz, "Aromatic boron heterocycles or halogen-metal interconversion in thiophenes and pyrimidines"; D. M. Lemal, "Aspects of diazene chemistry"; W. C. Linn, "Cyano-substituted epoxides"; F. Ramirez, "The oxaphospholane and oxaphospholene ring systems"; R. K. Robins, "Purines, pyrimidines and related systems"; G. Smolinsky, "Azirines"; E. C. Taylor, "New Syntheses in heterocyclic chemistry"; P. Yates, "Dihydrofuranone chemistry"; Martin J. Weiss, "Indole and pyrroloindole chemistry."

Glass

Martin Goldstein and C. R. Kurjian are chairman and vice chairman, respectively.

30 August–3 September. J. W. Cahn, "Nucleation and spinodal mechanisms of phase separations"; W. B. Hillig, (subject to be announced); J. J. Hammel, "The stability of a glass phase on, or near, a glass coexistence curve"; R. C. Charles, "Connectivity of phase separated structures in glass"; E. M. Levin, "Structural interpretation of immiscibility in oxide systems: elaboration and experimentation"; J. A. Williams and G. E. Rindone, "Application of small angle x-ray scattering to studies of phase separation in glass"; R. Roy, "Sequence of phases appearing in some simple and complex glasses"; J. Zarzycki, "X-ray diffraction study of phase separation"; F. Oberlies, "Proof of microheterogeneities on ultra-microtome slices of different glasses"; P. W. McMillan, "Microphase separation in simple glasses"; W. Vogel, "Investigation of the unmixing process and the resulting structure of different glasses"; G. H. Beall, "Crystallization of β -quartz solid solutions from glass."

Proctor Academy

Dielectric Phenomena

John D. Hoffman is chairman.

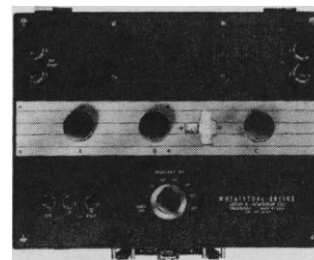
21–25 June. *Dielectric relaxation in polar liquids*: Worth E. Vaughan, "Survey of dielectric loss in polar liquids in microwave region"; Robert Zwanzig, "Dielectric friction in fluids"; T. Litovitz and G. D. McDuffie, "Dielectric and mechanical relaxation in nonpolymeric liquids"; Robert S. Cole, "The dielectric relaxation spec-

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trum of simple polar liquids." *Dielectric relaxation in organic glasses and polymers*: Julian Gibbs, "On the temperature dependence of cooperative relaxation in glass-forming liquids"; W. Stockmayer, "Dielectric dispersion in dilute polymer solutions"; Hyuk Yu and A. Bur, "Dielectric relaxation of rod-like molecules in solution"; E. Passaglia and J. D. Hoffman, "Dielectric and mechanical relaxation in semicrystalline polymers." *The transition from resonant to nonresonant dielectric absorption (gases)*: A. A. Maryott, "Dielectric relaxation in gases: experimental foundation"; G. Birnbaum, "Microwave relaxation in gases"; A. Ben-Reuven, "Theoretical aspects of line shape and microwave relaxation effects." *Rotation of dipoles in molecular crystals*: Mansel Davies, "Aspects of the dielectric study of molecular rotation in the solid state"; M. Broadhurst, "Model for dielectric relaxation in molecular crystals"; J. G. Powles, "Dielectric and NMR studies of rotation of molecules in molecular crystals."

Environmental Sciences:

Air Pollution

Allen D. Brandt and Frank E. Clarke are chairman and vice chairman, respectively.

Sulfur oxides and related compounds.

28 June. "Sources of sulfur oxides, quantities, forms, etc. (general)" (A. D. Brandt, *chairman*; J. H. Field, *discussion leader*). "Oxidation-reduction reactions; aerosol formation; adsorption on particulates; washout" (A. J. Haagen-Smit, *chairman*; F. E. Gartrell, *discussion leader*).

29 June. "Methods of identification and measurement" (M. D. Thomas, *chairman*; J. P. Lodge, Jr., *discussion leader*). "Physiological effects—experimental" (Leonard Greenburg, *chairman*; Mary Amdur, *discussion leader*).

30 June. "Health effects—epidemiological evaluation" (J. L. Whittenberger, *chairman*; E. J. Cassell, *discussion leader*). "Economic aspects—vegetation, materials and goods" (Ronald Ridker, *chairman*; J. T. Middleton and R. O. McCaldin, *discussion leaders*).

1 July. "Control by decreasing mass emission rate" (T. T. Frankenberg, *chairman*; Harry Perry, *discussion leader*). "Meteorological factors in preventing high sulfur compound concentrations at affected receptors" (G. H. Strom, *chairman*; M. E. Smith, *discussion leader*).

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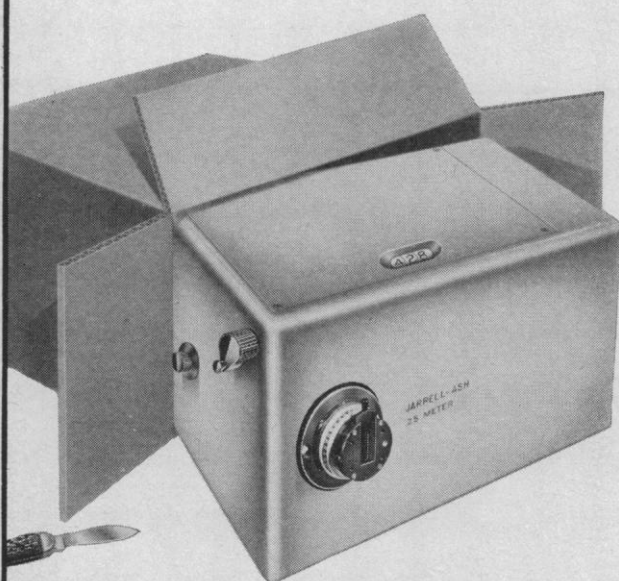
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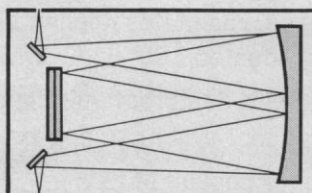
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2 July. "Permissible levels in ambient air, and criteria affecting or governing such levels" (V. G. MacKenzie, *chairman*; D. W. Fassett, *discussion leader*). *Summary*: Norton Nelson.

Chemistry and Metallurgy of Semiconductors

G. A. Wolff and R. C. Sangster are chairman and vice chairman, respectively.

12 July. *Crystal growth and etching*: J. P. Hirth, "Nucleation and growth of crystals"; R. Kern, "Morphology and crystal growth as influenced by crystal structure and matrix"; W. R. Runyan, "Epitaxial growth of semiconductors"; A. Reisman, "The kinetics of vapor phase etching of semiconductors."

13 July. *Crystal surfaces*: G. Rupprecht, "Semiconductor surface states"; H. E. Farnsworth, "The structure of semiconductor surfaces as determined by low-energy electron diffraction"; R. J. Jaccodine, "Electron microscope studies of semiconductor surfaces"; W. W. Harvey, "Semiconductor surface properties and electrode behavior."

14 July. *Semiconductor compounds*: R. W. Haisty, "A review of the preparation, properties and applications of semi-insulating III-V compounds"; M. Aven, "Preparation and properties of II-VI compounds"; F. Hulliger, "Crystal chemistry of transition-element compounds TX_2 "; E. Parthé, "On the stability of diamond structure materials."

15 July. J. C. Woolley, "Preparation and properties of solid solutions of III-V compounds"; F. A. Trumbore, "Solubilities and electrical behavior of impurities in III-V compounds"; (speaker and subject to be announced).

16 July. R. Roy, "Phase diagrams and materials research"; A. L. McWhorter, "Semiconductor laser."

Biomathematics

L. Stark and G. O. Barnett are chairman and vice chairman, respectively.

19-23 July. *Mathematical concepts of central nervous system function* (Lawrence Stark, *chairman*): Warren McCulloch and Lewis Sutro. *Non-linear control system theory* (G. Octo Barnett, *chairman*): Richard Bellman and Otto Smith. *Sensory communication* (Samuel Mason, *chairman*): Gil-



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Talanta, 3, 151, ('59).

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Ref: Momose, T., Inaba, A., Mukai,
Y., Shinkai, T., Chem. Pharm.
Bull. (Tokyo), 8, 514 ('60).

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1. Anderson, G.W., & McGregor A.C., "N-t-BOC-Amino Acids and Their Use in Peptide Synthesis," JACS, 79, 6180, (1957).
2. Merrifield, R.B., "Solid Phase Peptide Synthesis," JACS, 86, 304, (1964).

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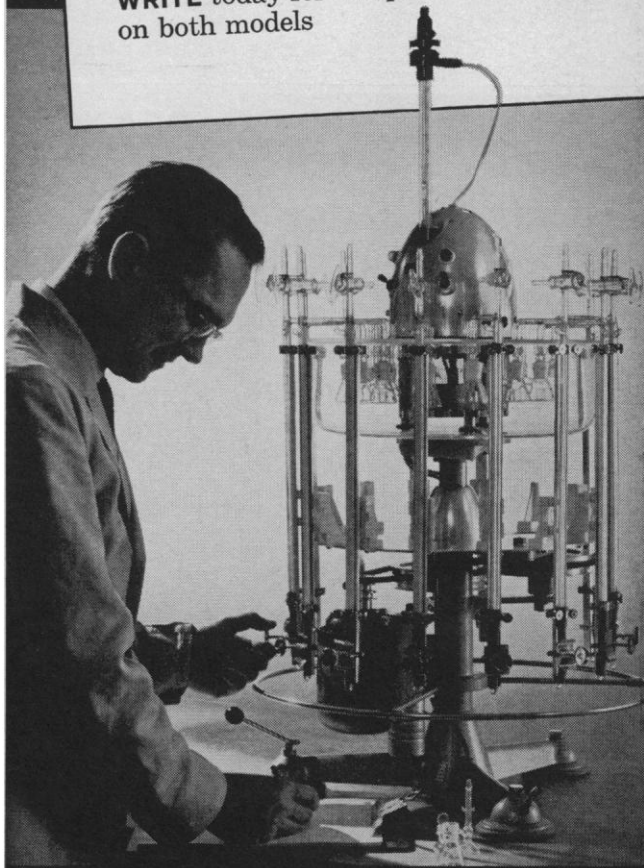
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bert McCann and David Lange. *Mathematical biophysics* (Wilfred Rall, *chairman*): Ernst Attinger, Richard Fitz-Hugh, and Arne Troelstra. *Taxonomic approach to pattern recognition* (Earl Gose, *chairman*): Kosei Takahashi and Vincent Giuliano. *Stochastic models in biology* (Anthony Bartholomay, *chairman*): A. T. Bharucha-Reid and John Stephenson. *Potential distribution functions in electrocardiography* (Otto Schmitt, *chairman*): David B. Geselowitz and H. L. Gelernter. *Mathematical biology: past, present, and future* (Herbert Landahl, *chairman*): Nicolas Rashevsky. *Use of computers for training in biomathematics*: Panel, Alan J. Perlis, Samuel Talbot, Bernard Widrow, James Dow, and Donald Perkel.

Lasers in Medicine and Biology

Peter Hornby and Leon Goldman are cochairmen.

23 August. *Laser instrumentation*: Edward Damon, "A review of calorimetric and photodetection techniques together with their anticipated accuracies"; Ronald J. Rockwell, Jr., "Harmonic generation techniques using ruby lasers"; Fred Johnson, "Second and fourth harmonic generation using neodymium"; Paul Mauer, "Characteristics and system parameters necessary for consistent high energy neodymium performance"; Glenn Hardway, "Techniques for expanding Q-switching lasers into higher megawatt outputs with single spiking."

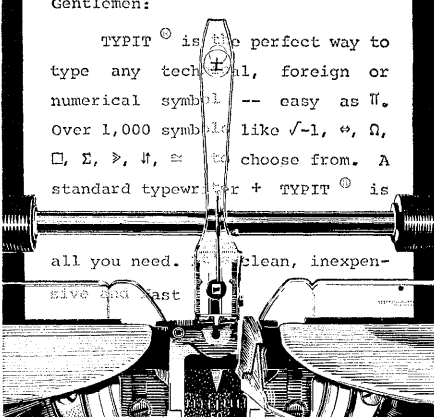
24 August. *Experimental retinal studies*: Leo Amar, "Generation of elastic waves in the eye"; Arnold Shapiro and Milton Zaret, "Some quantitative methods for the analysis of ocular damage"; William Ham, "Nonthermal effects in the eye due to high power density lasers." *Clinical retinal studies*: A. E. Jones, G. H. Herbener, and A. J. McCartney, "Morphological effects of liminal ruby laser exposures of the retina"; H. Christian Zweng, "Clinical observations and results of laser retinal photocoagulation."

25 August. *Laser-tissue interaction models*: Samuel Fine, Edmund Klein, and M. Litwin, "Parameters of the interaction of lasers with biological systems"; Janice Mendelson, "Evaluation of the mechanics of some physical effects of laser radiation on tissue"; J. R. Hayes, "Studies of laser interactions in neurosurgery." *Laser applications*: R. C. Rosan, "Applications in quantitative tissue analysis."

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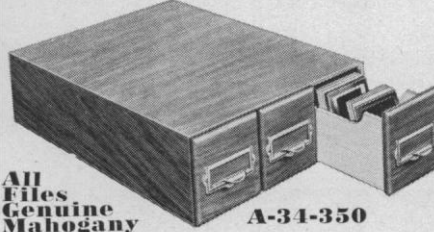
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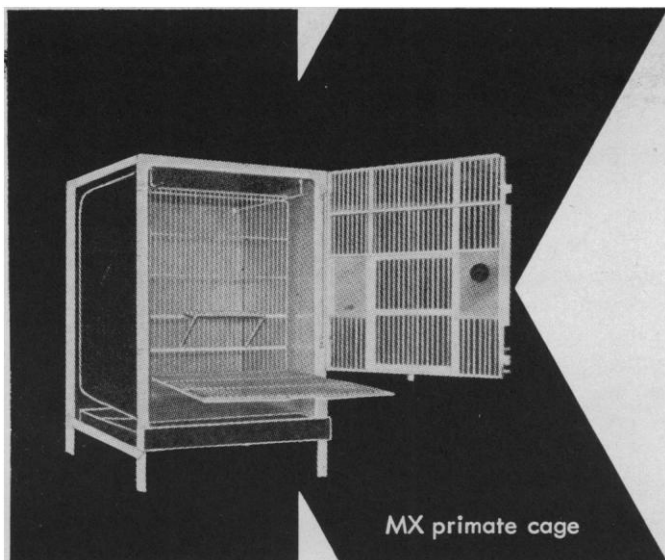
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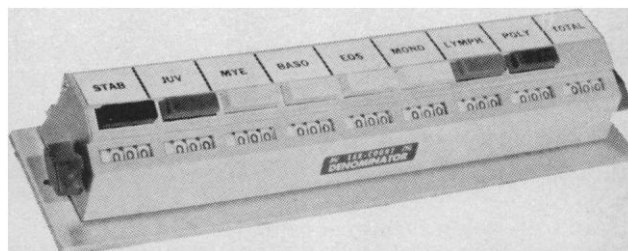
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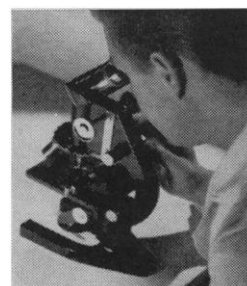
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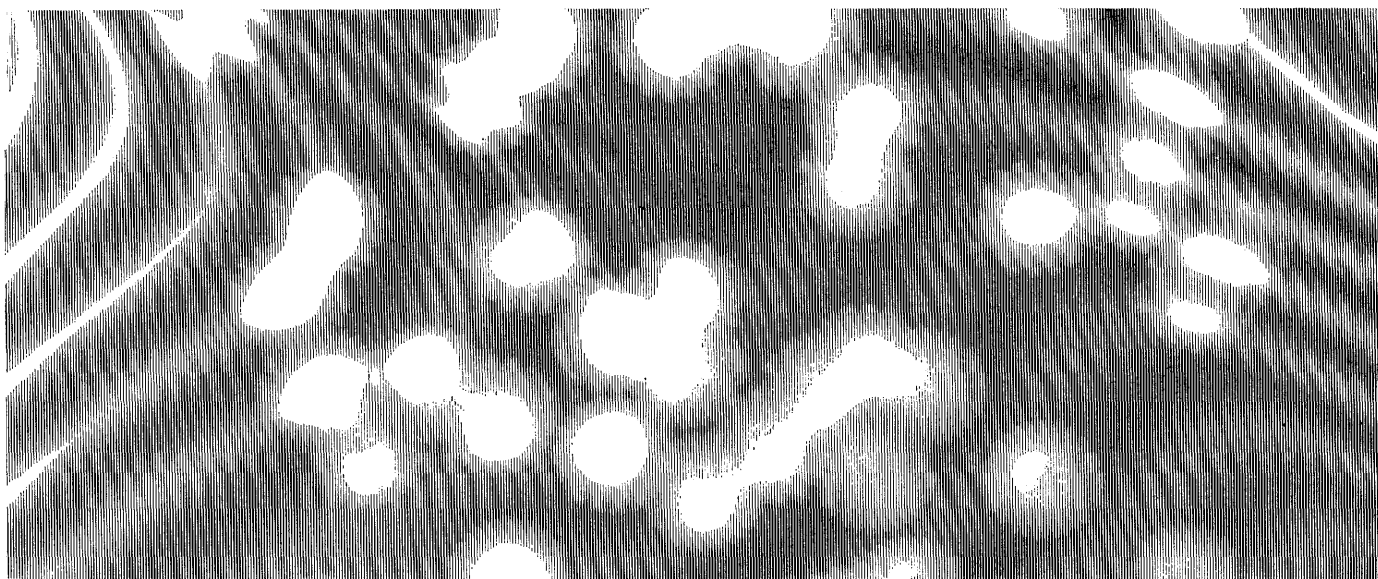
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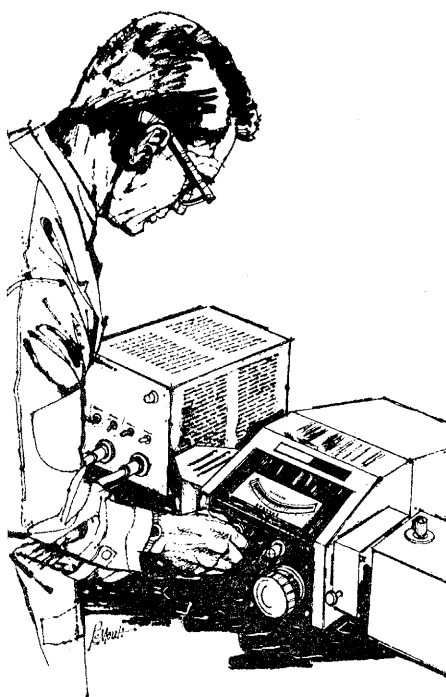
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26 August. *Laser cancer studies:* John Minton, "Factors in the quantitation of tumor destruction by laser energy"; Paul McGuff, "Experimental and clinical studies in laser tumor destruction"; Donald Rounds, "Basic studies on laser irradiation of tissue culture"; Alfred Ketcham, "Factors relating to the clinical application of laser energy for tumor destruction"; James Helsper, "Low energy clinical use of the laser in tumor surgery."

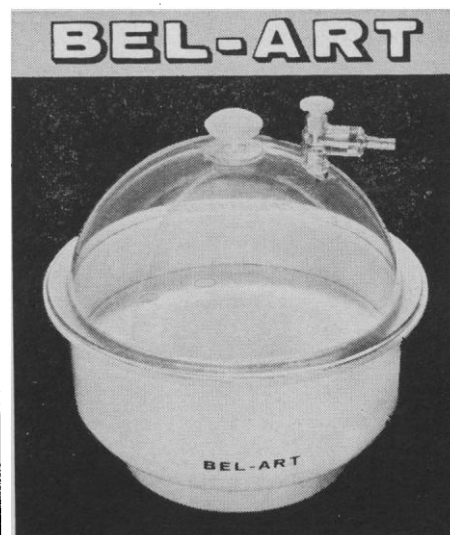
27 August. Ralph Stern and R. F. Sognnaes, "Laser effects on dental structures"; Leon Goldman, "Review of current and future laser studies."

Energy Coupling Mechanisms

Philip Handler is chairman.

30 August. *Microanatomy of phosphorylating structures. Mitochondria:* D. E. Green, "The repeating units of the mitochondrial outer and inner membranes"; F. L. Crane, "The relation between mitochondrial membrane structure and electron transport"; D. F. Parsons, "Recent advances correlating structure and function in mitochondria." *Chloroplasts:* L. Bogorad, "Structure and function of chloroplasts"; E. Moudrianakis, "Functional correlations to morphological units revealed by high resolution electron microscopy in spinach chloroplasts." *Photosynthesis. Photochemistry:* R. Clayton, "The significance of emitted light accompanying photosynthesis"; G. Seely, "Mechanisms of chlorophyll sensitized photo-reductions"; B. Kok, "Early events in photosynthesis"; G. Hind, "The site and mode of action of uncouplers on chloroplast electron transfer."

31 August. *Photophosphorylation:* H. Baltscheffsky and M. Baltscheffsky, "Multiple coupling sites in plant and bacterial photophosphorylation"; A. Jagendorf, "A high energy state of illuminated chloroplasts"; E. Racker, "A coupling factor for photophosphorylation"; C. Black and A. San Pietro, "Role of spinach ferredoxin in photophosphorylation"; M. Avron, "Photophosphorylation." *Carbohydrate formation:* M. Gibbs, "Energy requirements for photosynthetic biosynthesis of carbohydrate." *Oxidative phosphorylation. Efficiency:* A. L. Smith, "Increased efficiency of phosphorylation in oxidative phosphorylation of mitochondria"; W. Hemphing, "Electron transport and coupled energy conservation by intact bacteria"; R. H. Eisenhardt, "Uncoupling, respiratory control and the ATP-

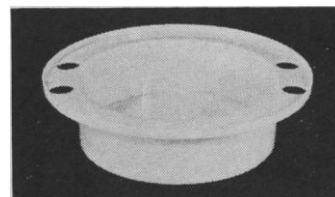


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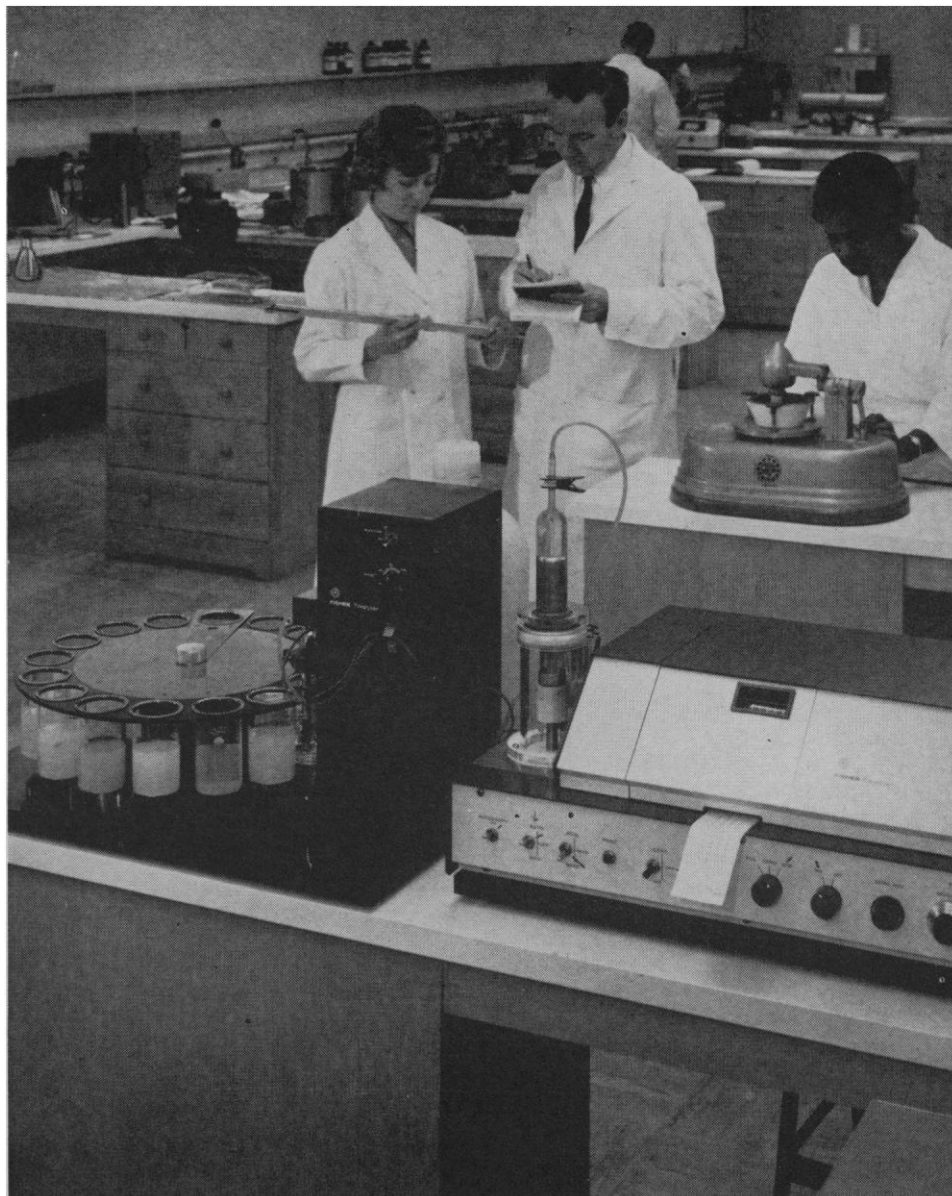
jump." *Mechanisms*: W. Wainio, "Iodo-histidine in the mitochondrion"; P. D. Boyer, "Phosphorylation mechanisms"; D. D. Tyler, "Studies on the possible role of free radicals in the uncoupling action of chemical compounds."

1 September. Coupling factors: G. Webster, "Mode of action of the site-specific ATP synthetases in mitochondrial oxidative phosphorylation"; R. Sanadi, "Coupling enzymes—single or multiple"; R. E. Beyer, "ATP synthetase II: its purification and function at phosphorylation site II during oxidative phosphorylation." *Associated electron transport*: E. C. Slater, "Mechanisms of energy conservation in mitochondrial oxidoreductions"; L. Ernster, "Mechanisms and pathways of energy conservation in submitochondrial electron transport particles"; H. A. Lardy, "Oxidative phosphorylation and the work of mitochondria"; *Ion transport. Mitochondria*: A. L. Lehninger, "Calcium transport in mitochondria"; J. B. Chappell, "Circumstantial evidence for the existence of a H^+ -pump in mitochondria"; H. Rasmussen, "A mitochondrial calcium pump"; G. F. Azzone, "Mechanisms of swelling and shrinkage in mitochondria"; W. S. Lynn, "Cation exchanges in mitochondria—a unified concept for ion transport, oxidative phosphorylation, and hydration of mitochondria"; G. P. Brierley, "Membrane permeability and ion transport in heart mitochondria."

2 September. Chloroplasts: L. Packer, "Energy-coupling of water and ion transport in chloroplasts"; R. Dilley, "Ion and water transport processes in chloroplasts related to light-dependent shrinkage"; N. E. Good, "Photophosphorylation and chloroplast conformation." *Other systems*: T. J. McManus, "Cation transport by erythrocyte membranes"; R. L. Post, "A phosphorylated intermediate in the membrane ATPase pump for sodium and potassium ions"; A. Weber, "Calcium transport by the endoplasmic reticulum."

3 September. Metabolic controls: M. Klingenberg, "Energy transfer in mitochondria: the relation between phosphate transfer and phosphate carrier transfer"; F. A. Hommes, "Oscillatory phenomena during anaerobic glycolysis in yeasts"; B. Chance, "Control of glycolysis"; R. Estabrook, "The pattern of glycolytic intermediates during the Pasteur effect"; I. Harary, "Energy sources for beating heart cells in culture"; Th. Bucher, "Mitochondrial-extramitochondrial interreaction in liver cells."

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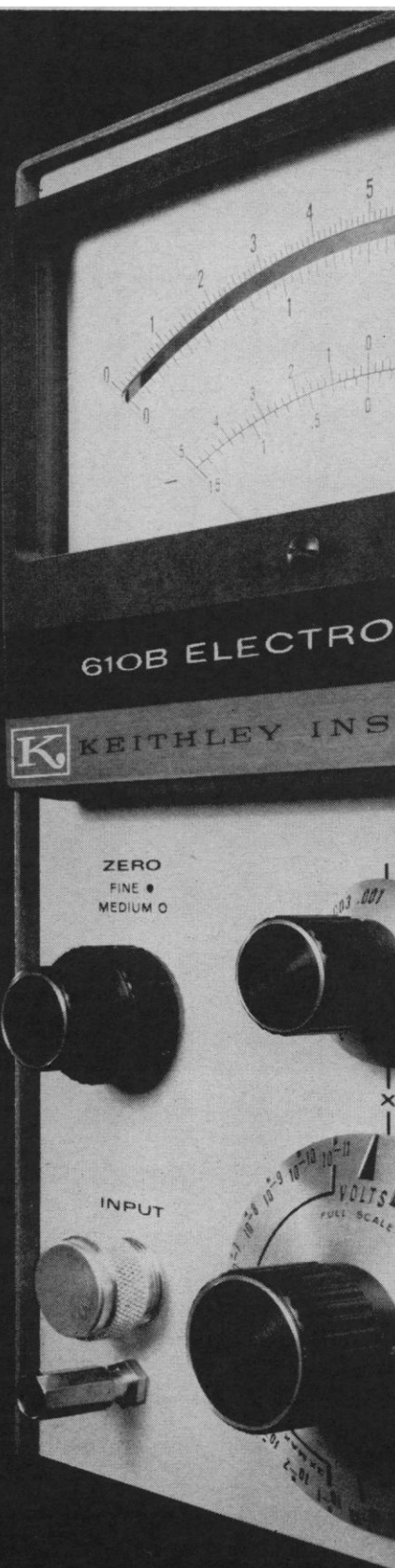
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MEETINGS

Forthcoming Events

March

17-19. Instrumentation in the Iron and Steel Industry, 15th natl. conf., Pittsburgh, Pa. (R. P. Trauterman, Allegheny-Ludlum Steel Corp. Research Center, Alabama Ave., Backenridge, Pa.)

17-20. Medical Schools and Teaching Hospitals: Curriculum, Programming and Planning, New York Acad. of Sciences, New York, N.Y. (NYAS, 2 E. 63 St., New York 10021)

17-20. American Orthopsychiatric Assoc., New York, N.Y. (E. Harrison, 477 FDR Drive, New York, N.Y.)

18. American Vacuum Soc., midwestern section, Houston, Tex. (J. H. Kimzey, Manned Spacecraft Center, 2101 Webster-Seabrook Rd., Houston 77058)

18-19. Zinc Metabolism, symp., Detroit, Mich. (A. S. Prasad, School of Medicine, Wayne State Univ., Detroit 48207)

18-20. Michigan Acad. of Science, Arts, and Letters, Univ. of Michigan, Ann Arbor. (I. J. Cantrall, Museum of Zoology, Univ. of Michigan, Ann Arbor)

19-20. New York Microscopical Soc., biennial symp., New York, N.Y. (T. G. Rochow, American Cyanamid Co., Room 467A, Stamford, Conn. 06904)

19-20. British Assoc. of Physical Medicine, annual, London, England. (J. P. Mitchell, 21 St. John St., Manchester 3, England)

19-21. American Soc. of Internal Medicine, Chicago, Ill. (A. V. Whitehall, 3410 Geary Blvd., San Francisco, Calif.)

20. Identification of Drugs and Poisons, symp., Pharmaceutical Soc. of Great Britain, London. (PSGB, 17 Bloomsbury Sq., London, W.C.1)

22-25. Thermophysical Properties, 3rd symp., Purdue Univ., Lafayette, Ind. (S. Gratch, Ford Motor Co., P.O. Box 2053, Dearborn, Mich. 48121)

22-26. Medical Film, intern. congr., Paris, France. (Dr. Beauchesne, 22, rue Micheli-du-Crest, Geneva, Switzerland)

22-26. Institute of Electrical and Electronics Engineers, intern. convention, New York, N.Y. (E. L. Harder, IEEE, Box A, Lenox Hill Station, New York 10021)

22-26. American College of Physicians, Chicago, Ill. (E. C. Rosenow, Jr., ACP, 4200 Pine St., Philadelphia, Pa. 19104)

22-26. Physics and Chemistry of Fission, symp., Salzburg, Austria. (J. H. Kane, Intern. Conferences Branch, Div. of Special Projects, U.S. Atomic Energy Commission, Washington, D.C. 20545)

23-24. Progress in Biochemistry and Therapeutics, 2nd symp., New York, N.Y. (C. Neuberger, Soc. for Intern. Scientific Relations, 600 Lafayette Ave., Brooklyn, N.Y. 11216)

23-25. Asthma, world conf., Eastbourne, England. (Secretary, Chest and Heart Assoc., Tavistock House North, Tavistock Sq., London, W.C.1, England)

24-26. Society of the Plastics Industry, 22nd conf., western section, Coronado, Calif. (SPI, 611 S. Catalina, Los Angeles, Calif.)

24-26. National Federation of Science

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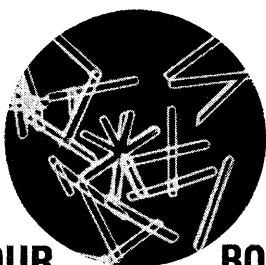
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24-27. **American Physical Soc.,** Kansas City, Mo. (R. G. Sachs, P.O. Box 344, Argonne, Ill. 60440)

24-27. **Society for Research in Child Development,** biennial, Minneapolis, Minn. (W. Hartup, Inst. for Child Development, Univ. of Minnesota, Minneapolis 55455)

25-26. **Advances in Tracer Methodology,** 10th symp., Zurich, Switzerland. (E. Landegren, New England Nuclear Corp., Ave. de Chailly 28 c, P.O. Box 31, Lausanne 12, Switzerland)

25-27. **Heart and Circulation in the Newborn and Infant,** Chicago, Ill. (D. E. Cassels, Chicago Heart Assoc., 22 W. Madison St., Chicago 60602)

25-27. **Mid-Central States Orthopaedic Soc.,** 12th annual, Hot Springs, Ark. (Mrs. P. Lovan, 4101 Westport Lane, Wichita, Kan.)

26. **Marine Environment,** symp. and NDEA workshop, Fullerton, Calif. (M. D. Brown, Fullerton Junior College, Fullerton)

26-27. **Association of Industrial Medical Officers,** spring meeting, London, England. (Joint Secretariat, 47 Lincoln's Inn Fields, London, W.C.2)

26-27. **Louisiana Acad. of Sciences,** Natchitoches. (S. M. Weathersby, Dept. of Zoology, Louisiana Polytechnic Inst., Ruston)

26-27. **Rural Health,** 18th natl. conf., Miami Beach, Fla. (B. L. Bible, 535 N. Dearborn St., Chicago, Ill. 60610)

26-2. **Rehabilitation,** natl. conf., Melbourne, Australia. (Intern. Soc. of Rehabilitation of the Disabled, 701 First Ave., New York, N.Y. 10017)

27-31. **National Science Teachers Assoc.,** natl. convention, Denver, Colo. (NSTA, 1201 16th St., Washington, D.C. 20036)

27-3. **Developmental Biology, U.S.-Japan Cooperative Science Program seminar,** Tokyo, Japan. (Office of International Science Activities, National Science Foundation, 1951 Constitution Ave., NW, Washington, D.C.)

28. **American College of Apothecaries, Inc.,** Detroit, Mich. (R. E. Abrams, Hamilton Court Hotel, 39th and Chestnut Sts., Philadelphia, Pa. 19104)

28-30. **American Assoc. of Colleges of Pharmacy,** Detroit, Mich. (C. W. Bliven, AACP, 1507 M St., NW, Washington, D.C. 20005)

28-30. **Experimental Dermatology,** 4th symp., Palermo, Italy. (A. Tosti, Intern. College of Experimental Dermatology, Ist Dermatologico dell'Universita, Via del Vespro 131, Palermo)

28-31. **American Soc. of Abdominal Surgeons,** Washington, D.C. (B. F. Alfano, 663 Main St., Melrose 76, Mass.)

28-31. **Canadian Inst. of Mining and Metallurgy,** annual, Toronto, Ontario. (E. G. Tapp, CIMM, 906-117 St. Catherine St., W., Montreal 2, Quebec)

28-1. **International Anesthesia Research Soc.,** Washington, D.C. (A. W. Friend, 227 Wade Park Manor, Cleveland, Ohio 44106)

28-2. **American Soc. of Hospital Pharmacists,** Detroit, Mich. (J. A. Oddis, 2215

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28-2. Society of **Motion Picture and Television Engineers**, 97th annual, Los Angeles, Calif. (R. J. Goldberg, Technicolor Corp., Research and Development Div., 2800 West Olive Ave., Burbank, Calif. 91505)

28-2. Chemical Aspects of **Electron Spin Resonance**, intern. conf., Cirencester, England. (D. H. Whiffen, Basic Physics Div., Natl. Physical Laboratory, Teddington, England)

28-3. American Soc. of **Photogrammetry/American Congress on Surveying and Mapping**, convention, Washington, D.C. (ASP, 44 Leesburg Pike, Falls Church, Va. 22044)

28-4. North American **Clinical Dermatologic** Soc., Las Vegas, Nev. (E. F. Finnerty, 177 E. 75 St., New York, N.Y. 10021)

29-31. American Assoc. for **Thoracic Surgery**, 45th annual, New Orleans, La. (Miss A. Hanvey, 7730 Carondelet Ave., St. Louis, Mo. 63105)

29-2. American Soc. of **Tool and Manufacturing Engineers**, annual conf., Cleveland, Ohio. (ASTM, 20501 Ford Rd., Dearborn, Mich. 48128)

29-30. **Great Lakes Research**, 8th conf., Ann Arbor, Mich. (J. L. Hough, Great Lakes Research Div., 1077 North Univ. Bldg., Ann Arbor, Mich.)

29-29 Apr. **Genito-Urinary Diseases**, symp., Univ. of Kentucky, Lexington. (N. J. Pisacano, Continuation Medical Education, Univ. of Kentucky, Lexington)

30-31. **Formulation of Pesticides**, symp., London, England. (Assistant Secretary, Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1)

30-1. Non-conventional **Electron Microscopy**, Cambridge, England. (Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

31-2. **Corrosion** by Hot Gases and Combustion Products, symp., European Federation of Corrosion, Frankfurt am Main, Germany. [DECHEMA, 6 Frankfurt (Main) 7, Postfach 7746, Germany]

31-2. **Optical** Soc. of America, Dallas, Tex. (M. E. Wurga, 1155 16th St., NW, Washington, D.C. 20036)

31-2. **Textile Research** Inst., annual, New York, N.Y. (TRI, Princeton, N.J.)

31-2. Recent Developments in **Heat Treatment of Food**, 2nd European symp., Frankfurt am Main, Germany. [Gesellschaft Deutscher Chemiker, Dr.rer. nat. Wolfgang Fritzsche, 6000 Frankfurt (Main), Postfach 9075, Warrentappstr. 40-42, Germany]

31-2. **Electron Beam**, 7th annual symp., University Park, Pa. (A. B. El-Kareh, Dept. of Electrical Engineering, Pennsylvania State Univ., University Park)

April

1-3. Association of **Surgeons** of Great Britain and Ireland, annual, London, England. (Joint Secretariat, 47 Lincoln's Inn Fields, London, W.C.2)

1-3. **Dermovenereology**, 7th meeting Univ. of Catania, Italy. (Direzione della Clinica Dermosifilopatica, Piazza S. Agata La Vetere 5, Catania, Sicily, Italy)

1-4. **British Medical Assoc.**, annual clinical meeting, Dundee, Scotland. (D. Gul-

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2-3. **Pennsylvania Acad. of Science**, 41st annual, Villanova Univ., Villanova. (G. E. Grube, Lock Haven State College, Lock Haven, Pa.)

2-4. **Society for Applied Anthropology**, annual, Lexington, Ky. (SAA, Rand Hall, Cornell Univ., Ithaca, N.Y.)

2-4. **American Soc. for the Study of Sterility**, San Francisco, Calif. (H. H. Thomas, 944 S. 18th St., Birmingham, Ala.)

2-7. **West African Science Assoc.**, 5th biennial conf., Freetown, Sierra Leone. (M. M. Anderson, Geology Dept., Fourah Bay College, Freetown)

4. **Chest Disease**, symp., Arizona Acad. of General Practice. (Cardiopulmonary Section, Tucson Medical Center, P.O. Box 6067, Tucson, Ariz. 85716)

4-7. **American College of Obstetricians and Gynecologists**, annual, San Francisco, Calif. (ACOG, 79 W. Monroe St., Chicago, Ill. 60603)

4-9. **Division of Chemical Literature**, American Chemical Soc., Detroit, Mich. (B. M. Davis, Cabot Corp., Concord Rd., Billerica, Mass.)

4-9. **American Chemical Soc.**, spring natl. meeting, Detroit, Mich. (ACS, 1155 16th St., NW, Washington, D.C. 20036)

5-7. **Atomic Energy Soc. of Japan**, annual, Kyoto, Japan. (M. Masamoto, Atomic Energy Soc. of Japan, c/o Japan Atomic Energy Research Inst., 1, 1-chome, Shibata-mura-cho, Minato-ku, Tokyo, Japan)

5-7. **Hormonal Effects of Cutaneous Structure and Function**, New York Univ., New York, N.Y. (Office of the Recorder, New York Univ. Post-Graduate Medical School, 550 First Ave., New York 10016)

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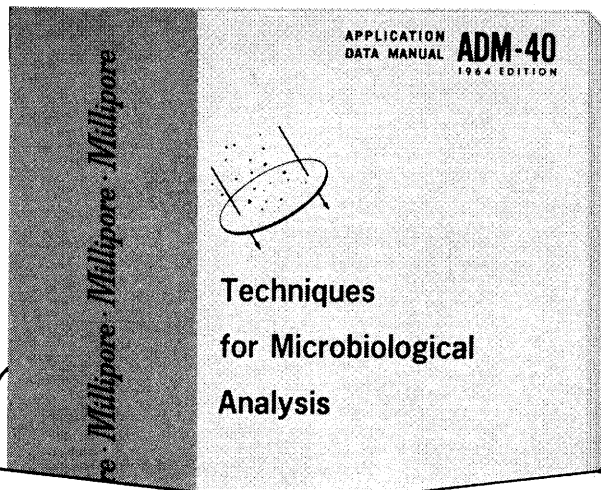
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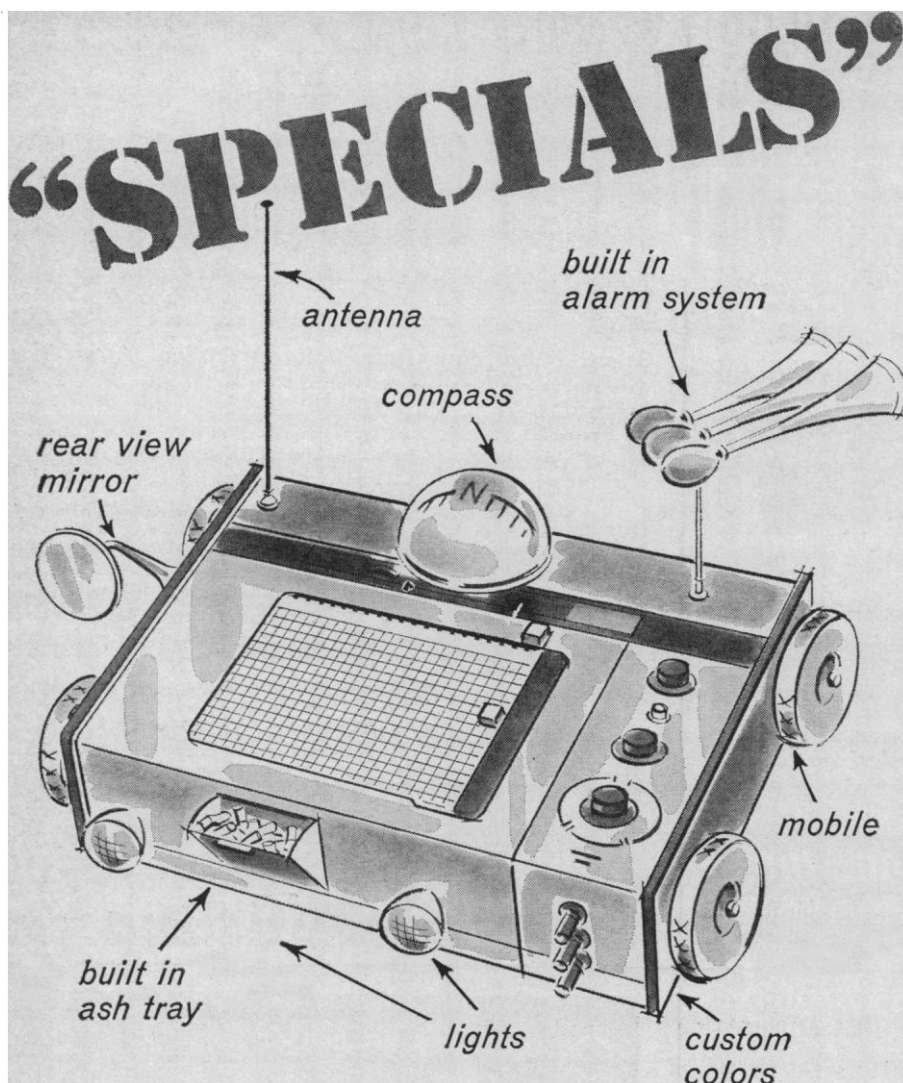


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5-8. **High Energy Physics**, symp., Birmingham, England. (Administration Asst., Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

5-8. **Industrial Health**, American conf., Miami Beach, Fla. (American Industrial Health Conf., 55 East Washington St., Chicago, Ill.)

5-9. American College of **Allergists**, seminar and 21st annual congr., Las Vegas, Nev. (Administrative Office, 2141 14th St., Boulder, Colo.)

5-9. **Clean Air**, congr. and exhibition, Dusseldorf, Germany. (Nordwestdeutsche Ausstellungen-und Messe-Gesellschaft mbH, Nowea 5, Dusseldorf, Messagelände, Germany)

5-9. Phenomena in the Neighborhood of **Critical Points**, Washington, D.C. (M. S. Green, Statistical Physics Section, Natl. Bureau of Standards, Washington, D.C. 20234)

5-10. **Nuclear Developments**, 1st intern. congr., Brighton, England. (J. B. Pinkerton, Inst. of Nuclear Engineers, 147 Victoria St., London, S.W.1, England)

5-12. **Large Telescopes**, symp., Pasadena and San José, Calif. (I. S. Bowen, c/o Mt. Wilson Observatory, 813 Santa Barbara St., Pasadena)

5-24. **World Meteorological Organization**, Regional Assoc. VI (Europe), 4th session, Paris, France. (WMO, 41 Avenue Giuseppe Motta, Geneva, Switzerland)

6-8. **Biomathematics and Computer Science** in the Life Sciences, 3rd annual symp., Houston, Tex. (Office of the Dean, Div. of Continuing Education, Univ. of Texas Graduate School of Biomedical Sciences, 102 Jesse Jones Library Bldg., Texas Medical Center, Houston 77025)

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7-9. American Assoc. for **Cancer Research**, 56th annual, Philadelphia, Pa. (AACR, 7701 Burholme Ave., Fox Chase, Philadelphia 19111)

7-9. The **Chemical Soc.**, anniversary meetings, Glasgow, Scotland. (CS, Burlington House, London, W.1, England)

7-9. **Nucleation Phenomena**, intern. symp., Cleveland, Ohio. (A. G. Walton, Dept. of Chemistry, Case Inst. of Technology, University Circle, Cleveland 6)

7-9. **Stress Analysis**, conf., Bristol, England. (Administration Asst., Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

8-9. **Histochemical Soc.**, 16th annual, Philadelphia, Pa. (S. S. Spicer, Natl. Inst. of Health, Bethesda, Md. 20014)

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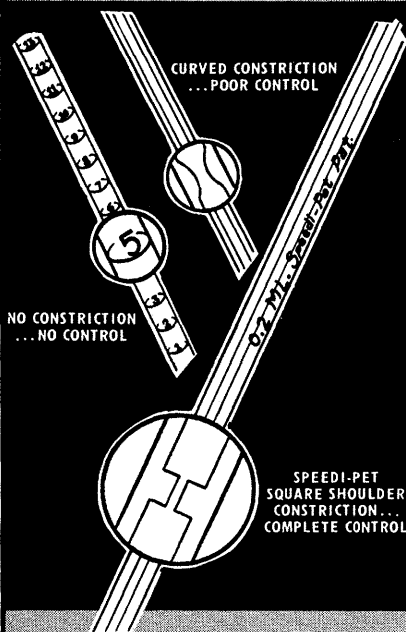
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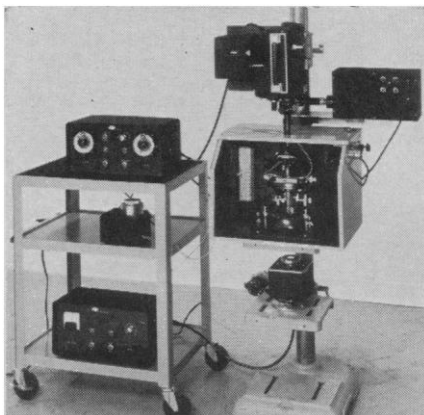
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9-11. Southwestern **Psychological** Assoc., annual, Oklahoma City, Okla. (O. Parsons, Dept. of Psychiatry, Neurology, and Psychology, Oklahoma Medical Center, Oklahoma City)

9-13. Mediterranean Cooperation for **Solar Energy**, Istanbul, Turkey. (M. Perrot, c/o Faculte des Sciences, Pl. Victor Hugo, Marseilles, France)

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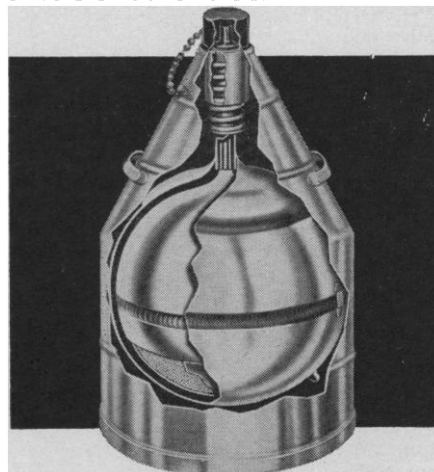
11-15. **Calcified Tissues**, 3rd European symp., Davos, Switzerland. (H. Fleisch, Laboratorium für Experimentelle Chirurgie, Schweizerisches Forschungsinstitut, Davos)

12-13. **Inorganic Single Crystals**, symp., London, England. (Asst. Secretary, Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1)

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12-14. Ballistocardiography and Cardiovascular Dynamics, 1st world congr., Amsterdam, Netherlands. (A. A. Knoop, Physiological Laboratory, Free Univ., Valeriusplein 11, Amsterdam)

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13-14. Kinetics of Proton Transfer Processes, Faraday Soc., Univ. of Newcastle-upon-Tyne, England. (FS, 6 Gray's Inn Square, London, W.C.1, England)

13-14. Thermal Analysis, symp., London, England. (B. R. Currell, Dept. of Chemistry, Mathematics, Biology, and Geology, Northern Polytechnic, Holloway Rd., London, N.7)

13-15. Telemetering, natl. conf., Houston, Tex. (R. W. Towle, Advanced Technology Laboratories, 369 Winsman Ave., Mountain View, Calif.)

13-17. American Soc. of Parasitologists, 40th annual, Atlanta, Ga. (F. J. Kruidenier, Dept. of Zoology, Univ. of Illinois, Urbana)

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16-17. Montana Acad. of Sciences, Montana State College, Bozeman. (L. H. Harvey, Dept. of Botany and Microbiology, Montana State Univ., Missoula)

16-18. Association of Southeastern Biologists, annual, Charlottesville, Va. (J. N. Dent, Room 270, Gilmer Hall, McCormick Rd., Charlottesville 22903)

18-22. Association of American Geographers, annual, Columbus, Ohio. (E. Taafee, Dept. of Geography, Ohio State Univ., Columbus)

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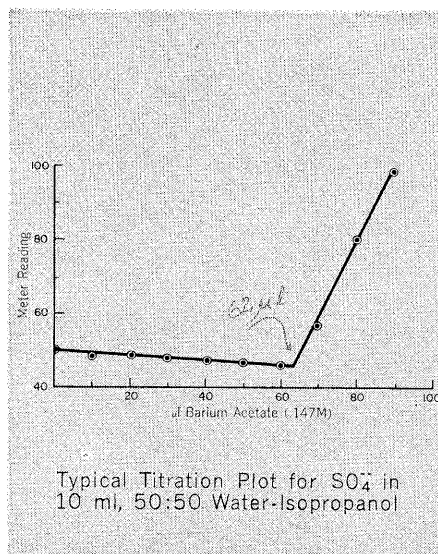
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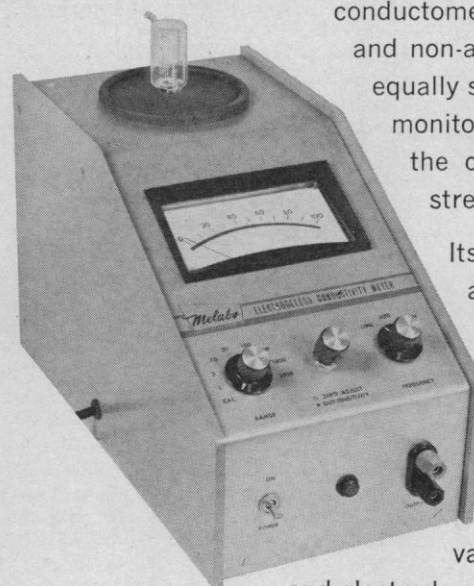
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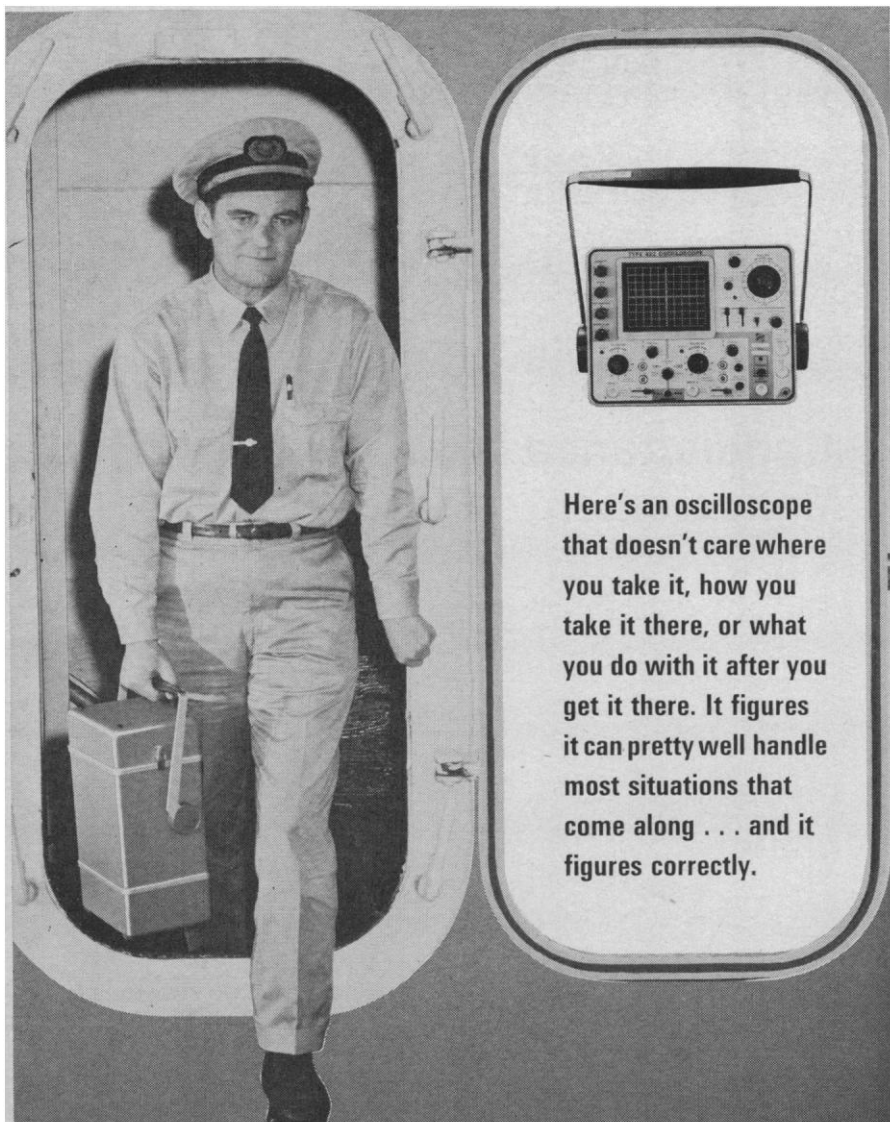
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19-21. **Biomedical Sciences Instrumentation**, 3rd natl. symp., Instrument Soc. of America, Dallas, Tex. (D. R. Stearn, ISA, 530 William Penn Place, Pittsburgh, Pa. 15219)

19-21. **Mechanics, Physics, and Chemistry of Solid Propellants**, Purdue Univ., Lafayette, Ind. (A. C. Eringen, School of Aeronautics, Astronautics and Engineering Sciences, Purdue Univ., Lafayette 47907)

19-22. **Modern Trends in Activation Analysis**, intern. conf., Texas A&M Univ., College Station. (R. E. Wainardi, Texas A&M Univ., College Station)

19-22. **American Geophysical Union**, annual, Washington, D.C. (W. E. Smith, AGU, 1145 19th St., NW, Washington, D.C. 20036)

19-22. **Nuclear Magnetic Resonance**, 2nd annual workshop, Washington, D.C. (A. J. Rosen, Dept. of Chemistry, Georgetown Univ., Washington, D.C.)

20-22. **Frequency Control**, 19th annual symp., Atlantic City, N.J. (Director, U.S. Army Electronics Laboratories, Headquarters, U.S. Army Electronics Command, Attn: AMSEL-RD-PF, Fort Monmouth, N.J. 07703)

20-22. **Great Plains**, symp., North Dakota State Univ., Fargo. (S. W. Russell, North Dakota State Univ., Fargo)

20-22. **Physics of Solids at High Pressures**, 1st intern. conf., Tucson, Ariz. (C. T. Tomizuka, Dept. of Physics, Univ. of Arizona, Tucson 85721)

20-22. **Photochemical Aspects of Air Pollution**, symp., Cincinnati, Ohio. (A. P. Altshuller, Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 45226)

20-22. **System Theory**, symp., Polytechnic Inst. of Brooklyn, Brooklyn, N.Y. (J. Fox, Polytechnic Inst. of Brooklyn, 333 Jay St., Brooklyn 1)

20-23. **American Assoc. of Anatomists**, annual, Miami, Fla. (R. T. Woodburne, Dept. of Anatomy, Univ. of Michigan, Ann Arbor 48104)

20-23. **American Meteorological Soc.**, spring meeting, Washington, D.C. (K. C. Spengler, 45 Beacon St., Boston 8, Mass.)

20-23. **U.S. Natl. Committee, Intern. Scientific Radio Union/Inst. of Electrical and Electronics Engineers**, spring meeting, Washington, D.C. (A. T. Waterman, Stanford Electronics Laboratories, Stanford Univ., Stanford, Calif.)

21. **Oral Cancer**, 3rd annual symp., Poughkeepsie, N.Y. (M. A. Engelman, 1 East Academy St., Wappingers Falls, N.Y. 12590)

21-22. **Mathematical Geodesy**, symp., Turin, Italy. (A. Marussi, Univ. of Trieste, Trieste, Italy)

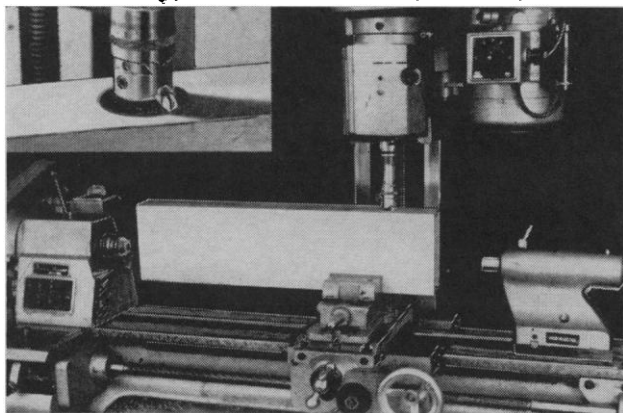
21-23. **American Inst. of Chemists**, 42nd annual, Richmond, Va. (R. E. Anderson, Albemarle Paper Manufacturing Co., Richmond 23217)

21-23. **Cognitive Processes and Clinical Psychology**, 3rd symp., Univ. of Colorado, Boulder. (R. Jessor, Dept. of Psychology, Univ. of Colorado, Boulder)

21-23. **Combustion Inst.**, western states section, spring meeting, Hollywood, Calif. (A. S. Gordon, Forrestal Research Center, Princeton Univ., Princeton, N.J.)

21-23. **Institute of Environmental Sciences**, 11th annual, Chicago, Ill. (IES, 34

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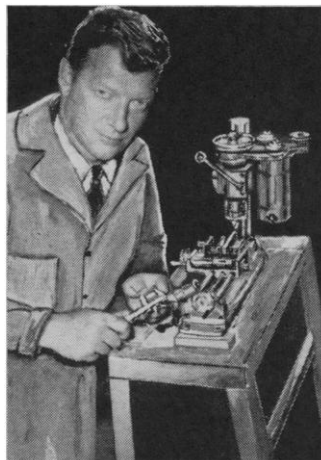
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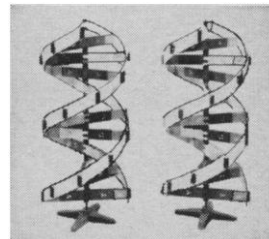
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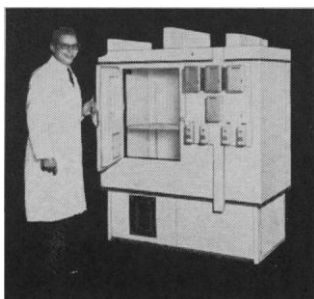
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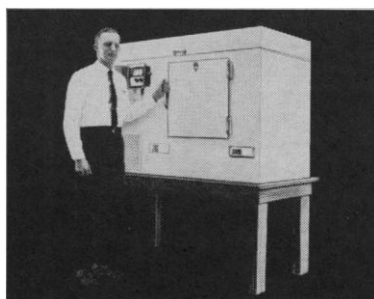
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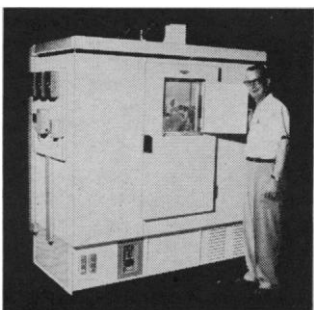
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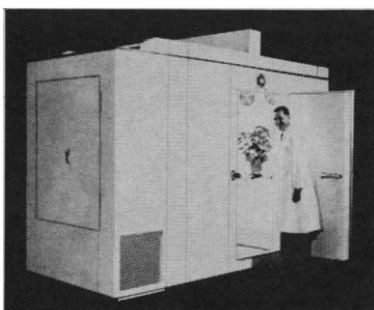
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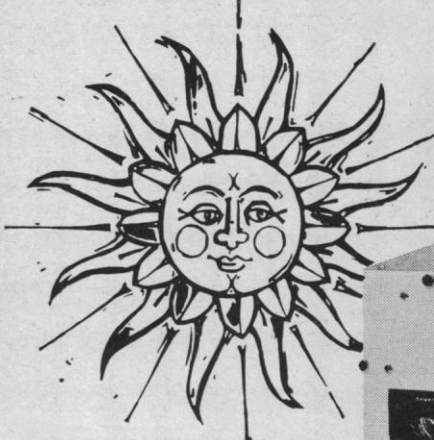
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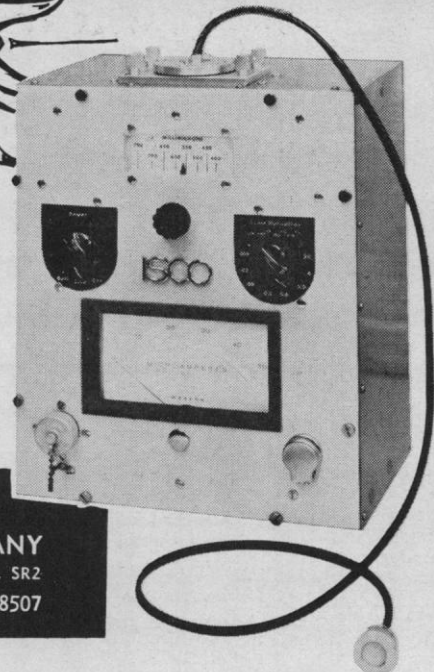
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21-23. Engineering Aspects of **Magneto-hydrodynamics**, 6th symp., Pittsburgh, Pa. (E. Reshotko, Div. of Electrical Engineering, Case Inst. of Technology, Cleveland, Ohio 44106)

21-23. Support for **Manned Flight**, conf., Dayton, Ohio. (G. L. Schwarz, Headquarters, AF Logistics Command (MCO), Wright-Patterson AFB, Ohio)

21-23. **Marine Sciences Instrumentation**, 3rd natl. symp., Instrument Soc. of America, Univ. of Miami, Miami, Fla. (H. A. Cook, Airpax Electronics, Inc., P.O. Box 8488, Fort Lauderdale, Fla.)

21-23. **Nonlinear Magnetics**, 3rd intern. conf., (INTERMAG), Washington, D.C. (E. W. Pugh, I.B.M. Components Div., Dept. 231, Bldg. 703-2, Poughkeepsie, N.Y. 12602)

21-23. **Ophthalmological** Soc. of the United Kingdom, annual, London, England. (Joint Secretariat, 47 Lincoln's Inn Fields, London, W.C.2)

21-23. **Optimization Techniques**, symp., Pittsburgh, Pa. (Inst. of Electrical and Electronics Engineers, Box A, Lenox Hill Station, New York, N.Y.)

21-23. **Pulse Radiolysis**, symp., Manchester, England. (M. Ebert, Paterson Laboratories, Christie Hospital and Holt Radium Inst., Withington, Manchester 20, England)

21-24. Federation of European **Biochemical** Societies, Vienna, Austria. (The Secretariat, Alserstr. 4, Vienna 9)

21-24. British **Paediatric** Assoc., Scarborough, England. (E. W. Hart, Hospital for Sick Children, Great Ormond St., London, W.C.1, England)

21-2. **Industrial Chemistry**, 26th intern. congr., Paris, France. (Soc. of Industrial Chemistry, 28 rue St. Dominique, Paris 7)

22-23. **Nondestructive Testing** of Materials, intern. conf., Vienna, Austria. (Firma Gebr. Böhler & Co., A.G., Kapfenberg, Austria)

22-23. Chemistry of **Polymerization Processes**, symp., London, England. (W. R. Moore, Dept. of Chemical Technology, Bradford Inst. of Technology, Bradford 7, Yorkshire, England)

22-24. Eastern **Psychological** Assoc., 36th annual, Atlantic City, N.J. (M. A. Iverson, Queens College, Flushing, N.Y. 11367)

22-24. Role of the **Solvent in Chemical Kinetics**, E. A. Moelwyn-Hughes symp., Univ. of Arkansas, Fayetteville. (A. Fry, Dept. of Chemistry, Univ. of Arkansas, Fayetteville 72701)

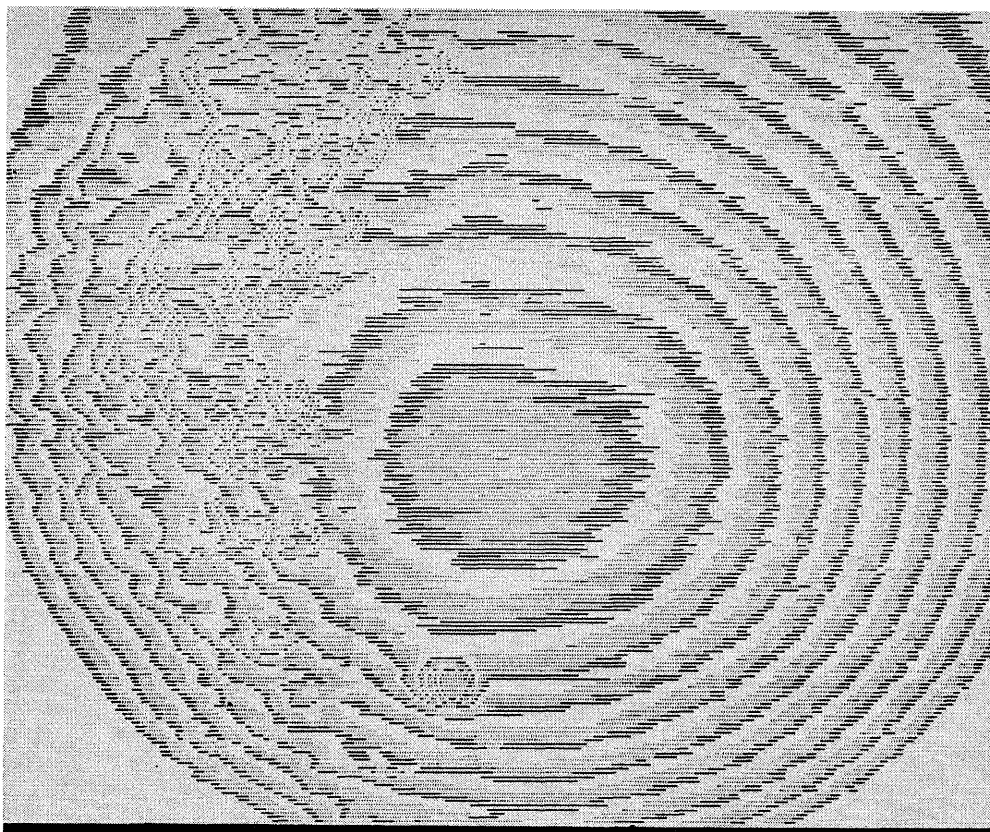
22-24. **Wildflower Pilgrimage**, 15th annual, Great Smoky Mountains Natl. Park. (E. E. C. Clebsch, Dept. of Botany, Univ. of Tennessee, Knoxville)

23-24. **Georgia** Acad. of Science, Oglethorpe Univ., Atlanta. (J. T. May, School of Forestry, Univ. of Georgia, Athens)

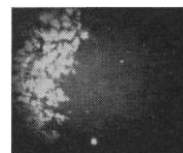
23-24. **Information Retrieval**, 2nd annual natl. colloquium, Univ. of Pennsylvania, Philadelphia. (Inst. for Scientific Information, 325 Chestnut St., Philadelphia 19106)

23-24. **Iowa** Acad. of Science, Univ. of Dubuque, Dubuque, Iowa. (G. W. Peglar, Dept. of Mathematics, Iowa State Univ., Ames)

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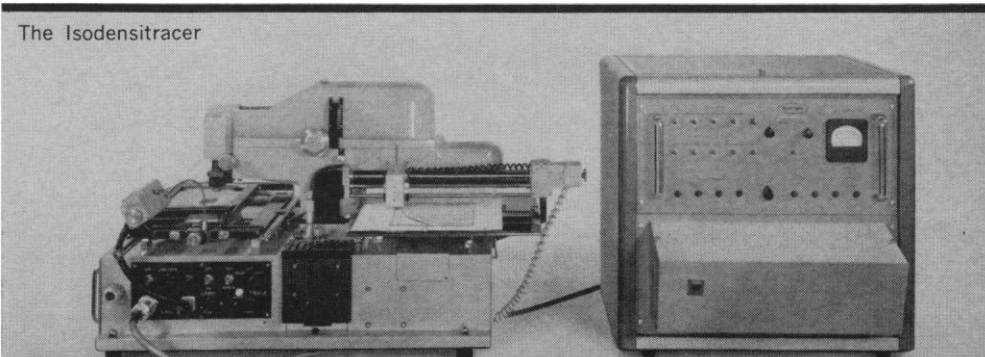
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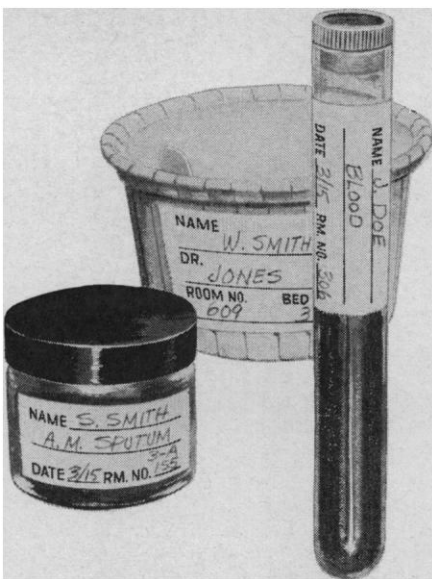
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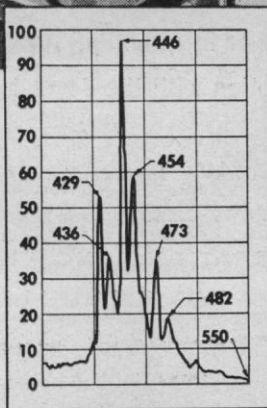
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23-24. **Ohio Acad. of Science**, annual, Ohio Univ., Athens. (J. H. Melvin, 505 King Ave., Columbus, Ohio 43201)

23-24. **Parasitism**, colloquium, Oregon State Univ., Corvallis. (J. E. McCauley, Dept. of Oceanography, Oregon State Univ., Corvallis 97331)

23-24. **Population Assoc. of America**, annual, Chicago, Ill. (A. J. Coale, PAA, Office of Population Research, 5 Ivy Lane, Princeton, N.J.)

23-24. **South Dakota Acad. of Science**, Black Hills State College, Spearfish. (T. Van Bruggen, Botany Dept., Univ. of South Dakota, Vermillion)

23-24. **West Virginia Acad. of Science**, Fairmont State College, Fairmont. (J. B. Hickman, 8 Mineral Industries Bldg., West Virginia Univ., Morgantown)

25-26. **Pi Gamma Mu**, natl. social science honor soc., St. Paul, Minn. (E. B. Urquhart, 1719 Ames St., Winfield, Kan.)

25-28. **American Oil Chemists Soc.**, Houston, Tex. (C. W. Hoerr, Durkee Foods, 2333 Logan Blvd., Chicago, Ill.)

25-28. **Southeastern Psychiatric Assoc.**, annual, Southern Pines, N.C. (H. Brackin, Jr., 1918 Church Ave., Nashville 3, Tenn.)

25-29. **American Assoc. of Cereal Chemists**, Kansas City, Mo. (E. J. Bass, Intern. Milling Co., Inc., 1423 S. 4th St., Minneapolis, Minn. 55404)

25-29. **American Soc. for Microbiology**, annual, Atlantic City, N.J. (R. W. Sarber, ASM, 115 Huron View Blvd., Ann Arbor, Mich.)

25-29. **International College of Surgeons**, North American Federation, Las Vegas, Nev. (Secretariat, 1516 Lake Shore Dr., Chicago, Ill. 60610)

26-27. **European Days of Chemical Engineering**, Paris, France. (Société de Chimie Industrielle, 28, rue St. Dominique, Paris 7)

26-27. **Electroanesthesia**, 2nd symp., Univ. of Tennessee, Knoxville. (C. E. Short, UT-AEC Agricultural Research Laboratory, 1299 Bethel Valley Rd., Oak Ridge, Tenn.)

26-27. **Environmental Health Problems**, 2nd AMA congr., Chicago, Ill. (Dept. of Environmental Health, AMA, 535 North Dearborn St., Chicago, Ill. 60610)

26-28. **Error in Digital Computation**, symp., Madison, Wis. (L. B. Rall, U.S. Army Mathematics Research Center, Univ. of Wisconsin, Madison 53706)

26-29. **Aerospace Medical Assoc.**, 36th annual, New York, N.Y. (Gen. J. M. Talbot, Headquarters USAF, AFMSPA, Washington, D.C. 20333)

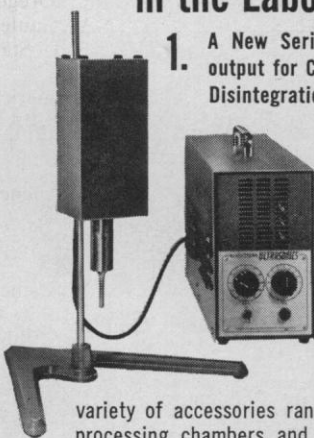
26-29. **Mechanisms and Therapy of Cardiac Arrhythmias**, 14th Hahnemann symp., Philadelphia, Pa. (L. Dreifus, Dept. of Medicine, Hahnemann Medical College and Hospital, Philadelphia)

26-29. **Society of Economic Paleontologists and Mineralogists**, New Orleans, La. (D. M. Curtis, Shell Oil Co., Box 127, Metairie, La.)

26-29. **American Assoc. of Petroleum Geologists**, 39th annual, New Orleans, La. (G. Atwater, 424 Whitney Bldg., New Orleans)

26-29. **American Physical Soc.**, Wash-

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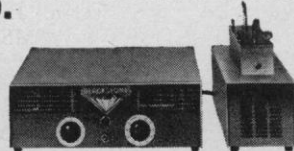
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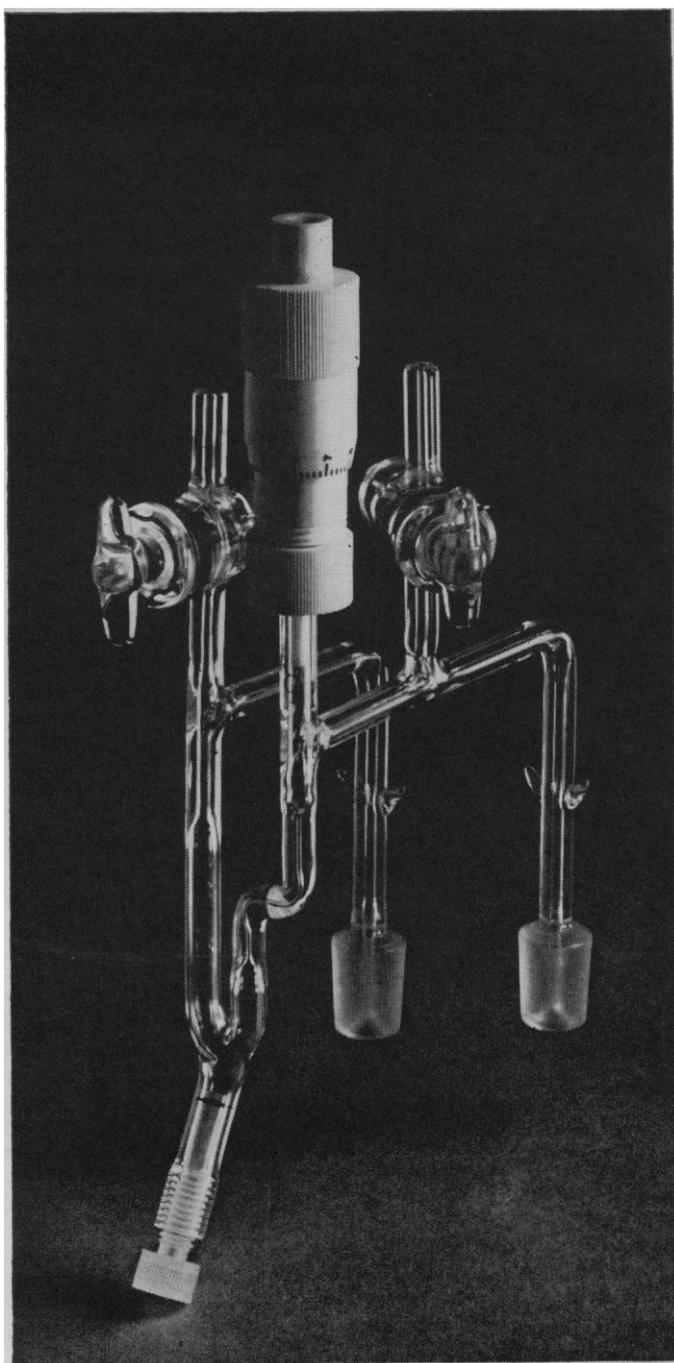
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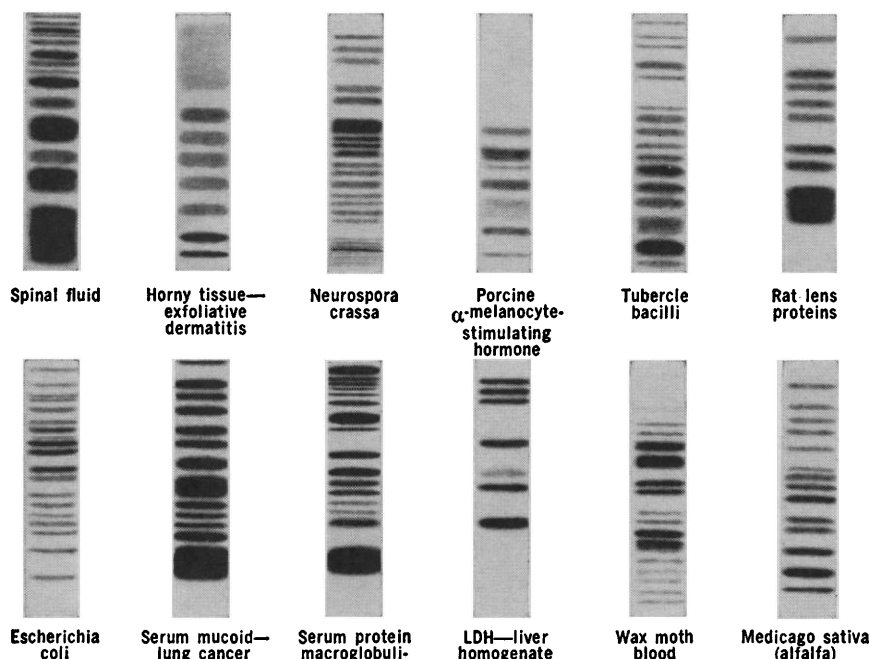


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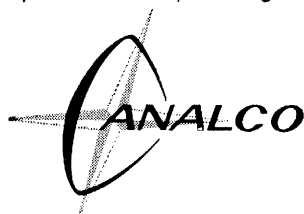
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ington, D.C. (K. K. Darrow, APS, Columbia Univ., New York 10027)

26-1. **Geodetic Uses of Satellites**, conf., Athens, Greece. (Intern. Organizations Staff, Bureau of Intern. Commerce, U.S. Department of Commerce, Washington, D.C.)

28-30. **Hypnosis and Psychosomatic Medicine**, intern. congr., Paris, France. (H. C. Harding, 2050 NW Lovejoy, Portland 9, Ore.)

28-30. National Soc. for **Prevention of Blindness**, Houston, Tex. (J. W. Ferree, 16 E. 40 St., New York 10016)

28-1. **Biometric Soc.**, eastern North America regional, Florida State Univ., Tallahassee. (E. L. LeClerg, 6804 40th Ave., University Park, Hyattsville, Md. 20782)

28-1. American College Health Assoc., Miami Beach, Fla. (R. E. Boynton, 5518 Merrick Dr., Coral Gables, Fla.)

29-30. **Space Navigation and Communications**, natl., Houston, Tex. (P. Schrock, Inst. of Navigation, 711 14th St. NW, Washington, D.C. 20005)

29-30. Association for **Symbolic Logic**, Chicago, Ill. (T. Hailperin, Dept. of Mathematics, Lehigh Univ., Bethlehem, Pa. 18015)

29-1. American Assoc. of **Endodontists**, Detroit, Mich. (E. C. Van Valey, 9 Rockefeller Plaza, New York 10020)

29-1. American Assoc. for **History of Medicine**, Philadelphia, Pa. (J. B. Blake, Natl. Library of Medicine, 9600 Wisconsin Ave., Bethesda, Md.)

29-1. American Acad. of **Neurology**, annual, Cleveland, Ohio. (AAN, 7100 France Ave. S., Minneapolis, Minn. 55410)

29-1. Midwestern **Psychological Assoc.**, 27th annual, Chicago, Ill. (F. A. Mote, Psychology Bldg., Madison, Wis. 53706)

29-1. American **Philosophical Assoc.**, western div., Chicago, Ill. (L. E. Hahn, Dept. of Philosophy, Southern Illinois Univ., Carbondale)

29-2. **Protides of the Biological Fluids**, 13th colloquium, Bruges, Belgium. (P.O.B. 71, Bruges 1)

29-2. Association of **Clinical Scientists**, New York, N.Y. (R. P. MacFate, ACS, 300 N. State St., Chicago, Ill. 60610)

29-2. **Pan American Medical Assoc.**, 40th annual congr., Grand Bahama Island. (PAMA, 745 Fifth Ave., New York 10022)

29-2. **Roentgen**, 46th German congr., Nuremberg, Germany (A. Jakob, c/o Strahleninstitut der Städt. Krankenanstalten, Flurstr. 17, 85 Nuremberg)

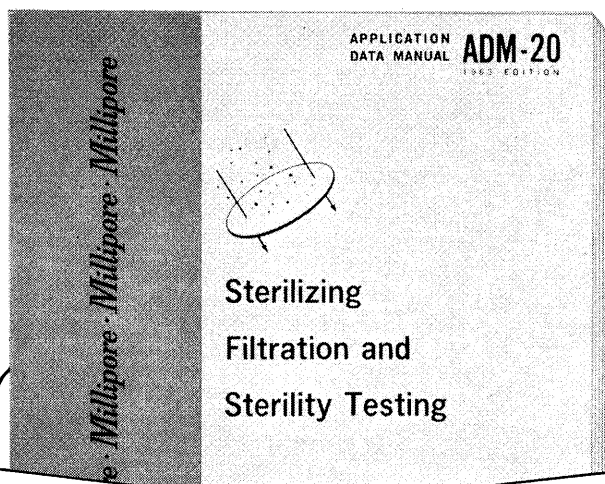
30-1. **Colorado-Wyoming Acad. of Science**, annual, Univ. of Denver, Denver, Colo. (C. Norton, Dept. of Botany and Plant Pathology, Colorado State Univ., Fort Collins)

30-1. **Indiana Acad. of Science**, Culver. (C. F. Dineen, St. Mary's College, Notre Dame, Ind. 46556)

30-1. **Nebraska Acad. of Sciences**, Lincoln. (C. B. Schultz, Morrill Hall 101, Univ. of Nebraska, 14th and U St., Lincoln 68508)

30-2. Society of **Biological Psychiatry**, New York, N.Y. (G. N. Thompson, 2010 Wilshire Blvd., Los Angeles, Calif.)

30-2. Academy of **Psychoanalysis**, annual, New York, N.Y. (A. H. Rifkin, 125 E. 65 St., New York 10021)



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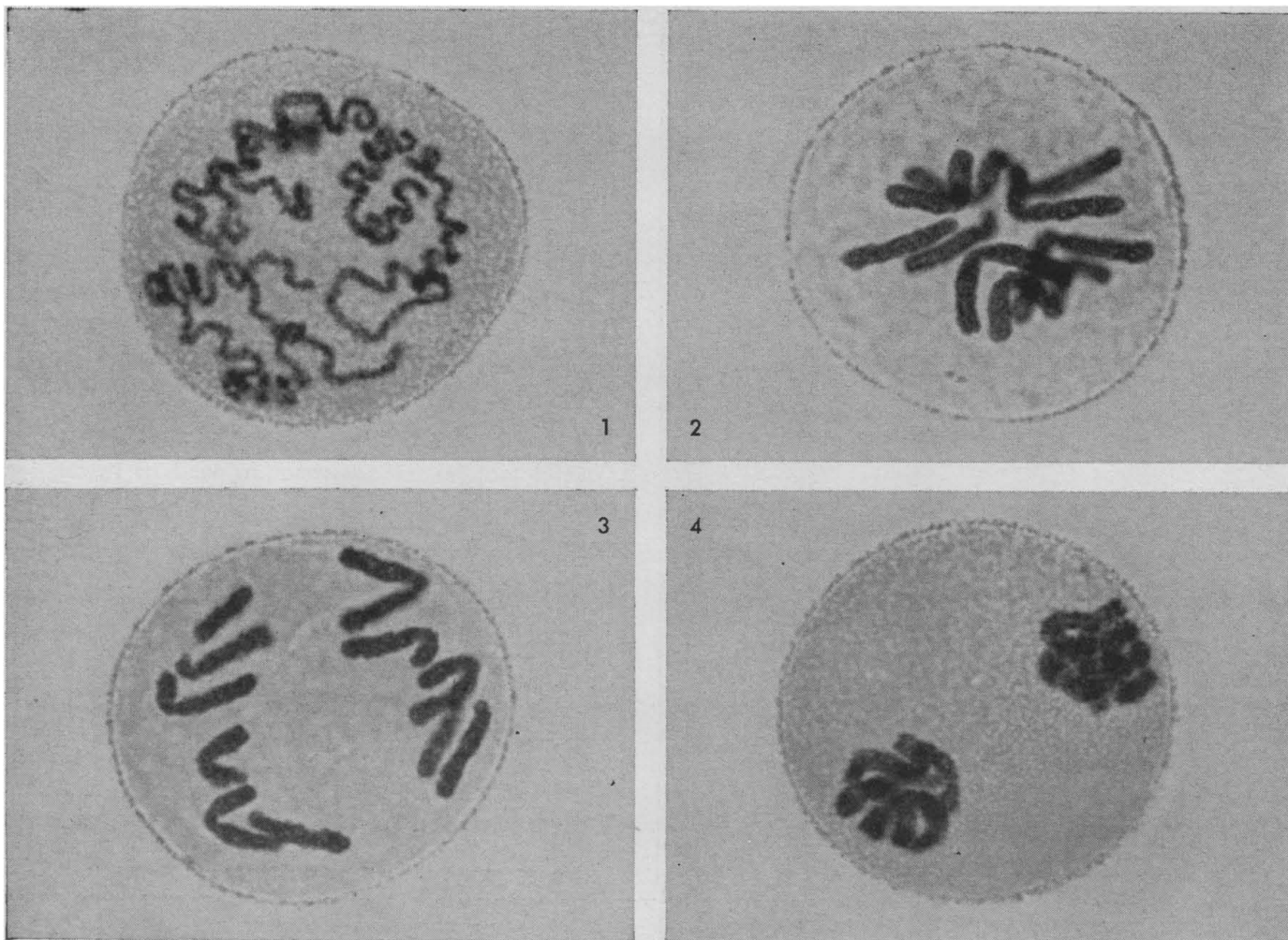
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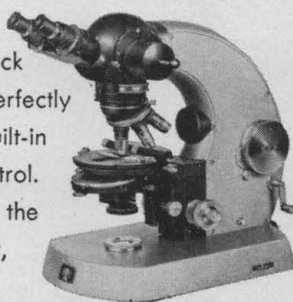


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for probe, a-c outlets for heating and cooling systems, and output terminal for millivolt recorder. Instructions permanently printed on box. Dimensions: 11.5 by 6.25 by 4 inches deep (30 by 15 by 10 cm). Teflon-coated 6-foot coaxial probe cable. List: \$197.50.—D.J.P. (Matheson Co., Inc., Jackson and Swanson Sts., Philadelphia, Pa.)

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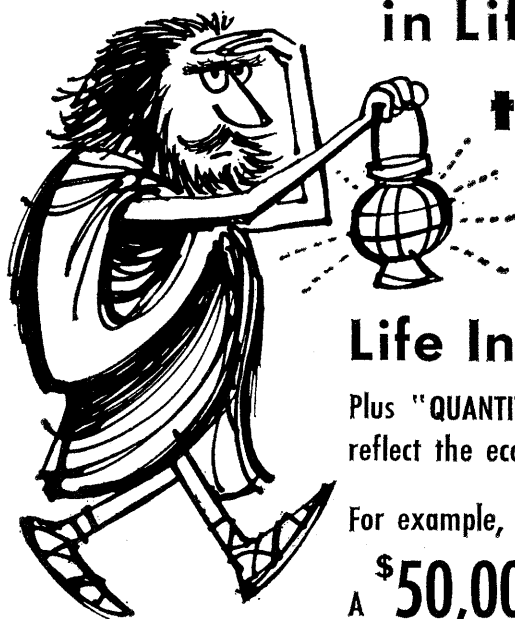
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The material in this section is prepared by Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

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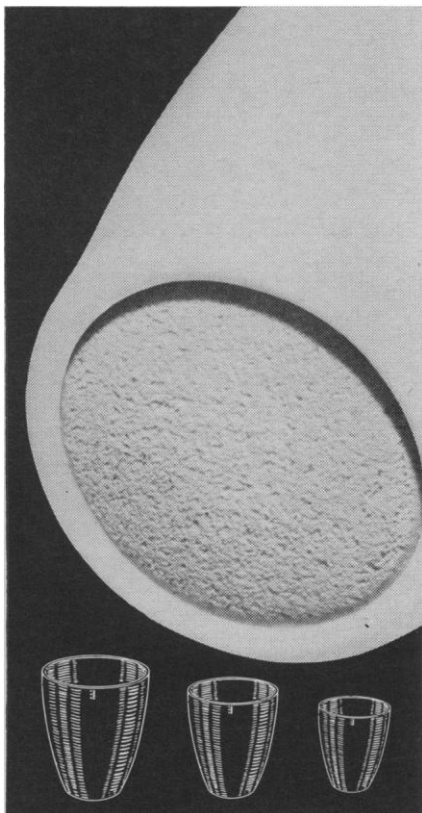
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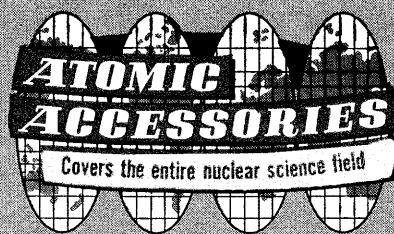
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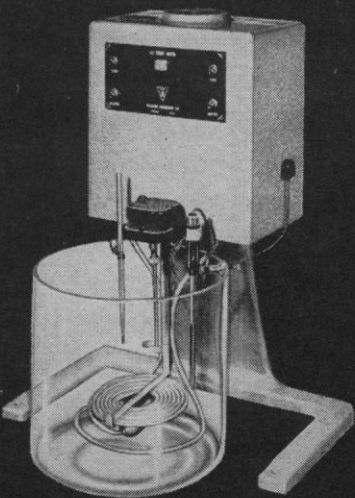
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The Deep and the Past. David B. Ericson and Goesta Wollin. Knopf, New York, 1964. 315 pp. Illus. \$6.95.

Descripción Sumaria del Templo Semisubterráneo de Tiwanaku. Carlos Ponce Sanginés. Centro de Investigaciones Arqueológicas en Tiwanaku, Tiwanaku, Bolivia, 1964. 90 pp. Illus. Plates.

Direct Use of the Sun's Energy. Farington Daniels. Yale Univ. Press, New Haven, Conn., 1964. 392 pp. Illus. Paper, \$2.45; cloth, \$7.50.

Documents on Disarmament, 1963. Compiled and annotated by Robert W. Lambert, Ruth Ihara, and Charles R. Gellner. U.S. Arms Control and Disarmament Agency, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 756 pp. Paper, \$2.

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An Essay Concerning Human Understanding. John Locke. Abridged and edited with an introduction by A. D. Woozley. World, Cleveland, Ohio, 1964. 475 pp. Paper, \$2.65.

Exploring the World of Fossils. William H. Matthews, III. Childrens Press, Chicago, 1964. 157 pp. Illus. \$4.50 (juvenile).

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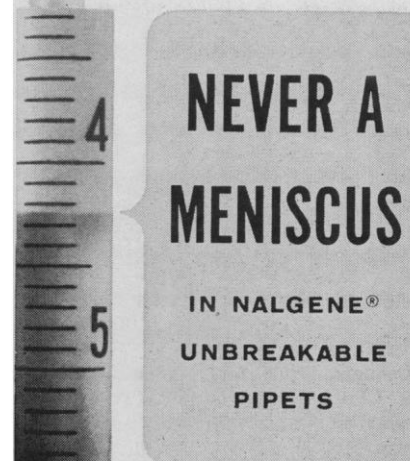
The Flammarion Book of Astronomy. Camille Flammarion. Prepared under the direction of Gabrielle Camille Flammarion and André Danjon. Translated from the French edition (1955-60) by Annabel and Bernard Pagel. Simon and Schuster, New York, 1964. 670 pp. Illus. \$22.95.

The Flying Trapeze: Three Crises for Physicists. J. Robert Oppenheimer. Oxford Univ. Press, New York, 1964. 75 pp. Illus. \$2.75.

The Friendly Stars. Martha Evans Martin. Revised by Donald H. Menzel. Dover, New York, 1964 (revised and enlarged version of the 1907 edition). 159 pp. Illus. Paper, \$1.

Genetics and Man. C. D. Darlington. Macmillan, New York, 1964. 382 pp. Illus. \$7.50. A revised and expanded edition of *The Facts of Life* (1953).

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The Hospitals, 1800-1948. A study in social administration in England and Wales. Brian Abel-Smith. Harvard Univ. Press, Cambridge, Mass., 1964. 528 pp. Illus. \$9.

Indians of Southern Illinois. Irvin M. Peithmann. Thomas, Springfield, Ill., 1964. 141 pp. Illus. \$6.50.

Industrial Espionage and Mis-Use of Trade Secrets. Worth Wade. Advance House, Ardmore, Pa., 1964. 140 pp. Paper, \$12.50.

Inference and Disputed Authorship: The Federalist. Frederick Mosteller and David L. Wallace. Addison-Wesley, Reading, Mass., 1964. 303 pp. Illus. \$12.50.

Insect Pests of Livestock, Poultry, and Pets and Their Control. Rudolph Seiden. Springer, New York, 1964. 174 pp. Illus. Paper, \$4.

Inside the Nucleus. Irving Adler. New American Library, New York, 1964. 157 pp. Illus. Paper, 60¢.

Islands in Space: The Challenge of the Planetoids. Dandridge M. Cole and Donald W. Cox. Chilton, Philadelphia, 1964. 298 pp. Illus. \$6.95.

The Land and Wildlife of Africa. Archie Carr and the Editors of *Life*. Time, New York, 1964. 200 pp. Illus. \$3.95.

Leonardo da Vinci and a Memory of His Childhood. Sigmund Freud. Translated from the German by Alan Tyson. James Strachey, Ed. Norton, New York, 1964. 101 pp. \$3.50.

Life and Death of the Sun. John Rudlowsky. Basic Books, New York, 1964. 176 pp. Illus. \$4.50.

The Life and Times of Emil H. Grubbe. The biography of a pioneering Chicago radiologist. Paul C. Hodges. Univ. of Chicago Press, Chicago, 1964. 151 pp. \$3.95.

Life Histories of North American Cuckoos, Goatsuckers, Hummingbirds, and Their Allies. pts. 1 and 2. Arthur Cleveland Bent. Dover, New York, 1964 (reprint of Smithsonian Institution *Bulletin* 176, 1940). pt. 1, 256 pp.; pt. 2, 270 pp. Plates. Paper, \$2.50 each.

Life Histories of North American Jays, Crows, and Titmice. pts. 1 and 2. Arthur Cleveland Bent. Dover, New York, 1964 (reprint of Smithsonian Institution *Bulletin* 191, 1946). pt. 1, 224 pp.; pt. 2, 287 pp. Plates. Paper, \$2.50 each.

The Living Battery. An introduction to bioelectricity. E. E. Suckling. Macmillan, New York, 1964. 160 pp. Illus. \$3.95.

Louis Pasteur. Founder of bacteriology. John Mann. Scribner, New York, 1964. 160 pp. \$3.50 (juvenile book).

Man and Space. Arthur C. Clarke and the Editors of *Life*. Time, New York, 1964. 200 pp. Illus. \$3.95.

Management and Mathematics. The practical techniques available. Allan Fletcher and Geoffrey Clarke. Gordon and Breach, New York, 1964. 247 pp. Illus. \$7.50.

The Many Worlds of Man. Jack Conrad. Crowell, New York, 1964. 319 pp. Illus. \$6.95.

Mathematical Bafflers. Compiled and edited by Angela Dunn. McGraw-Hill,



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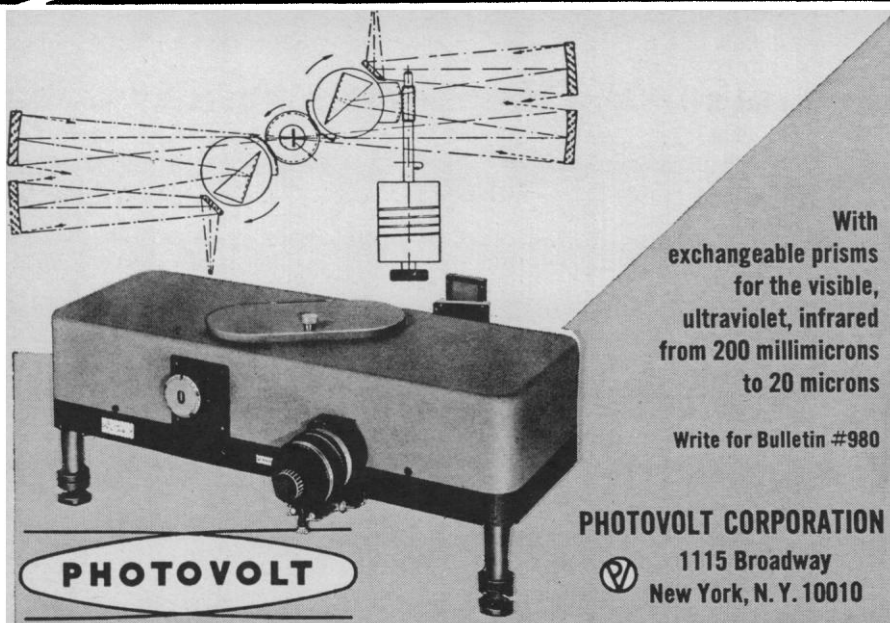
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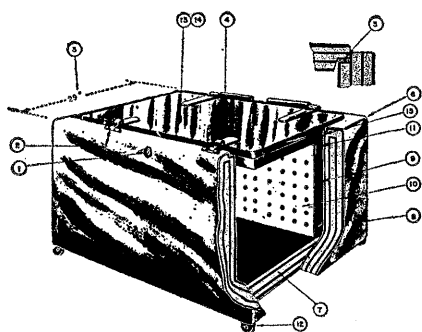
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New York, 1964. 231 pp. Illus. \$6.50.

Medical Illustration. A guide for the doctor-author and exhibitor. William E. Loechel. Thomas, Springfield, Ill., 1964. 355 pp. Illus. \$14.50.

Methods of Forensic Science. vol. 3. A. S. Curry, Ed. Interscience (Wiley), New York, 1964. 356 pp. Illus. Nine papers: "Lead poisoning" by S. L. Tompsett; "Non-biological applications of neutron activation analysis in forensic studies" by Vincent P. Guinn; "Biological applications of activation analysis" by Hamilton Smith and J. M. A. Lenihan; "Forensic chemical analysis of urine for drugs" by Elliott B. Hensel; "The administration of a forensic science laboratory" by Robert F. Borkenstein; "Examination of fiduciary counterfeits and forgeries" by P. Fauconnier, J. Cogniard, and P. F. Ceccaldi; "The toxicology of cyanides" by Manuel A. Guatelli; "The acid phosphates test" by S. S. Kind; and "Erasures" by Wilson R. Harrison.

My View of the World. Erwin Schrödinger. Translated from the German edition (Hamburg, 1961) by Cecily Hastings. Cambridge Univ. Press, New York, 1964. 118 pp. \$3.50.

A New System of Chemical Philosophy. John Dalton. Philosophical Library, New York, 1964. 182 pp. Illus. \$6. A reprint with a brief (2 1/3 pp.) introduction.

Organic Name Reactions. A contribution to the terminology of organic chemistry, biochemistry, and theoretical organic chemistry. Helmut Krauch and Werner Kunz. Translated from the second revised German edition by John M. Harkin. Wiley, New York, 1964. 644 pp. Illus. \$16.

The Origins and Growth of Physical Science. vols. 1 and 2. D. L. Hurd and J. J. Kipling, Eds. Penguin Books, Baltimore, Md., 1964 (reprint of the 1958 edition). vol. 1, 343 pp.; vol. 2, 427 pp. Illus. Paper, \$1.45 each.

Our Work in Space. Willy Ley. Macmillan, New York, 1964. 143 pp. Illus. \$3.95.

Physics-Electronics Titles, 1960. Bibliography and key-words index of titles of leading articles in about 200 journals. Boston Technical Publishers, Lexington, Mass., 1964. 463 pp. \$12.50.

Proceedings of the Royal Institution of Great Britain. S. K. Runcorn and others. Royal Institution, London, 1964. 118 pp. Illus. Paper, 10s. 6d. Nine papers: "How the continents drift" by S. K. Runcorn; "A baby's first breaths" by K. W. Cross; "Noise and hearing" by W. Burns; "The law of disorder" by George Porter; "Infectious heredity and man's future (Woodhull lecture)" by R. Dulbecco; "Minerals" by Sir Lawrence Bragg; "Control and behaviour in the honeybee colony" by C. G. Butler; "Hugh Miller: Geologist and man of letters" by James Lawrie, and "Writers and libraries: The dependence of the scientific writer on library facilities" by J. G. Crowther. Two Royal Institution Notes are included.

Pulp and Paper Research and Technology in the Middle East and North Africa. Proceedings, UNESCO/FAO regional symposium (Beirut, Lebanon), December 1962. Jan Smid, Ed. UNESCO Middle East Science Cooperation Office,

Cairo, Egypt, 1963. 489 pp. Illus. Paper. The purpose of the meeting was to consider the best existing production methods and to motivate research and training activities that would effect low-cost paper production in the Middle East and North Africa. The papers were divided into the sections: Country Statements (10 papers); The Use of Short-Fibred Raw Materials for Pulp and Paper (9 papers); Statements on Waste Paper, Rags, and Cotton Linters as Raw Materials for Paper Making (2 papers); Water Requirements and Pollution Problems (3 papers); Research Needs in Pulp and Paper (3 papers).

San Francisco Port Study. vol. 2, *Tests of Modified Cargo-Loading Methods and the Port as a System*. Natl. Acad. Sciences-Natl. Research Council, Washington, D.C., 1964. 127 pp. Illus. vols. 1 and 2, \$12. Volume 1 was published in the spring. Available only as a set.

The Savage Cell. A report on cancer and cancer research. Pat McGrady. Basic Books, New York, 1964. 448 pp. \$8.50.

Science. John H. Pomeroy. Holt, Rinehart, and Winston, New York, 1964. 336 pp. Illus. Paper, \$2.48.

The Science of Smell. R. H. Wright. Basic Books, New York, 1964. 176 pp. Illus. \$4.95.

Semiconductor Devices. James J. Brophy. McGraw-Hill, New York, 1964. 140 pp. Illus. Paper, \$2.95.

Star Names: Their Lore and Meaning. Richard Hinckley Allen. Dover, New York, 1964 (reprint of the 1899 edition). 577 pp. Paper, \$2.35.

Taiwan—ilha Formosa: A Geography in Perspective. Chiao-min Hsieh. Butterworth, Washington, D.C., 1964. 380 pp. Illus. \$11.50.

Waterfowl Tomorrow. Joseph P. Linduska, Ed. U.S. Department of the Interior, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 784 pp. Illus. \$4.

Ways of Thought of Great Mathematicians. An approach to the history of mathematics. Herbert Meschkowski. Translated from the German edition (Berlin, 1961) by John Dyer-Bennet. Holden-Day, San Francisco, Calif., 1964. 120 pp. Illus. Paper, \$3.95; cloth, \$5.95.

Wood Machining Processes. Peter Koch. Ronald, New York, 1964. 540 pp. Illus. \$15.

The World of Probability: Statistics in Science. Solomon Diamond. Basic Books, New York, 1964. 205 pp. Illus. \$4.95.

Worlds Without Ends. A reflection on planets, life, and time. N. J. Berrill. Macmillan, New York, 1964. 250 pp. \$5.95.

Mathematics, Physical Sciences, and Engineering

Advanced Plasma Theory. Course 25, International School of Physics "Enrico Fermi". M. N. Rosenbluth, Ed. Academic Press, New York, 1964. 280 pp. Illus. \$9.75. Eight papers: "Kinetic theory of plasma" by W. B. Thompson; "General stability theory in plasma physics" by Russel Kulsrud; "Gas discharge theory" by G. Ecker; "Topics in microinstabilities" by M. N. Rosenbluth; "Instabilities due to

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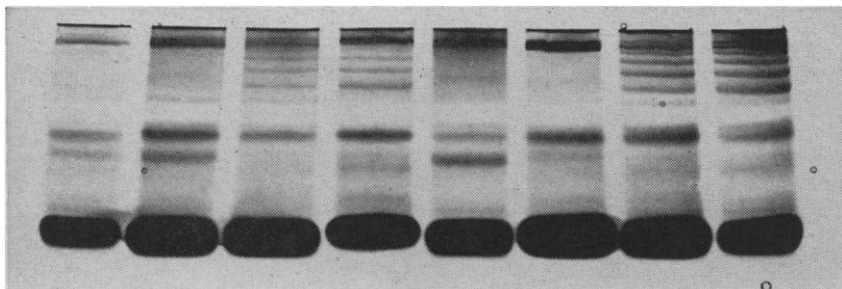
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Advances in Computers. vol. 5. Franz L. Alt and Morris Rubinoff, Eds. Academic Press, New York, 1964. 413 pp. Illus. \$14. Seven papers: "The role of computers in election night broadcasting" by Jack Moshman; "Some results of research on automatic programming in Eastern Europe" by Władysław Turski; "A discussion of artificial intelligence and self-organization" by Gordon Pask; "Automatic optical design" by Orestes N. Stravroudis; "Computing problems and methods in x-ray crystallography" by Charles L. Coulter; "Digital computers in nuclear reactor design" by Elizabeth Cuthill; and "An introduction to procedure-oriented languages" by Harry D. Huskey.

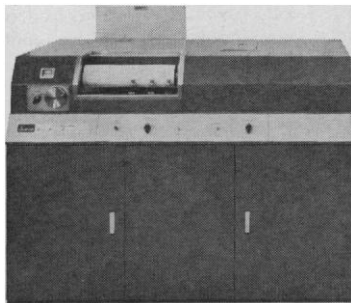
Advances in Mathematics. vol. 1, pt. 2, Herbert Busemann, Ed. Academic Press, New York, 1964. 164 pp. Illus. Paper, \$5.50. Three papers: "Die Theorie der geometrischen Ordnungen" by Hermann Küneth; "Lie groups in the foundations of geometry" by Hans Freudenthal; and "Some results on surface theory in the large" by A. V. Pogorelov.

Analysis of Essential Nuclear Reactor Materials. Clement J. Rodden, Ed. U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1964 (order from Superintendent of Documents, Washington, D.C.). 1294 pp. Illus. Paper, \$4.25. Fourteen chapters contributed by C. J. Rodden; Charles F. Metz and Glenn R. Waterbury; Robert Z. Bachman and Charles V. Banks; R. W. Bane; G. L. Booman and J. E. Rein; F. E. Clark; M. W. Lerner and J. Rynasiewicz; C. E. Anderson and D. G. Ebenhack; W. C. Judd, D. Dutina and C. J. Rodden; Harold R. Mullin and Clara Gale Goldbeck; A. E. Cameron and C. M. Stevens; S. A. Reynolds; W. N. Carson, Jr.; and C. G. Goldbeck.

Applied Mathematics for Engineers and Scientists. S. A. Schelkunoff. Van Nostrand, Princeton, N.J., ed. 2, 1965. 508 pp. Illus. \$9.50.

Auroral Phenomena: Experiments and Theory. First Lockheed Research Symposium on Space Science (Palo Alto, Calif.), January 1964. Martin Walt, Ed. Stanford Univ. Press, Stanford, Calif.; Oxford Univ. Press, London, 1965. 180 pp. Illus. \$6.50. Ten papers: "Morphology of auroral displays" by C. T. Elvey; "Television cinematography of auroras" by T. Neil Davis; "Optical measurements of auroras" by A. Vallance Jones; "Interaction of energetic charged particles with the atmosphere" by A. Dalgarno; "Balloon measurements of x-rays in the auroral zone" by Kinsey A. Anderson; "Precipitation of energetic particles into the atmosphere" by B. J. O'Brien; "Electromagnetic measurements of auroras" by R. L. Leadabrand; "Co-

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Boolean Algebras. Roman Sikorski. Academic Press, New York; Springer, Berlin, ed. 2, 1964. 247 pp. Illus. \$9.50.

Chemical Reactions in Shock Waves. Edward F. Greene and J. Peter Toennies. Academic Press, New York, 1964. 369 pp. Illus. \$11.

Cloud Structure and Distributions over the Tropical Pacific Ocean. Joanne S. Malkus and Herbert Riehl. Univ. of California Press, Berkeley, 1964. 239 pp. Illus. \$7.50.

Controlled Thermonuclear Reactions. L. A. Artsimovich. Translated from the Russian edition (Moscow, 1961) and edited by P. Kelly and A. Peiperl. A. C. Kolb and R. S. Pease, Translation Eds. Gordon and Breach, New York, 1964. 421 pp. Illus. \$19.50.

Cosmic Radiation and High Energy Interactions. V. D. Hopper. Logos Press, London; Prentice-Hall, Englewood Cliffs, N.J., 1965. 244 pp. Illus. \$12.95.

Design in Structural Steel. John E. Lothers. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1965. 599 pp. Illus. \$17.35.

Electrons and Chemical Bonding. Harry B. Gray. Benjamin, New York, 1964. 239 pp. Illus. Paper, \$3.95; cloth, \$8.

The Equilibrium Theory of Classical Fluids. Harry L. Frisch and Joel L. Lebowitz. Benjamin, New York, 1964. Unpaged. Illus. Paper, \$5.95; cloth, \$10.

First Course in Functional Analysis. Casper Goffman and George Pedrick. Prentice-Hall, Englewood Cliffs, N.J., 1965. 296 pp. Illus. \$16.

Fundamental Astrometry: Determination of Stellar Coordinates. V. V. Podobed. Translated from the Russian edition (Moscow, 1962) by Scripta Technica. A. N. Vyssotsky, Translation Ed. Univ. of Chicago Press, Chicago, 1965. 248 pp. Illus. \$7.50.

Gas-Chromatographie, 1963. A symposium (Leuna, East Germany), May 1963. Hans Georg Struppe and Hans-Peter Angelé, Eds. Akademie Verlag, Berlin, 1964. 384 pp. Illus. Paper, MDN. 44. Forty-six papers.

Generalized Functions. vol. 4, *Applications of Harmonic Analysis.* I. M. Gel'fand and N. Ya. Vilenkin. Translated from the Russian edition (Moscow, 1961) by Amiel Feinstein. Academic Press, New York, 1964. 398 pp. Illus. \$11.50.

Group Theory and Solid State Physics: A Selection of Papers. vol. 1. Paul H. Meijer, Ed. Gordon and Breach, New York, 1964. 303 pp. Illus. \$5.95. Papers by H. A. Bethe, L. P. Bouckaert, R. J. Elliott, C. Herring, H. A. Kramers, W. Opechowski, F. Seitz, R. Smoluchowski, B. A. Tavger, L. Tisza, F. C. Von Der Lage, E. Wigner, T. Yamanouchi, and V. M. Zaitsev.

Groups and Their Graphs. Israel Grossman and Wilhelm Magnus. Random House, New York, 1965. 203 pp. Illus. Paper, \$1.95.

Handbook of Vacuum Physics. vol 3, *Technology*; pt. 4, *Properties of Miscellaneous Materials.* J. R. Bailey. A. H. Beck, Ed. Pergamon, London; Macmillan, New York, 1964. 86 pp. Illus. Paper, \$3.

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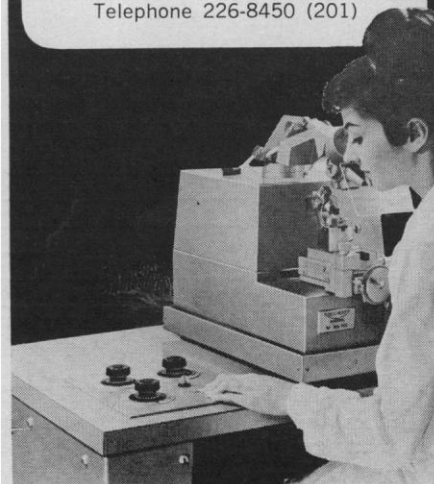
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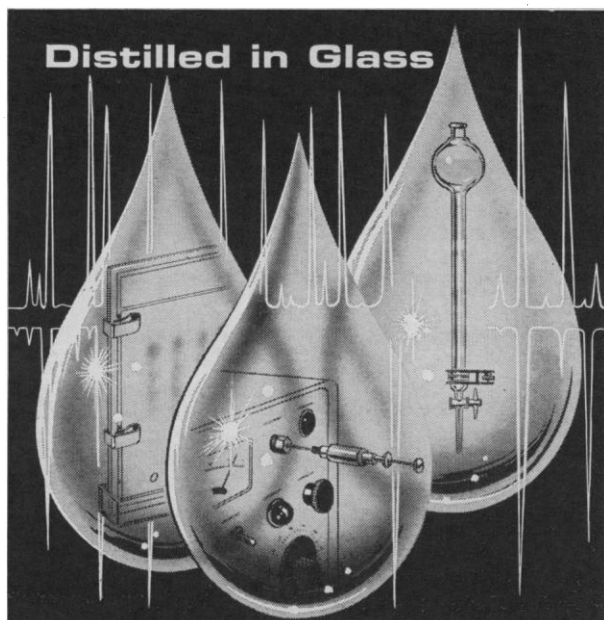
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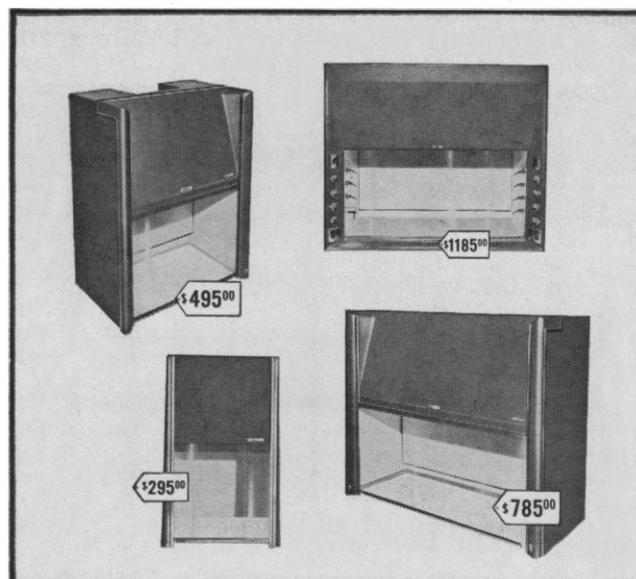
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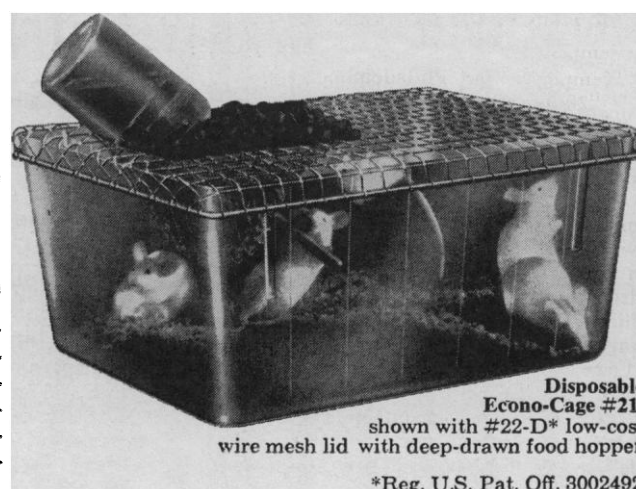
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Humidity and Moisture: Measurement and Control in Science and Industry. vol. 1, *Principles and Methods of Measuring Humidity in Gases.* Based on papers presented at the international symposium (Washington, D.C.), May 1963. Robert E. Ruskin, Ed. Reinhold, New York; Chapman and Hall, London, 1965. 703 pp. Illus. \$30. Sixty-eight papers, most of which were presented at the symposium sponsored by the National Bureau of Standards, the U.S. Weather Bureau, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the American Meteorological Society, and the Instrument Society of America.

Inorganic Complex Compounds. R. Kent Murmann. Reinhold, New York; Chapman and Hall, London, 1964. 128 pp. Illus. Paper, \$1.95.

Integral Equations: And Their Applications to Certain Problems in Mechanics, Mathematical Physics, and Technology. S. G. Mikhlin. Translated from the Russian edition (Moscow, 1959) by A. H. Armstrong. Pergamon, London; Macmillan, New York, ed. 2, 1964. 355 pp. Illus. \$12.50.

The Interaction of Radiation with Solids. Proceedings, International Summer School on Solid State Physics (Mol, Belgium), August 1963. R. Strumane, J. Nihoul, R. Gevers, and S. Amelinckx, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. 824 pp. Illus. \$25. Twenty-three papers by S. Amelinckx, T. H. Blewitt, B. N. Brockhouse, W. D. Compton, J. H. Crawford, Jr., J. Debrue, C. Erginsoy, J. Friedel, E. Germagnoli, R. Gevers, J. A. Goedkoop, S. Hautecler, D. K. Holmes, B. Jacrot, G. Leibfried, A. B. Lidiard, D. G. Martin, F. Motte, S. F. Pugh, Y. Quéré, F. Seitz, R. Smoluchowski, H. Stiller, M. W. Thompson, and M. S. Wechsler.

Introduction to General Relativity. Ronald Adler, Maurice Bazin, and Menahem Schiffer. McGraw-Hill, New York, 1965. 467 pp. Illus. \$12.50.

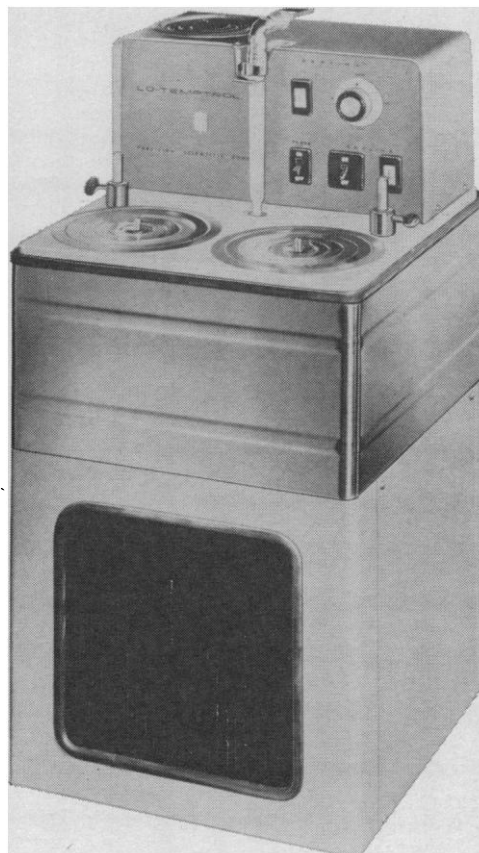
Mathematical Theory of Probability and Statistics. Richard von Mises. Edited and complemented by Hilda Geiringer. Academic Press, New York, 1964. 708 pp. Illus. \$22.

Mathematics for Radiographers. L. A. W. Kemp. Davis, Philadelphia, ed. 2, 1964. 220 pp. Illus. \$6.

Methods in Computational Physics. Advances in research and applications. vol. 3, *Fundamental Methods in Hydrodynamics.* Berni Alder, Sidney Fernbach, and Manuel Rotenberg, Eds. Academic Press, New York, 1964. 398 pp. Illus. \$13.50. Ten papers: "Two-dimensional Lagrangian hydrodynamic difference equations" by William D. Schulz; "Mixed Eulerian-Lagrangian method" by R. M. Frank and R. B. Lazarus; "The strip code and the jetting of gas between plates" by John G. Trulio; "Cel: A time-dependent, two-space-dimensional, coupled Eulerian-Lagrange code" by W. F. Noh; "The tensor code" by G. Maenchen and S. Sack; "Calculation of elastic-plastic flow" by Mark L. Wilkins; "Solution by characteristics of the equations of one-dimensional unsteady flow" by N. E. Hoskin; "The solution of two-dimensional hydrodynamic equations by the method of characteristics" by D. J.

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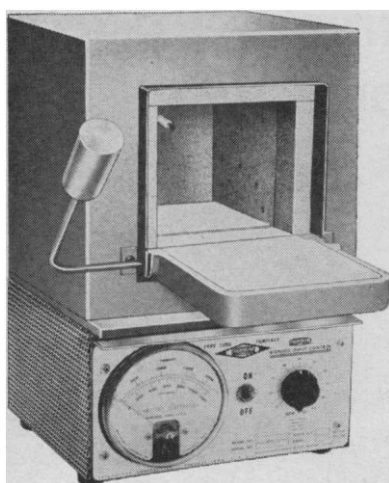


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Richardson; "The particle-in-cell computing method for fluid dynamics" by Francis H. Harlow; and "The time dependent flow of an incompressible viscous fluid" by Jacob Fromm.

The Physicochemical Principles of Igneous Petrology. A. N. Zavaritskii and V. S. Sobolev. Translated from the Russian edition (Moscow, 1961) by J. Kolodny and R. Amois. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 424 pp. Illus. \$14.

The Physics and Astronomy of Meteors, Comets, and Meteorites. Gerald S. Hawkins. McGraw-Hill, New York, 1964. 144 pp. Illus. Paper, \$2.50.

Physics: Fundamentals and Frontiers. Robert Stollberg and Faith Fitch Hill. Houghton, Mifflin, Boston, 1965. 704 pp. Illus. \$6.80.

Physikalische Chemie biogener Makromoleküle. A symposium (Jenaer), September 1963. Hermann Berg, Ed. Akademie Verlag, Berlin, 1964. 457 pp. Illus. DM. 47. Fifty-one papers.

Physiographic Diagram of the Indian Ocean: The Red Sea, the South China Sea, the Sulu Sea, and the Celebes Sea. Bruce C. Heezen and Marie Tharp. Geol. Soc. of America, New York, 1964. \$2. A map prepared from soundings obtained and contributed by members of the International Indian Ocean Expedition.

Practical Handbook on Spectral Analysis. V. S. Burakov and A. A. Yankovskii. Translated from the Russian edition (Minsk, 1960) by R. Hardbottle. S. Tolansky, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 204 pp. Illus. \$12.

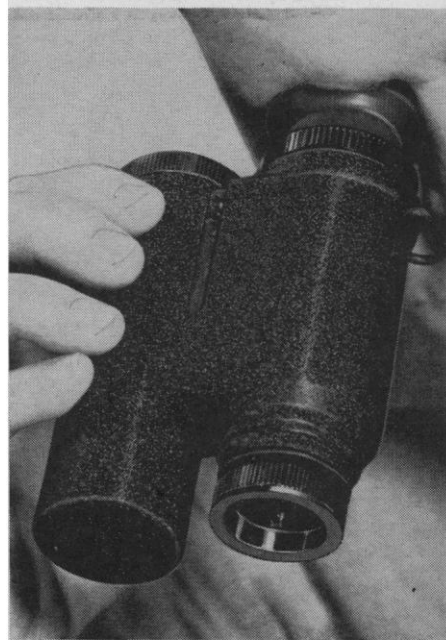
Principes de Chimie Organique. T. A. Geissman. Dunod, Paris, 1965. 859 pp. Illus. F. 68. A translation of *Principles of Organic Chemistry*, ed. 2, 1962 (Freeman, San Francisco).

Principles and Methods of Chemical Analysis. Harold F. Walton. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1964. 502 pp. Illus. \$10.95.

Progress in Infrared Spectroscopy. vol. 2. Based on lectures from the 6th and 7th Annual Infrared Spectroscopy Institutes (Buffalo, N.Y.), 1962 and 1963. Herman A. Szymanski, Ed. Plenum Press, New York, 1964. 304 pp. Illus. \$12.50. Nine papers: "Polarized infrared spectroscopy" by C. L. Angell; "Infrared spectra of crystals" by Shashanka S. Mitra and Peter J. Gielisse; "Infrared correlations for organophosphorus compounds" by John R. Ferraro; "Organometallic spectra of silicon, germanium, tin, and lead" by Francis J. Bajer; "Arsenic trichloride as a solvent for infrared spectroscopy" by Herman A. Szymanski, Robert Ripley, Robert Fiel, William Kinlin, Leon Zwolinski, Henry Drew, Denis Bakalik, Jorge Muller, Albert Bluemle, and William Collins; "Infrared spectroscopy of biological materials" by Leopold May; "Near-infrared spectroscopy: Theory, instrumentation, and applications" by James D. McCallum; "Progress in ultraviolet and visible spectrometry" by Robert G. White; and "Irrelevant absorption in quantitative ultraviolet spectrometry" by Robert G. White.

Progress in Inorganic Chemistry. vol. 6. F. Albert Cotton, Ed. Interscience (Wiley), New York, 1964. 356 pp. Illus. \$14. Four

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papers: "Reaction by metal halides with ammonia and aliphatic amines" by G. W. A. Fowles; "The magnetic properties of transition metal complexes" by B. N. Figgis and J. Lewis; "Reactions of the noble gases" by John H. Holloway, and "The coordination model for non-aqueous solvent behavior" by R. S. Drago and K. F. Purcell.

Pteridine Chemistry. Proceedings, 3rd International Symposium (Stuttgart, Germany), September 1962. Wolfgang Pfeiderer and Edward C. Taylor, Eds. Pergamon, London; Macmillan, New York, 1964. 555 pp. Illus. \$15. Thirty-six papers.

Quasi-Optics. Proceedings of a symposium (New York), June 1964. Jerome Fox, Ed. Polytechnic Press, Brooklyn, N.Y.; Interscience (Wiley), New York, 1964. 662 pp. Illus. \$12. Thirty-one papers.

Radar System Analysis. David K. Barton. Prentice-Hall, Englewood Cliffs, N.J., 1964. 624 pp. Illus. \$16.95.

Radiation Sources. A. Charlesby, Ed. Pergamon, London; Macmillan, New York, 1964. 276 pp. Illus. \$12. Eight papers: "Nuclear reactors as sources of radiation" by C. P. Bopp and W. W. Parkinson, Jr.; "Isotopic sources of radiation power" by O. A. Kuhl and D. S. Ballantine; "Van de Graaff accelerators for radiation research and applications" by E. A. Burrill; "Cylindrical electro-static generators" by N. J. Felici; "Resonant-transformer electron-beam generators" by W. F. Westendorp; "The linear accelerator as a power source for irradiation processing" by C. W. Miller; "Radiation protection aspects of the design and operation of irradiation facilities" by G. Saxon; and "Neutron flux and energy measurements" by L. G. Penhale and D. E. Vaughan.

Refractory Transition Metal Compounds: High Temperature Cermets. G. V. Samsonov and others. Translated by Scripta Technica. G. E. Gurr and D. J. Parker, Translation Eds. Academic Press, New York, 1964. 228 pp. Illus. \$9. Nineteen papers.

Reliability of Shell Buckling Predictions. William A. Little. M.I.T. Press, Cambridge, Mass., 1964. 188 pp. Illus. \$10.

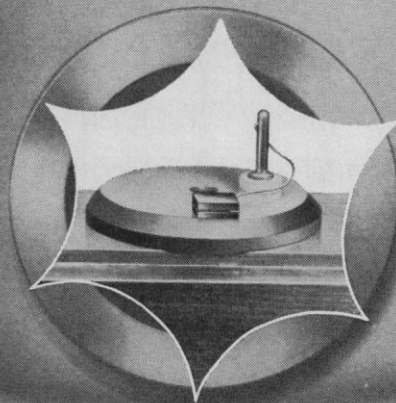
The Royal Society International Geophysical Year Antarctic Expedition. Halley Bay. Coats Land, Falkland Islands Dependencies, 1955-59. vol. 4, *Meteorology, Glaciology, Appendixes*. Sir David Brunt, Ed. Royal Soc., London, 1964. Illus. \$23.

Seismic Waves: Radiation, Transmission, and Attenuation. J. E. White. McGraw-Hill, New York, 1965. 318 pp. Illus. \$14.50.

Similarity Analyses of Boundary Value Problems in Engineering. Arthur G. Hansen. Prentice-Hall, Englewood Cliffs, N.J., 1964. 128 pp. Illus. \$6.75.

Single-Crystal Films. Proceedings of an international conference (Blue Bell, Pa.), May 1963. Maurice H. Francombe and Hiroshi Sato, Eds. Pergamon, London; Macmillan, New York, 1964. 430 pp. Illus. \$14.50. The conference which was sponsored jointly by the Office of Naval Research, Princeton University, University of Pennsylvania, and the Philco Corporation, stressed studies on films that are in an optimum state of structural perfection. The 28 papers are presented in three

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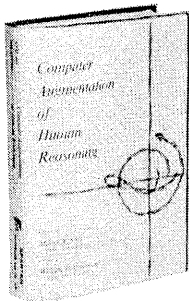
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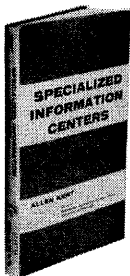
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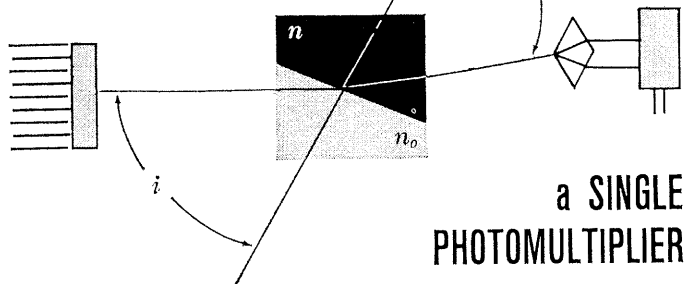


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Soil Clay Mineralogy. A symposium (Blacksburg, Va.), July 1962. C. I. Rich and G. W. Kunze, Eds. Univ. of North Carolina Press, Chapel Hill, 1964. 346 pp. Illus. \$8. Ten papers: "Processes of origin and alteration of clay minerals" by W. D. Keller; "Structure and mineral analysis of soils" by Roy Brewer; "X-ray diffraction analysis of soil clays and structures of clay minerals" by W. F. Bradley; "The application of electron microscopy in soil clay mineralogy" by Thomas F. Bates; "Laboratory techniques in the electron microscopy of clay minerals" by John L. Brown; "Infrared analysis of soil minerals" by R. J. P. Lyon; "The thermal investigation of soil clays" by R. C. Mackenzie; "Soil clay mineralogical analysis" by M. L. Jackson; "X-ray spectrographic analysis of soils" by A. H. Beavers and Robert L. Jones; and "Chemical analysis in the quantitative mineralogical examination of clays" by M. L. Jackson and R. C. Mackenzie.

Solid Circuits and Microminiaturization. Proceedings of a conference held in June 1963. G. W. A. Dummer, Ed. Pergamon, London; Macmillan, New York, 1964. 356 pp. Illus. \$8.50. Twenty-six papers contributed by J. S. Walker; C. P. Sandbank; J. T. Kendall; A. P. Bobenrieth; R. W. A. Scarr; B. L. H. Wilson; P. J. Bénéteau and S. Iannazzo; P. R. Thomas; E. F. Grube, D. Popplewell, and J. L. Storr-Best; T. E. Price; P. D. Forte; A. T. Lawton; J. A. Cayzer; M. W. Gribble; B. A. Boulter; R. S. Dunn; K. Gurnett and A. Bardsley; W. Holt; C. P. Sandbank; P. A. Einstein; W. C. Nixon; E. G. Sandifer; J. A. Chandler; E. E. Smith; D. H. Roberts; and J. W. Granville.

Solubilities of Inorganic and Organic Compounds. vol. 2, pt. 2, *Ternary and Multicomponent Systems*. H. Stephen and T. Stephen, Eds. Pergamon, London; Macmillan, New York, 1964. 1115 pp. \$35.

Soviet Researches on Luminescence. D. V. Skobel'tsyn, Ed. Translated from the Russian edition (Moscow, 1963). Consultants Bureau, New York, 1964. 156 pp. Illus. Paper, \$27. Transactions of the P. N. Lebedev Physics Institute, vol. 23.

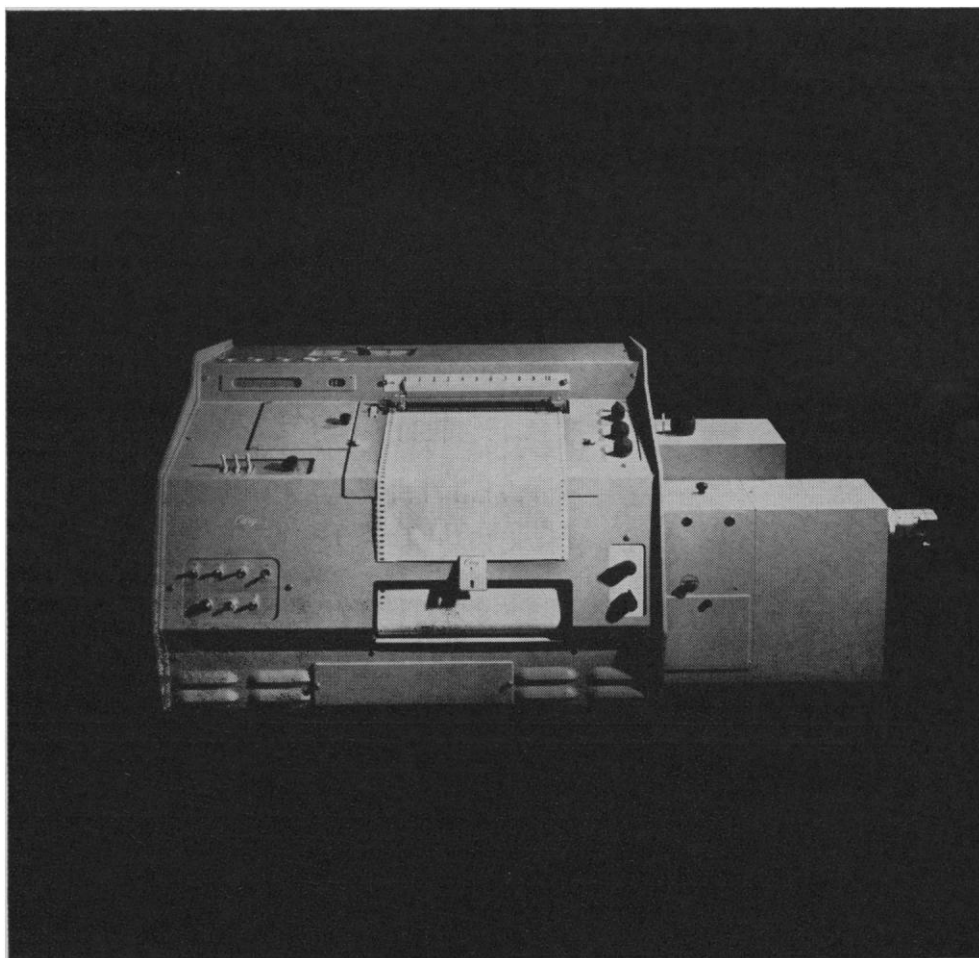
The Statistical Analysis of Experimental Data. John Mandel. Interscience (Wiley), New York, 1964. 422 pp. Illus. \$12.

Statistical Theory of Liquids. I. Z. Fisher. Translated from the Russian edition (Moscow, 1961) by Theodore M. Switz. Univ. of Chicago Press, Chicago, 1964. 347 pp. Illus. \$12.50.

Strength and Deformation in Nonuniform Temperature Fields. Ya. B. Fridman, Ed. Translated from the Russian edition (Moscow, 1962). Consultants Bureau, New York, 1964. 175 pp. Illus. Paper, \$25. Five papers: "Some of the laws governing mechanical and thermal strength" by Ya. B. Fridman; "Thermal stresses and their calculation" by E. M. Morozov and Ya. B. Fridman; "Thermal fatigue and thermal shock" by N. D. Sobolev and V. I. Egorov; "Fundamentals of creep calculations on nonuniformly heated parts" by B. F. Shorr; and "Thermal stability of plates and shells" by L. A. Shapovalov.

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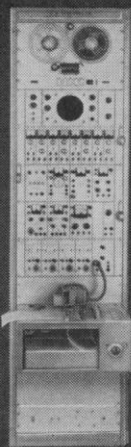
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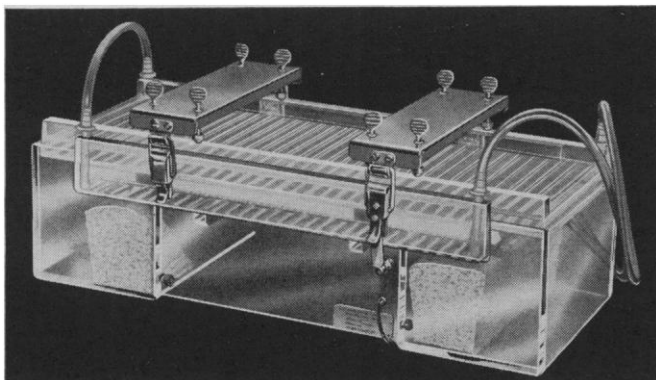


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