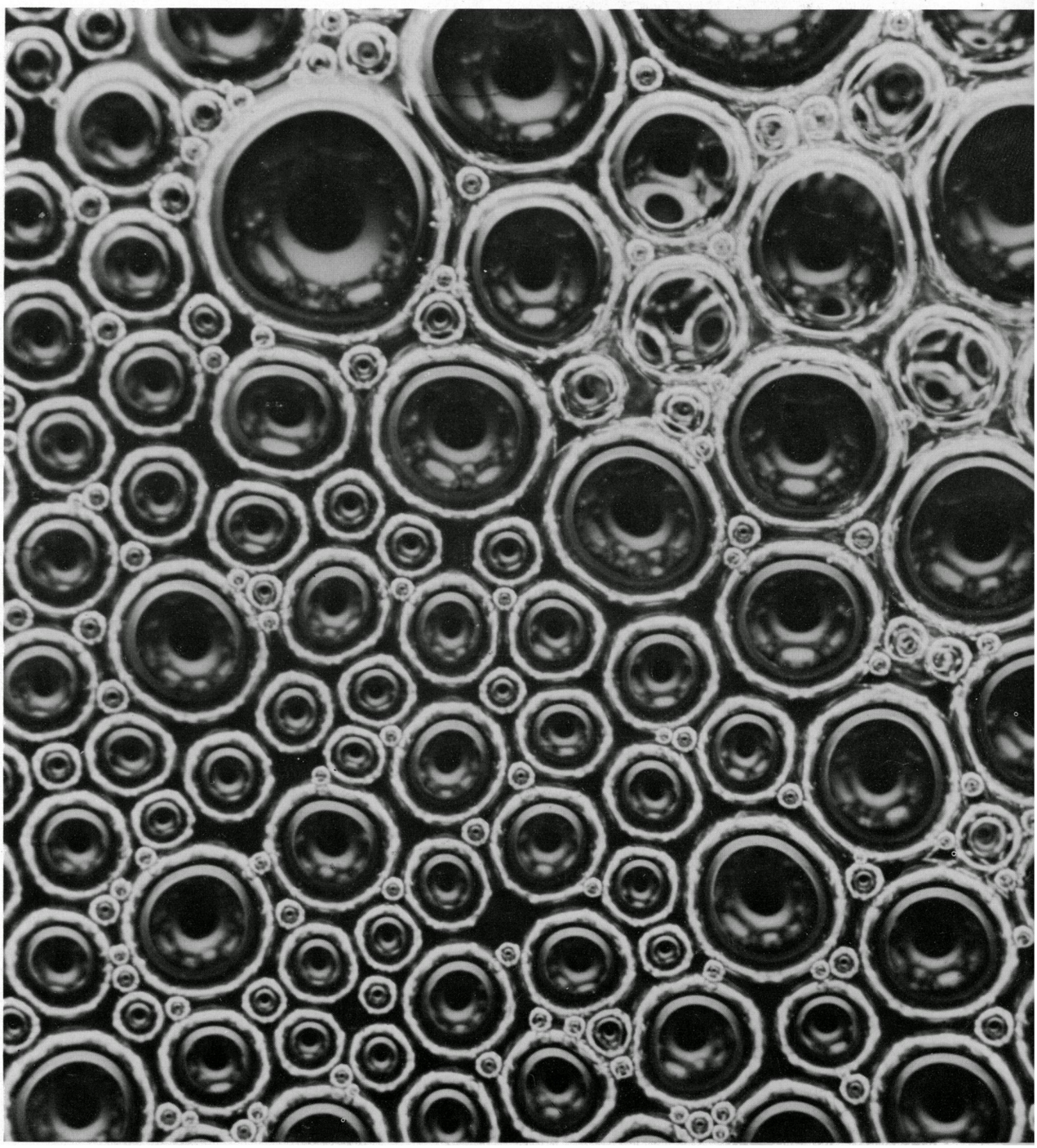
SCIENCE

10 November 1961

Vol. 134, No. 3489

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

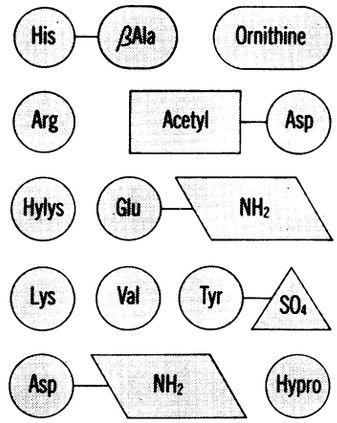


Amino acid analysis

... quantitative analysis in 24 hours for the twenty amino acids in protein hydrolyzates ... in 50 hours for the free amino acids and related compounds in physiological fluids.

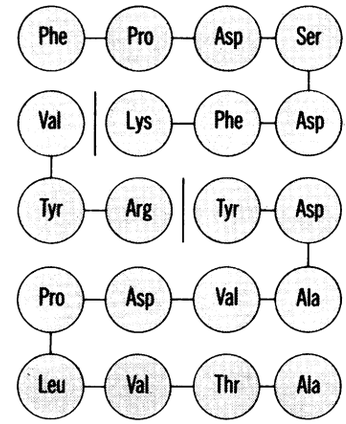
Amino acid isolation

... separation, collection, and identification of amino acids and related compounds in physiological fluids and tissue and plant extracts on both analytical and preparative scale.



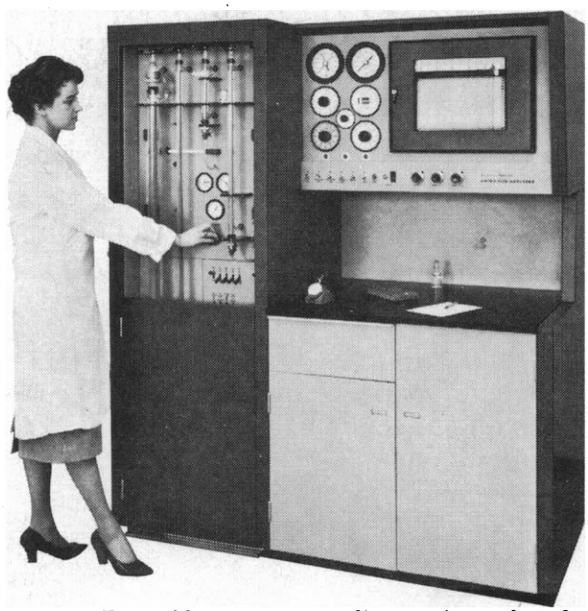
Peptide isolation

... separation, collection, and identification of peptides on both analytical and preparative scale.



MODEL 120 AMINO ACID ANALYZER DOES ALL THREE...

automatically!



To enable owners to realize maximum benefits from the Model 120, Spinco Division now offers regularly scheduled operator training sessions. These are comprehensive courses covering operation of the instrument, the chemistry involved and advanced techniques. We will be happy to send you the curriculum and schedule.

With the addition of new accessories, the 120 Analyzer has become an even more valuable time-saving tool for the biochemist. Large-bore columns allow preparative runs on mixtures of peptides or amino acids. A versatile new valving system and an accessory stream divider pump permit part of the column effluent to be analyzed colorimetrically, while diverting the main flow either to an external fraction collector, through a scintillation counter, or both.

Whether your work involves analyzing protein hydrolyzates, physiological fluids, tissue extracts, foods, culture media, or pharmaceuticals, this versatile instrument can take over much of the routine of repetitive peptide and amino acid analyses.

For latest information on the Model 120 Analyzer, and its new accessories, write Beckman Instruments, Inc., Spinco Division, Stanford Industrial Park, Palo Alto, California, and ask for Data File 120-5.

Beckman® / **Spinco Division**
Beckman Instruments, Inc.

S-76A

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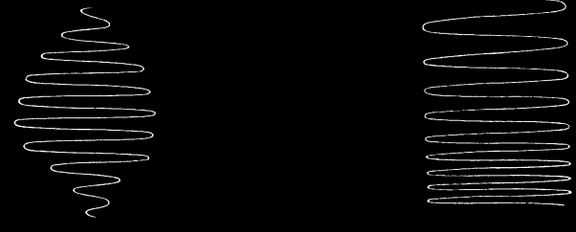
GME-LARDY WARBURG APPARATUS

The original circular model — proven reliability in many years of operation

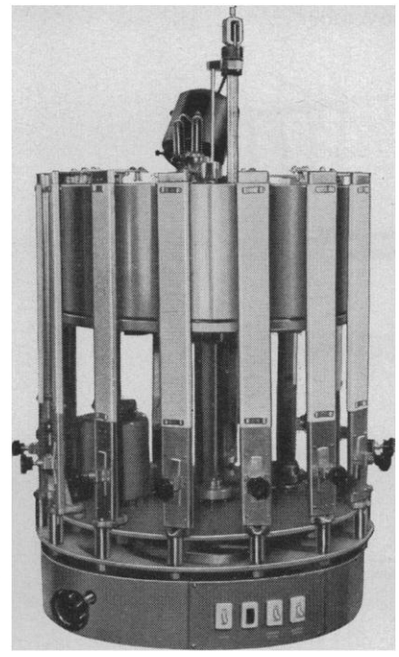
AMPLITUDE AND RATE CONTINUOUSLY VARIABLE



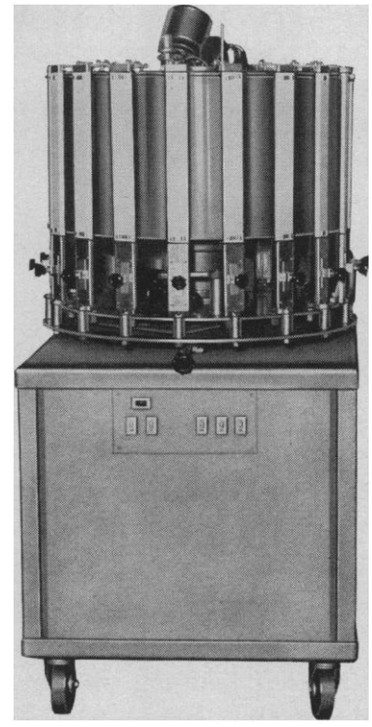
AMPLITUDE 0-5 cm

RATE 75-150 PER MINUTE

- **Quiet Operation**
- **Convenience** — Manometer holders rotate 180° for easy preparation on apparatus. Circular gassing manifold is available for placing on the center casting of apparatus; the manifold can rotate with the manometers as it receives its gas through the bearing. These two factors obviate the need for a separate manometer stand.
- **Accurate Temperature Control** — Provided by means of an electronic relay actuated by a hermetically sealed thermoregulator. Accuracy of control is better than ±.02° Centigrade.
- **Manometers easily read while flasks are in motion** — Pivotal shaking on an axis between the manometer arms provides maximum motion of the flask and minimum movement of the manometers.
- **Manometers stop individually** — Lifting the manometer holder disengages it from the drive pin and lowering re-engages it — both easily done while shaking is in progress.
- **Photosynthesis models available** — with a transparent bottom in the water bath. 30-watt lights provide 1000 to 1400 foot-candles on each lighted flask.



MODEL WB-4
Accommodates 14 manometers
20" diameter
Temperature range ambient to 50° C.
(Refrigerated model available)



MODEL RWB-3
Refrigerated model — Accommodates 18 manometers — 26" x 26"
Operates from 0° C. to 50° C.
(Non-refrigerated model available)

Apparatus accommodating 20 manometers available on special order. Send for complete glassware list.

GME GILSON
MEDICAL ELECTRONICS
Middleton, Wisconsin
On Madison's West Beltline Highway

10 November 1961, Volume 134, Number 3489 **SCIENCE**

The SARGENT Model XV
RECORDING POLAROGRAPH®

offers you—

- **FULL 10 INCH CHART**
- **1/10% ACCURACY OF MEASUREMENT**
- **TEN STANDARDIZED POLARIZING RANGES**

This new Sargent POLAROGRAPH gives you a large 250 mm (10 inches) chart and the highest accuracy and current sensitivity at the lowest price of any pen writing polarographic instrument on the market.

It offers you optimum specifications based on over twenty years of leadership in design, manufacture and service in this specialized field of analysis.

The polarographic method is capable of reproducibility to 1/10% and analytical accuracy to ½%. To make use of this facility, the instrument must be accurate to 1/10% and chart space must be provided for recording large steps to achieve measuring precision. We strongly advise against the purchase of any polarographic instrument using miniature (5 inch) charts and low gain balancing systems in the 1% order of precision.

This Model XV is adaptable to 10^{-6} M determinations with the S-29315 Micro Range Extender.

Current Ranges:	19, from .003 to 1.0 μA/mm.
Polarizing Ranges, volts:	0 to −1; −1 to −2; −2 to −3; −3 to −4; +.5 to −5; 0 to −2; −2 to −4, +1 to −1; 0 to −3; +1.5 to −1.5.
Balancing Speed:	standard, 10 seconds; 1 second or 4 seconds optional.
Bridge Drive:	synchronous, continuous repeating, reversible; rotation time, 10 minutes.
Chart Scale:	current axis, 250 mm; voltage axis, 10 inches equals one bridge revolution.
Current Accuracy:	1/10%
Voltage Accuracy:	¼%
Chart Drive:	synchronous, 1 inch per minute standard; other speeds optional.
Writing Plate:	10½ x 12½ inches; angle of slope, 30°.
Standardization:	manual against internal cadmium sulfate standard cell for both current and voltage.
Damping:	RC, four stage.
Pen:	ball point; Leroy type optional.
Suppression:	zero displacement control, mercury cell powered, 6 times chart width, upscale or downscale.
Potentiometric Range:	2.5 millivolts, usable as general potentiometric recorder.
Finish:	case, enameled steel; panels, anodized aluminum; writing plate, polished stainless steel; knobs and dials, chromium plated and buffed.
Dimensions:	23 x 17 x 10.
Net Weight:	65 pounds.

Catalog number **S-29310** with accessories and supplies. . . . **$1585.00**

®Registered Trade Mark (Pat. No. 2,931,964)

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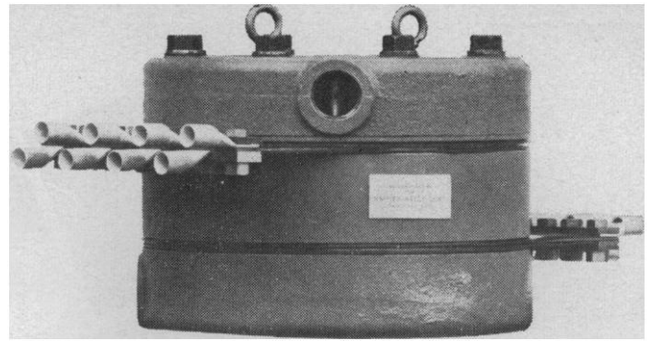
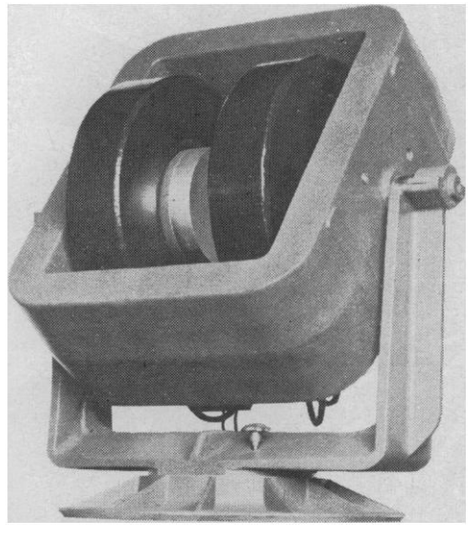
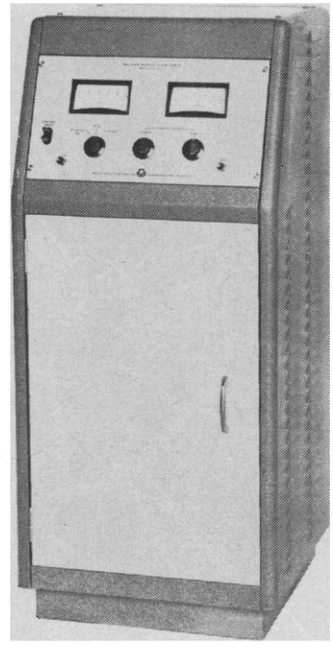


Model HF-26 2" Bore Solenoid Magnet

Model L-128 12" Electromagnet



Model HS-1050 Magnet Power Supply



magnets, power supplies, nmr* equipment

Model L-128 — 12" Diameter Electromagnet and HS — 1050 fully transistorized 5 KW Power Supply: Homogeneity $1x10^5$ readily available over 4 in^3 at 8 KG (cylindrical caps — 2" gap); maximum field this configuration in excess of 13 KG. Much higher fields available with tapered caps. Magnet features rugged cast frame, low impedance coils, rotation about two axes — Other Magnets available: 23" dia. — 7" dia. — 2½" dia. standard — plus custom special purpose. Power supplies of 250 KW, 50 KW, 20 KW, 5 KW, 2.5 KW — all solid state design.

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

nuclear magnetic resonance gaussmeters and field control systems

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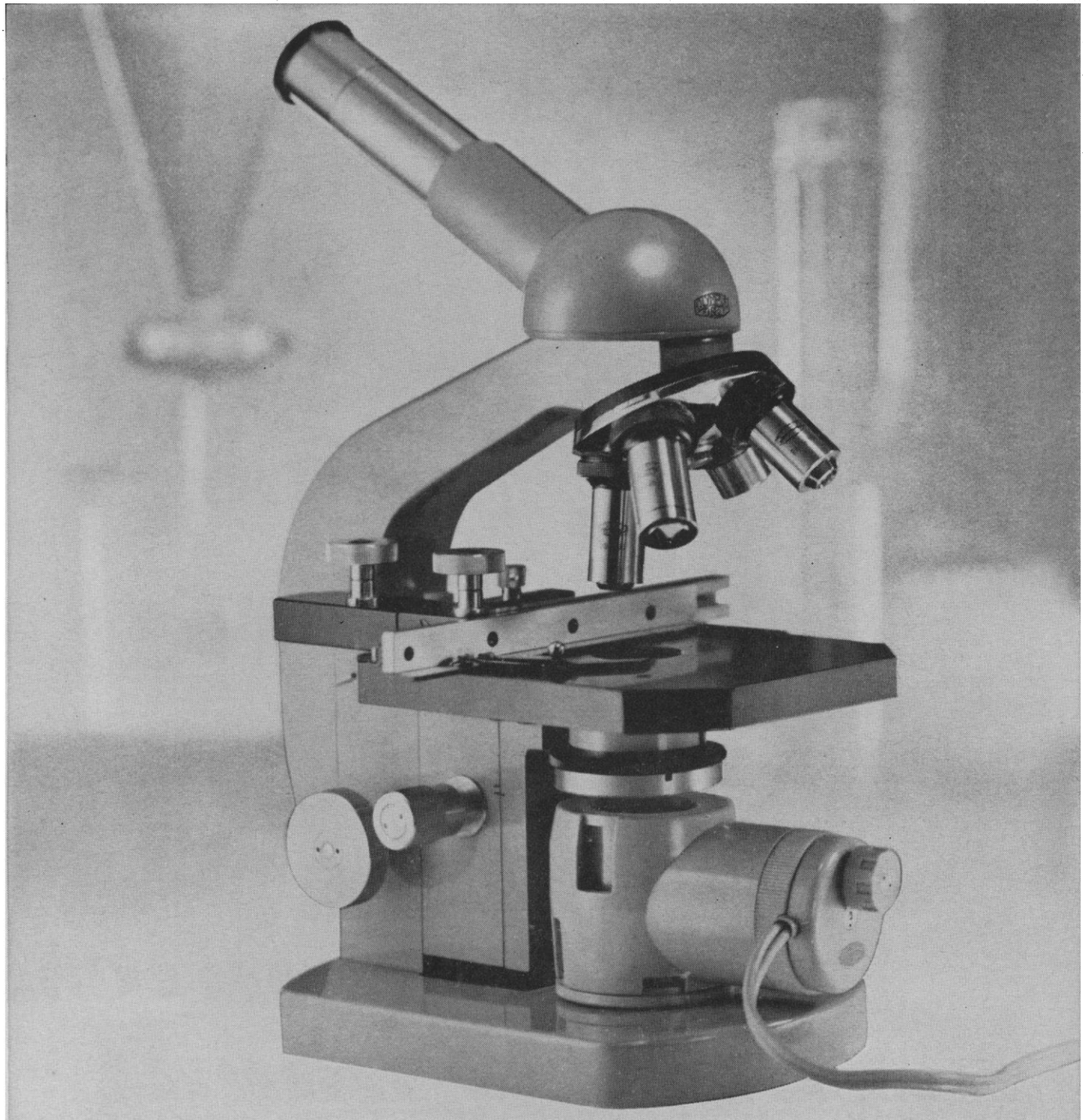


NOW...A DISTINGUISHED MEDICAL AND RESEARCH MICROSCOPE
ELGEET MODEL HM with all features for advanced microscopy
AT A VALUE-PACKED PRICE

The performance...the precision...the perfection you demand from quality optics...yours in this new system of modular-styled microscopes from America's newest scientific instrument leader. Write for Booklet HM561 for complete information on the Model HM series.

Model HM-4 with quadruple nosepiece including 4X, 10X, 40X and 100X (oil immersion) objectives. 10X eyepiece. $193.45.

Model HM-4S with accessory mechanical stage (as illustrated)...$218.45.

Elgeet OPTICAL CO., SCIENTIFIC INSTRUMENT DIV., 838 Smith St., Rochester 6, N.Y.

EL-77

MATHESON

Compressed Gas Notes

New, highly accurate

TRACE COMPONENT GAS MIXTURES

For use in

- PROCESS CONTROL
- INDUSTRIAL HYGIENE
- TOXICITY STUDIES

Air pollution studies require the determination of minute quantities of oxidized hydrocarbons, oxides of nitrogen, sulfur compounds, carbon monoxide and ozone which are thought to contribute to irritation and possible toxic effects emitted into the air from motor vehicle exhausts, plant effluent-gas streams and various stack-gases.

Matheson has pioneered in the development of highly accurate calibration mixtures for the standardization of Trace Analyzers used in Air Pollution Studies, Respiratory Studies, Chemical Process Systems and Exhaust Gas Composition Studies. Our Gas Mixing laboratory is especially well equipped to produce the ultra accurate mixtures required by the latest developments in Trace Analyzers.

Our Sales Engineering Department will be glad to provide information on your specific requirements.

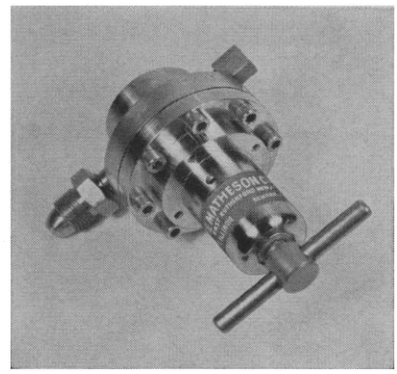
It is essential that the pressure regulator used in the above applications be capable of contamination-free transfer. We recommend the new Matheson Ultra Pure Transfer Regulator No. 18, which prevents contamination from outside air or water vapor.

New Ultra Pure Transfer Regulator No. 18

Our new No. 18 regulator was designed for use where gases of highest ultimate purity are required. In addition to Trace Component usage, it is recommended for the delivery of ultra pure gases used for crystal growing, transistor brazing, tube, switch and lamp filling, bright brazing and heat treating.

Although conventional automatic regulators **do not leak,** they will permit diffusion of atmospheric air and water vapor into the gas stream being regulated, which, under ordinary gas usage is of minor consequence. It will be of interest to read the stringent qualifications established for Matheson's No. 18 UPT.

Each regulator is tested before shipment by internal evacuation down to a vacuum of less then 0.3 micron of mercury. The regulator is then surrounded with helium and the inboard helium leakage rate is measured by a mass spectrometer. Every regulator is shipped with an affidavit stating the exact leakage rate. None is shipped if the helium inboard leakage rate is greater than 3×10^{-9} per second (about 1 cubic inch in 175 years). Most will have a helium inboard leakage rate of about 8×10^{-10} cc per second (about 1 cubic inch in 650 years).



Ultra Pure Transfer Regulator No. 18

All parts in the gas stream are 304 stainless steel (including the diaphragm), except the 303 stainless steel valve stem and the Kel-F seat. The regulator therefore can be used for delivering many corrosive gases.

Externally all parts are 304 stainless steel except the pressure-adjusting screw (nickel plated) and the pressure-adjusting spring (cadmium plated). The pressure-adjusting screw is insulated by a threaded nylon bushing from the stainless steel cap. Thus, the regulator can be used without damage in most corrosive gas atmospheres.

TYPE—Single stage

GASES—Any common gas and any corrosive gas compatible with stainless steel.

WEIGHT—6 pounds, 8 ounces.

OPERATING TEMPERATURE RANGE—minus 100 deg. F. to plus 225 deg. F.

Operating Pressure Range — This regulator can be used at inlet pressures up to 3000 psig. It has a delivery pressure range of 0-150 psig.

GAUGES—NONE. Normal leakage through a gauge connection will usually exceed the 3×10^{-9} cc per second allowed for the complete regulator.

Special Bulletin for Industrial Hygienists and Safety Engineers

Our new 8 page bulletin "Safe Handling of Compressed Gases in the Laboratory" is available without cost to Industrial Hygienists and Safety Engineers. Mail coupon for this and other literature.

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

- ☐ "Safe Handling of Compressed Gases in the Laboratory"
- ☐ UPT Regulator No. 18 Bulletin
- ☐ Matheson Gas Catalog
- ☐ Information on Matheson Gas Data Book, 3rd Edition

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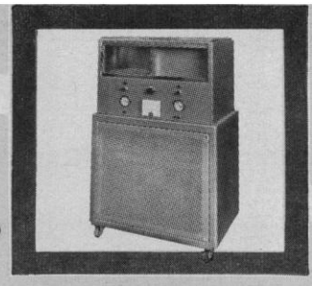
The Matheson Company, Inc.

Compressed Gases and Regulators — East Rutherford, N. J. — Joliet, Ill. — Newark, Calif.

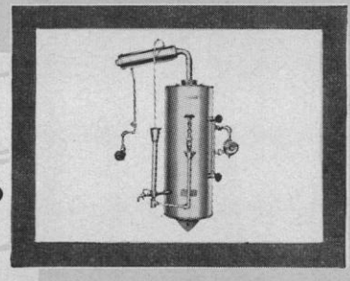
Matheson of Canada, Ltd. Whitby, Ont.

AMSCO Microbiological Equipment



FREEZE DRY EQUIPMENT

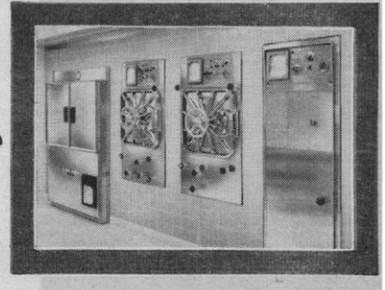
Models for laboratory, pilot plant and production. Used for the preservation and concentration of labile substances.



WATER STILLS and DEIONIZERS

STILL capacities from ½ to 500 gal./hr. Steam, Electric or Gas heat. Automatic or manual controls.

DEIONIZERS — Complete line ranging from 2 to 1000 gal./hr.

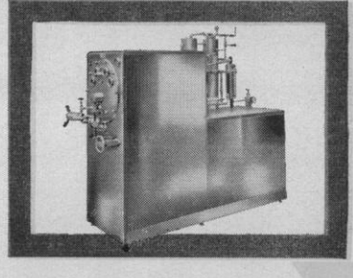


STERILIZERS

Pressure Steam, Ethylene Oxide and Combination Gas-Steam models. Chambers 16" x 16" x 24" to 60" x 66" x 120"

CONTINUOUS CULTURE APPARATUS

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

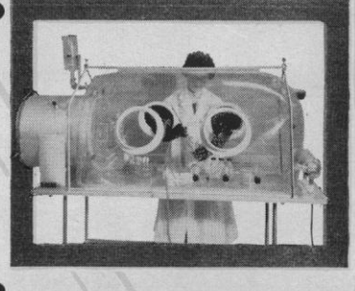


DRY BOXES

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

GERM-FREE LIFE APPARATUS

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



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

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

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

SCIENTIFIC AND INDUSTRIAL DEPARTMENT

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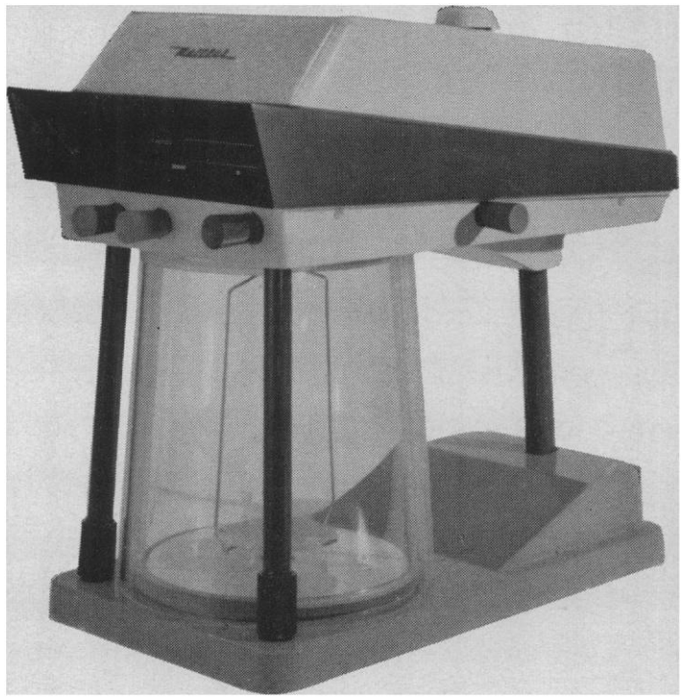
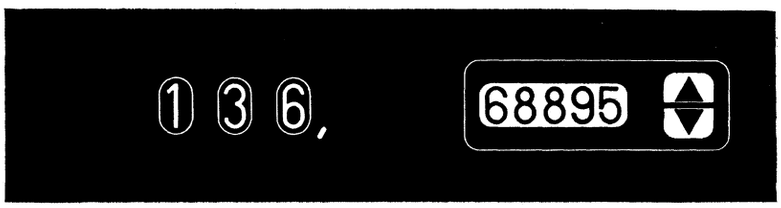
World's largest designer and manufacturer of Sterilizers, Operating Tables, Lights and related technical equipment for hospitals, industry and the biological sciences



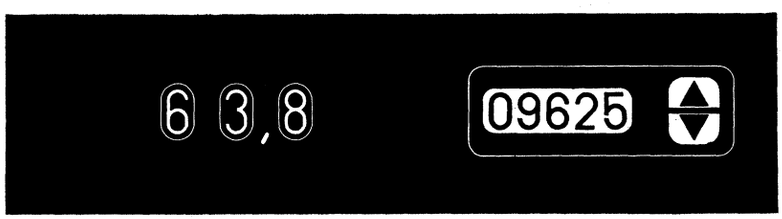
The new Mettler digital analytical balance type S

. . . with complete digital read-out . . .



actual size read-out

The macro-analytical balance, type S-5, capacity 160 grams, reads to 5 decimal places – the 5th place showing either as 0 or 5.



The semi-micro balance, type S-6, capacity 80 grams, reads to 6 decimal places – the 6th place showing either as 0 or 5.

The new Mettler balances, type S,
can be seen at the following trade shows:

Booth 89, Eastern Analytical Symposium and Instrument Exhibit, Statler Hilton Hotel, New York City.
November 15, 16 and 17

Booth 339, 28th Exposition of Chemical Industries,
Coliseum, New York City. November 27 through December 1

Write to us today for literature with detailed specifications.

Mettler

METTLER INSTRUMENT CORPORATION P. O. BOX 100, PRINCETON, NEW JERSEY

TO LIVE LONG, CHOOSE YOUR ANCESTORS WISELY . . . sums up nicely the influence of heredity on longevity. It is much the same with laboratory centrifuges. Take today's International PR-2 refrigerated centrifuge. It is the product of steady, part by part, point by point improvement over more years of centrifuge manufacturing than all other makers . . . 60 years to be exact. At the heart of the matter is the motor. We believe it to be the best. We build it in our own plant . . . by our own specialists . . . to our own custom design. This gives you that extra measure of assurance that when you buy the PR-2, you know it is right . . . for you . . . for the full long life of the equipment. For the complete story write:

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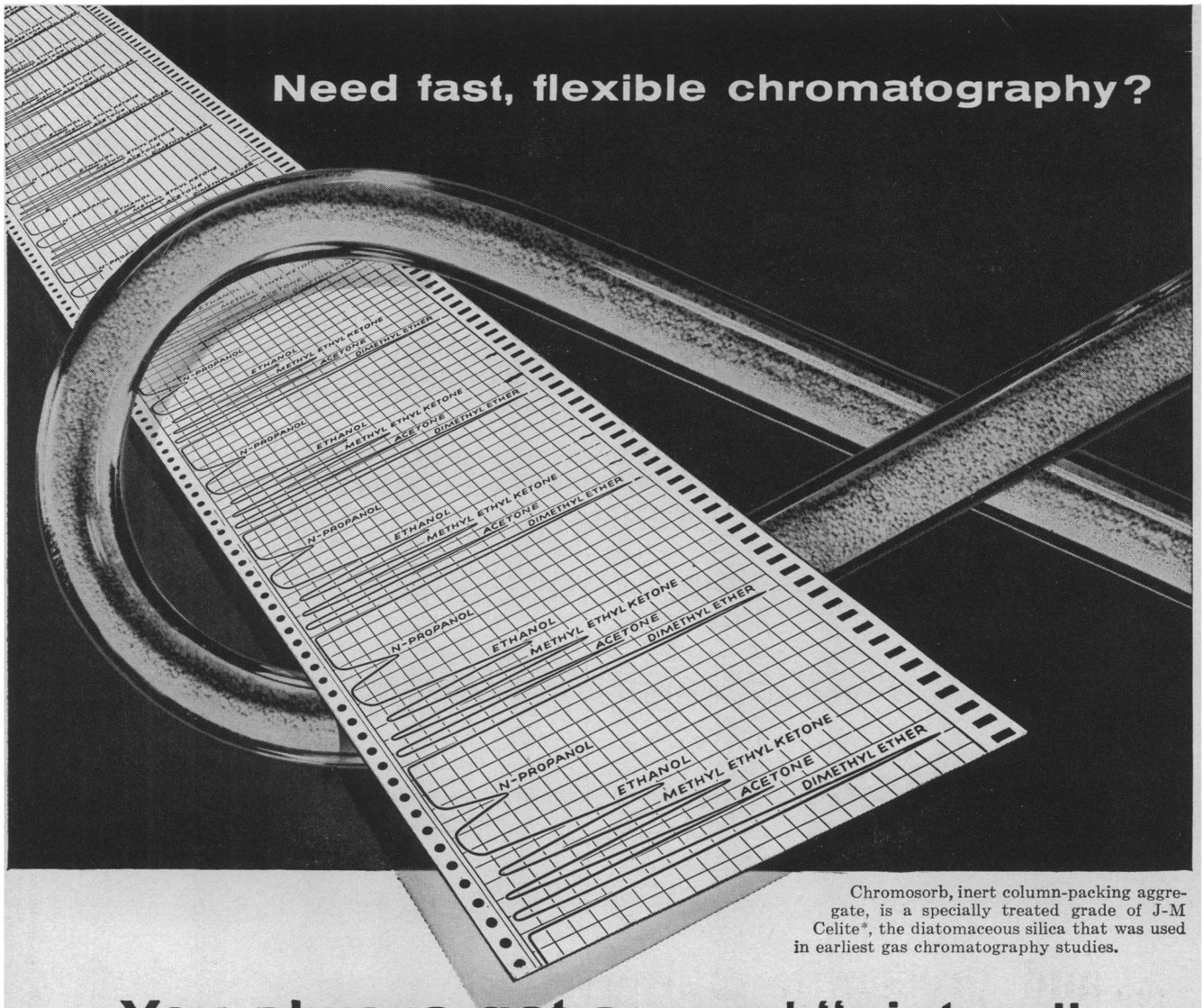


Chromosorb, inert column-packing aggregate, is a specially treated grade of J-M Celite*, the diatomaceous silica that was used in earliest gas chromatography studies.

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

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

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

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

For gas phase chromatography or where inertness is needed . . . Chromosorb

Typical Properties

Calcined diatomaceous earth aggregate.

Color	light pink
Free Fall Density—lbs./cu. ft. (avg.)	20-23
Specific Gravity—true	2.15
Water Absorption—cc./gr. (avg.)	2.4
Moisture—% by weight, maximum	1.0
pH (avg.)	6-7
Surface Area—sq. m./gm. (avg.)	3-5

For chromatographic studies . . . Chromosorb W

Typical Properties

Flux calcined diatomaceous earth aggregate.

Color	white
Free Fall Density—lbs./cu. ft. (avg.)	15-16
Specific Gravity—true	2.30
Water Absorption—cc./gr. (avg.)	4.0-5.0
Moisture—% by weight, maximum	1.0
pH (avg.)	8-10
Surface Area (BET Method)—sq. m./gr. (avg.)	3-4

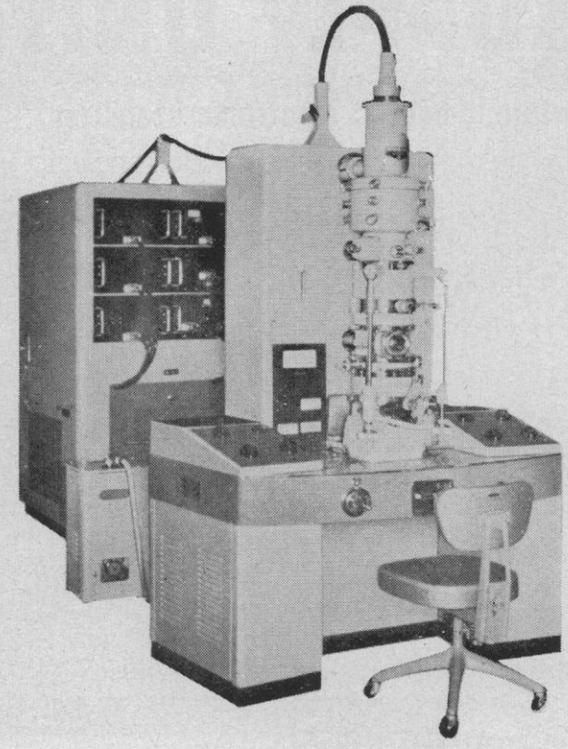
For fine filtration of liquids in laboratory application . . . Celite Analytical Filter Aid

Quality diatomite, calcined at high temperatures and acid-washed to remove organic and inorganic impurities. Filters out all types of precipitates, including the difficult-to-handle gelatinous and semi-colloidal materials, and produces brilliantly clear filtrates at high flow rates.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

HITACHI Electron Microscopes



featuring the new HU-11

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

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

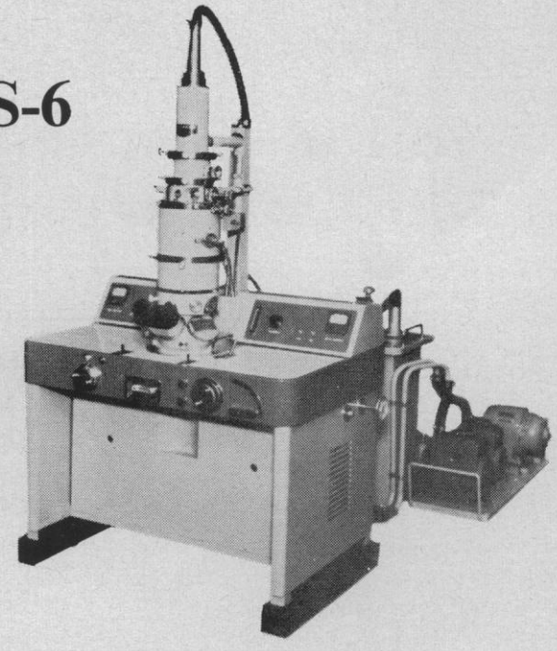
Other improvements include an enlarged specimen chamber facilitating handling of accessories, an exhaust system trap reducing contamination to a minimum (therefore eliminating the need to disassemble the column), increased exposure area of photography permitting recording of high resolution diffraction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

...and presenting the HS-6

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

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

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



Hitachi, Ltd.
Tokyo Japan
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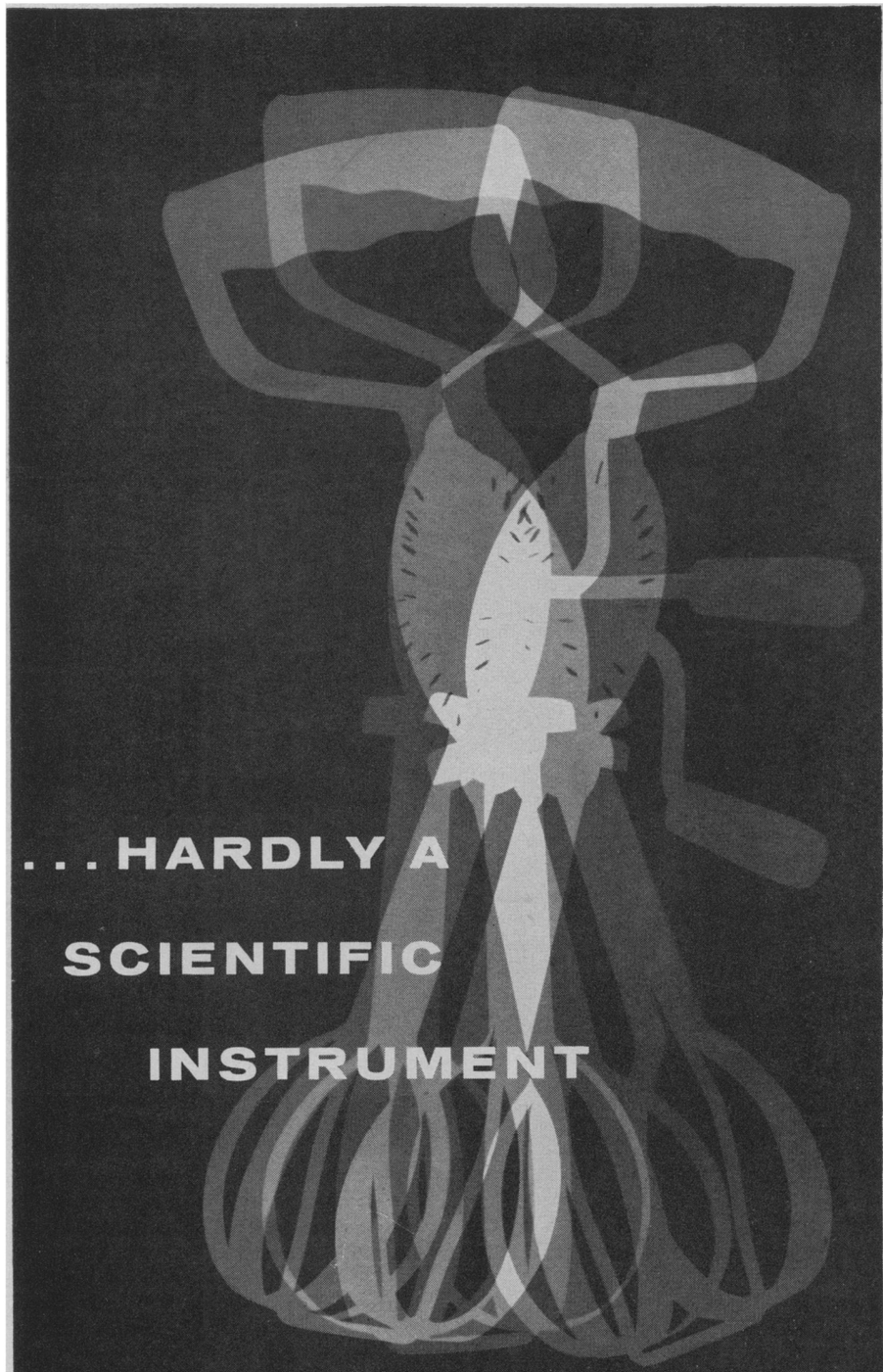

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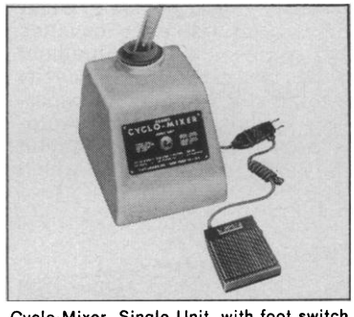

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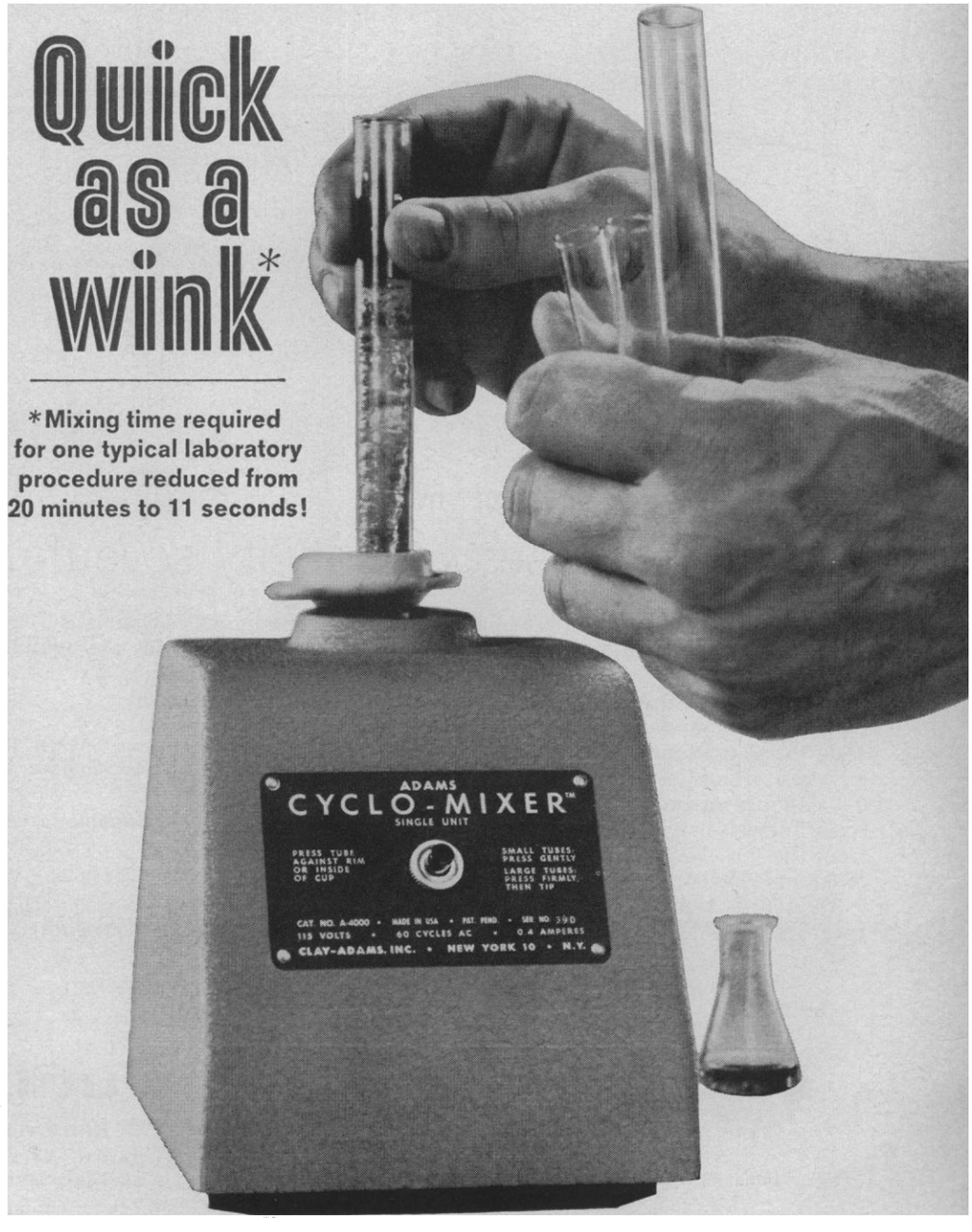

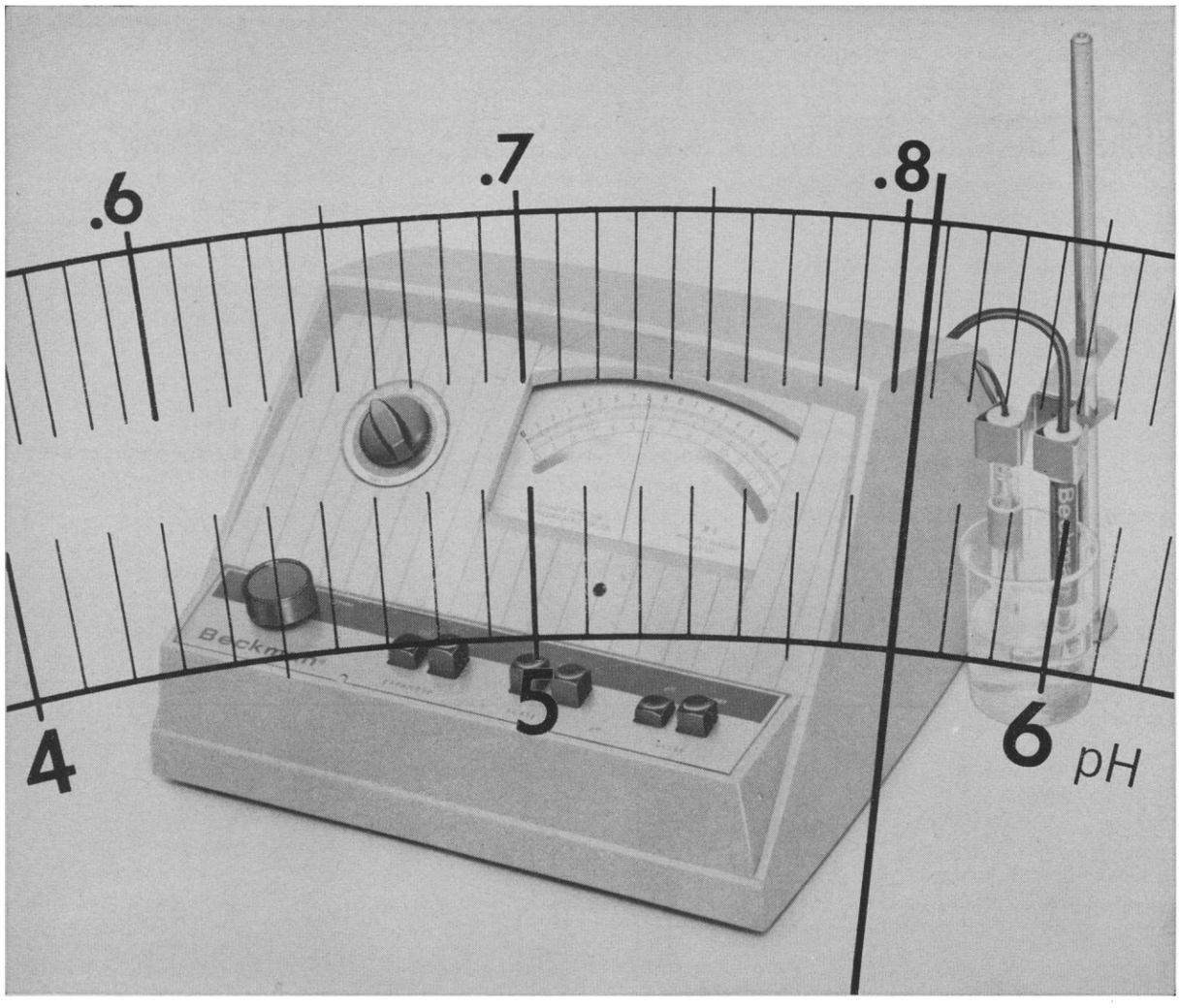

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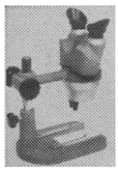

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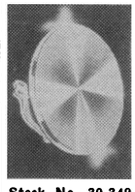

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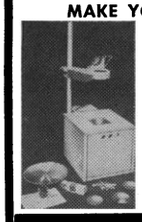

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Exact replica in relief with 30,000 formations for study—peaks, craters, the 2-million-square-mile Oceans of Storms, etc. Formations scaled to size. Distance relationships help to narrow margins—valuable teaching aid and outer-space display for museums and institutions. With proper rotation and lighting it shows Moon Phases, and with "black light" . . . spectacular effects! Made of tough, washable plastic in three colors, can be marked without damage. Reverse side blank to provide room for present and future space data. Wonderful gift for amateur astronomers—space enthusiasts. Exciting "conversation piece" for living room or den. Diam. 12". Wt. ¾ lbs. Priced remarkably low.

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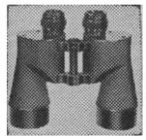

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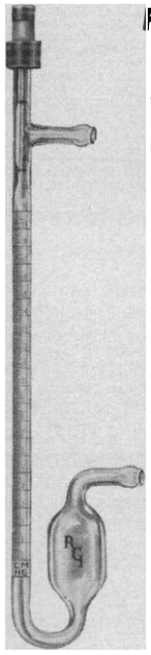


FOR LOW VACUUM MEASUREMENT
1-200 MM. HG.

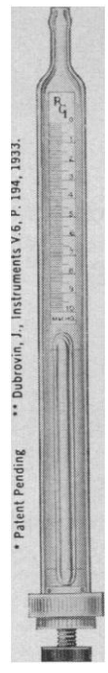
positive closed end MANOMETRIC GAGE*

*Patent Pending

- **High precision combined with direct reading**
- **Simplified construction permits easy assembly and cleaning**

1. High vacuum "O" rings seals to insure positive closure for either differential or absolute measurement.
2. Well type permits single direct reading on fully compensated scale in cm. of Hg at 0°C.
3. Permanent ceramic scale on heavy wall tubing for added strength.
4. White background for easy and accurate reading.
5. Open "U" tube construction assure easy cleaning.

G 1100 Gage Manometric range 0—20 cm., complete as illustrated **$19.50**



FOR MEDIUM VACUUM MEASUREMENT
0.1 — 10.0 MM. H.G.

absolute VACUUM GAGE*

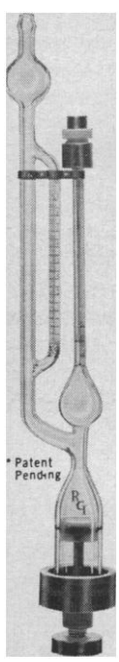
IMPROVED FLOAT** TYPE

- **For the intermediate vacuum range: 0 to 10mm. hg. in 0.1mm. divisions**
- **Direct and continuous reading**
- **New method for adjusting zero**

This vacuum gage was developed to cover the difficult intermediate vacuum range where the absolute manometer is too coarse and the McLeod gage too fine. The following important features have been incorporated:

1. Unique piston device for simple zero adjustment.
2. Specially selected thin wall glass tubing gives direct reading — **no factor needed.**
3. Approximately ten-fold magnification of 10mm. range to 100mm. scale.
4. Permanent ceramic scale with white background for easy reading.
5. Thin glass float protected on both ends with polyethylene guides.
6. Precision bore tubing and "O" ring seal assures high vacuum.

G1300 GAGE, VACUUM 0-10mm. hg in 0.1mm. divisions complete as shown without mercury **$24.50**



FOR HIGH VACUUM MEASUREMENT
.0001 — 1 MM. HG.

adjustable closed end McLEOD GAGE*

- **High precision single linear scale 0—100 mm**
- **Multiple ranges achieved with adjustable closed end** { **0—1 mm in .01 mm** / **0—0.1mm in .001 mm** / **0—.01 mm in .0001 mm** }
- **Closed end easily opened for cleaning**
- **Micrometer adjustment of meniscus**

1. High vacuum "O" ring seal and precision ground rod creates an adjustable closed end.
2. This permits multiple selection of range with a single linear scale.
3. High precision obtained with precision bore capillaries and permanent ceramic scale.
4. White background for easy accurate readings.
5. Removable precision ground rod allows for easy cleaning and removal of mercury separations.
6. Vacuum sealed plunger allows for compact simple adjustment of mercury meniscus.
7. Compactness and simplicity makes this instrument unique.

G 1400 Gage McLeod complete as described above without mercury **$45.00**

FOR FULL RANGE CONTROL
0 — 760 MM. HG.

VACUUM CONTROL*

* Patent Pending

CARTESIAN DIVER TYPE**

- **For the Control of Absolute Pressure (0-760 mm)**
- **New Simple Design for the Laboratory**
- **Micrometric Adjustment of Absolute Pressure by Unique Piston Device**

This new vacuum control for the Laboratory represents the ultimate in simplicity. Based on the cartesian diver principle, its design incorporates the following new features:

1. Stationery sealed-in orifice.
2. Precision bore tubing and "O" ring seal eliminates use of stopcocks.
3. Micrometric control is achieved in a glass model for the first time.
4. Elimination of troublesome central tube.
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7. Covers complete range of vacuum from 0 to 760 mm. hg. absolute pressure.

C-2100 VACUUM CONTROL, 0-760 mm. hg. range Complete as Shown Without Mercury **$22.50**

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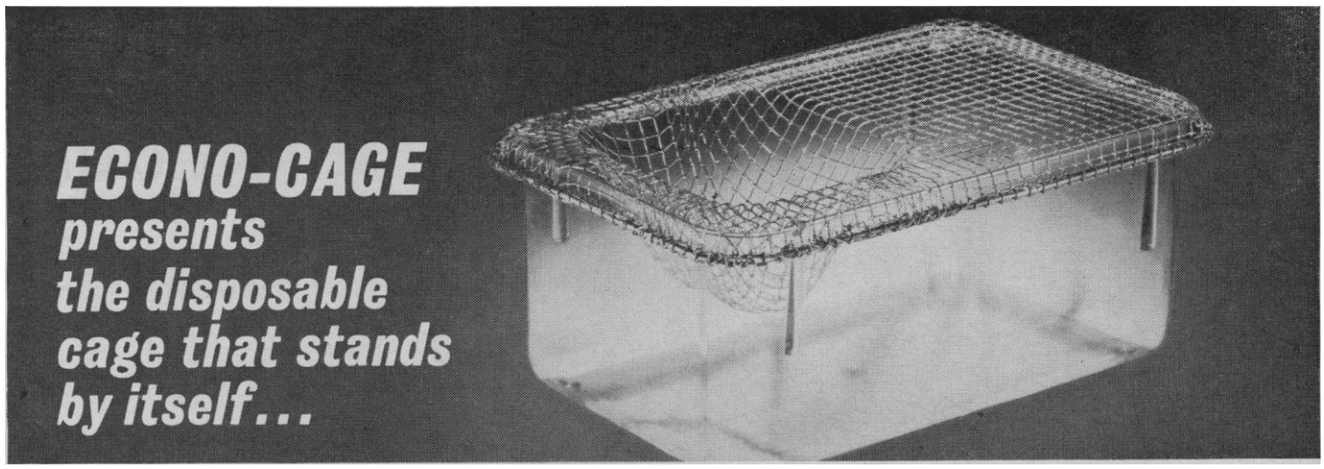
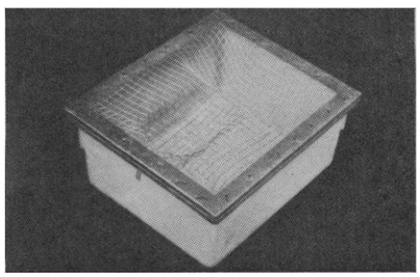


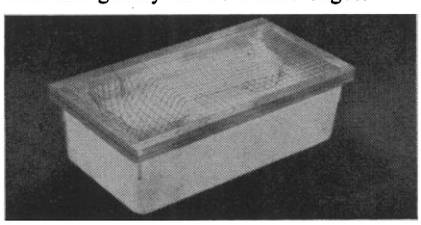
added to the line that stands by itself

The New Disposable Econo-Cage #21, Pictured Above, Brings To Animal Care A Rigid Plastic Disposable Cage That Spells Real Economy. It Stands By Itself Requiring No Expensive Supports That Prevent Full Visibility. Designed Primarily For Mice, The Cage Is 11½" X 7½" X 5" Deep. The Floor Area Of 84 Square Inches Will Adequately House Up To 12 Mice. All 20 Series Lids Fit The New Disposable Econo-Cage #21.



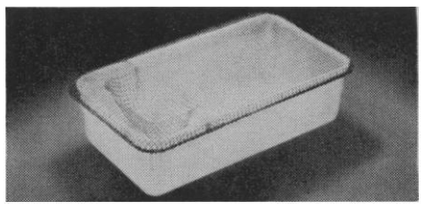
ECONO-CAGE #50 SERIES

The new 50 Series Econo-Cages and lids are designed for Hamsters or rats. Dimensions are 12⅞" X 14⅞" X 6⅝" deep with room for 11 adult Hamsters per cage. The cages are available in clear Acrylonitrile-Styrene Copolymer—Econo-Cage #53, Linear Polyethylene—Econo-Cage #54 and Polypropylene—Econo-Cage #55. All 50 Series lids fit interchangeably on 50 Series cages.



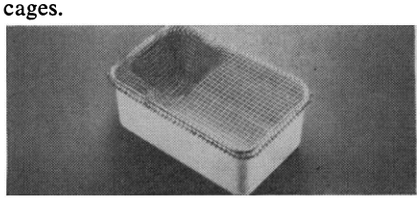
ECONO-CAGE #40 SERIES

Number 40 Series cages can be used interchangeably for Hamsters and/or rats. #43 is made of clear Acrilonitrile-Styrene-Copolymer, #44 of Linear Polyethylene and #45 of translucent Polypropylene. All 40 Series lids are standard ½" mesh designed for rat housing and fit interchangeably on all 40 Series cages. All 30 Series lids also fit all 40 Series cages but have the $\frac{5}{16}$" for mice.



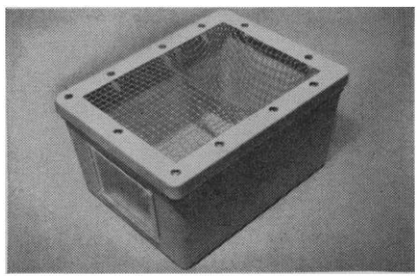
ECONO-CAGE #30 SERIES

Number 30 Series cages are designed as breeding and holding cages for mice. The over-all dimensions are 19" X 10½" X 5⅛" deep. Cage #32 is made of fiberglass, reinforced by plastic. Cage #33 is made of clear Acrylonitrile-Styrene Copolymer. Cage #34 is made of linear high density Polyethylene. Cage #35 is made of Polypropylene. All 30 Series lids are interchangeable on 30 Series cages.



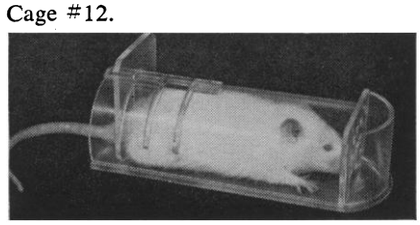
ECONO-CAGE #20 SERIES

Econo-Cages in the 20 Series are designed primarily for mice. Over-all dimensions of the cages are 11½" X 7½" X 5". This cage is used for housing animals during experimentation and also as a one-to-one and two-to-one breeding cage. The cages are available in Polystyrene – new disposable Econo-Cage #21, Fiberglass, reinforced plastic – Econo-Cage #22, clear Styrene-Acrylonitrile Copolymer – Econo-Cage #23, transculent Linear Polyethylene—Econo-Cage #24, autoclavable Polypropylene—Econo-Cage #25 and Polycarbonate Resin—Econo-Cage #27. All 20 Series lids are interchangeable on 20 Series cages.



GENERAL PURPOSE ECONO-CAGE #12

Over-all dimensions of the Econo-Cage general purpose unit are 11½" X 8" X 6" deep. This cage is designed especially for laboratories with changing animal use requirements. It can be used to house mice, Hamsters, rats and guinea pigs. Because of its versatility, it is ideal in teaching situations. The cage is available with or without windows. It is made of fiberglass reinforced polyester plastic. All #12 lids can be used on General Purpose Cage #12.



ECONO-RESTRAINING CAGES #90 SERIES

The small Restraining Cage #88 can be varied from 2" to 3½" in length and is 1¼" wide. Econo-Cage #90 can be varied from 4½" to 6" in length and is 2½" wide. Econo-Cage #91 can be varied from 5" to 7" in length and is 3" wide. All these units can be cleaned chemically or with hot water. They are not autoclavable.

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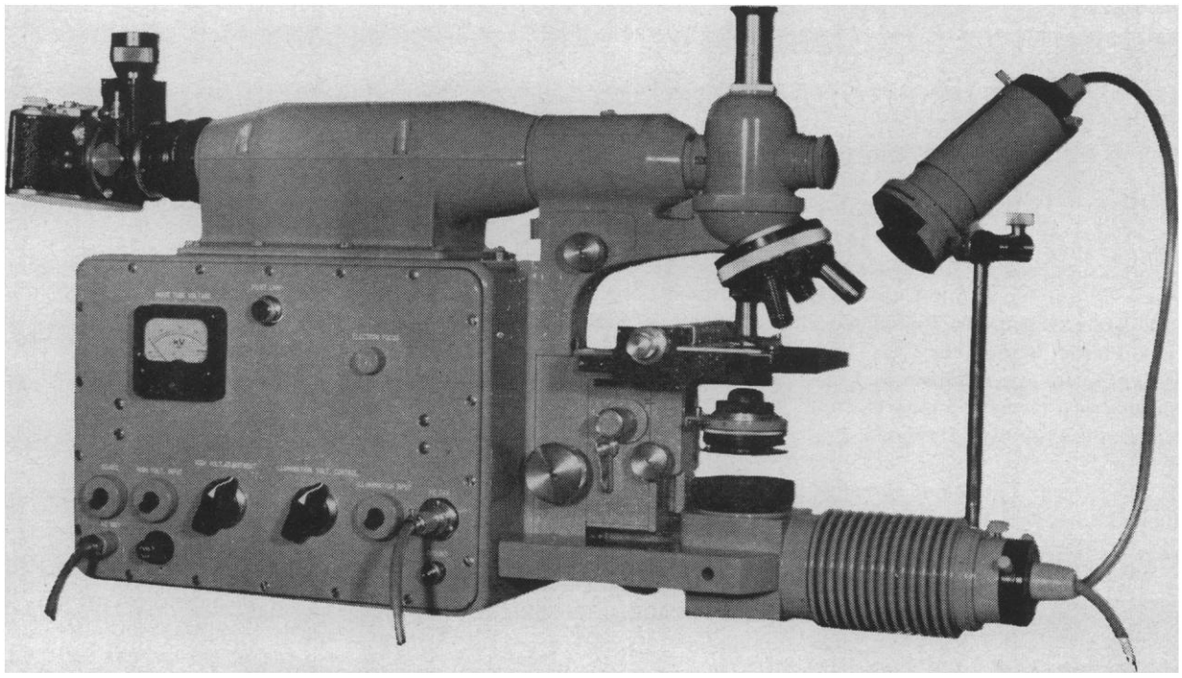

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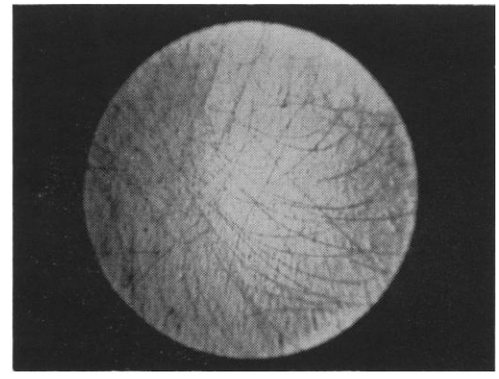
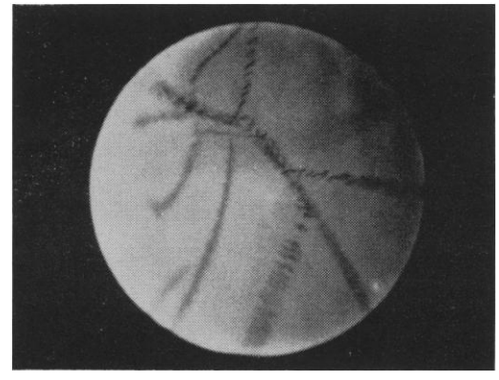


Silicon crystal at 11x



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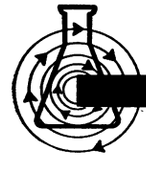

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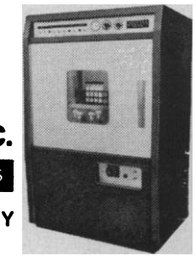

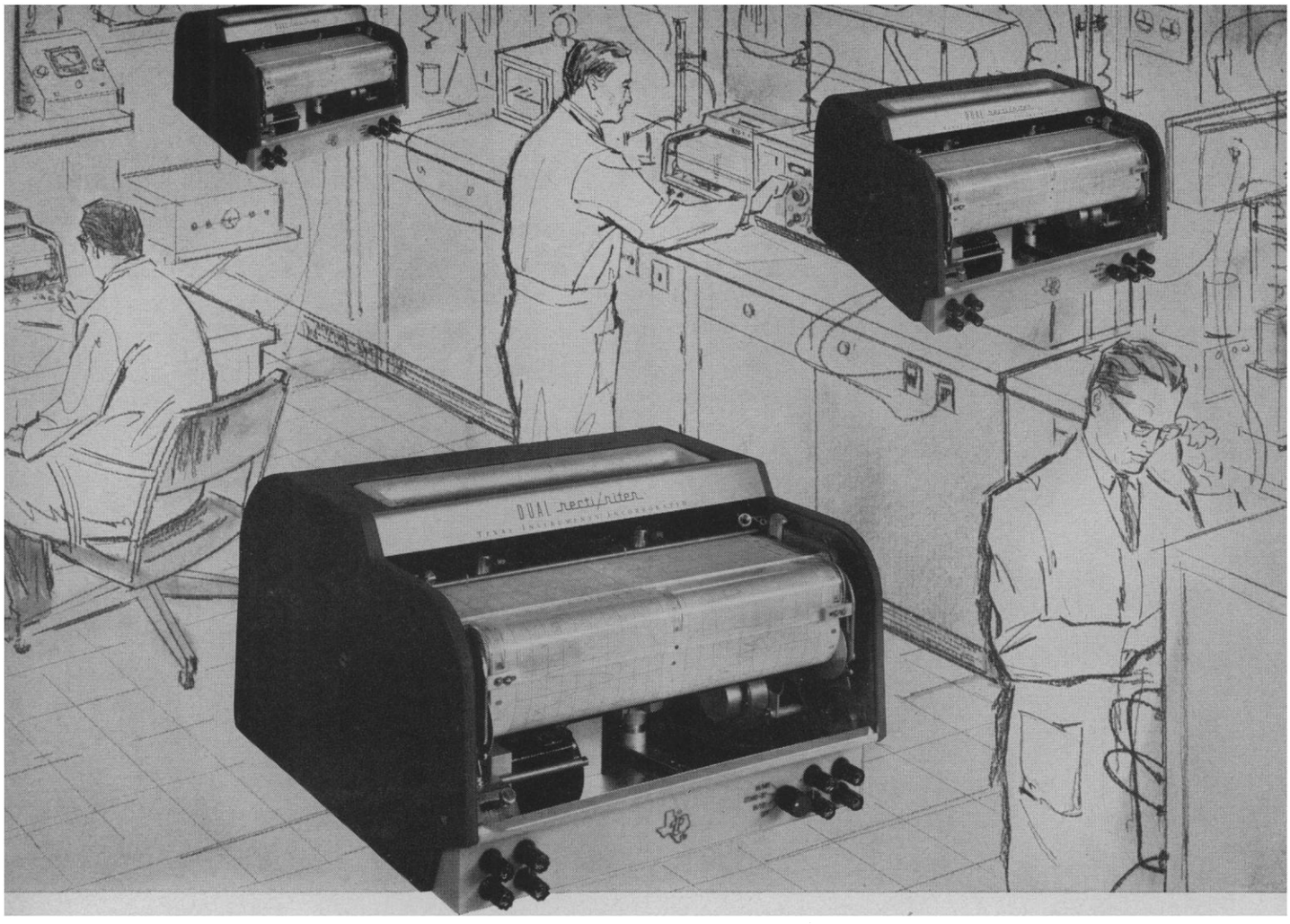

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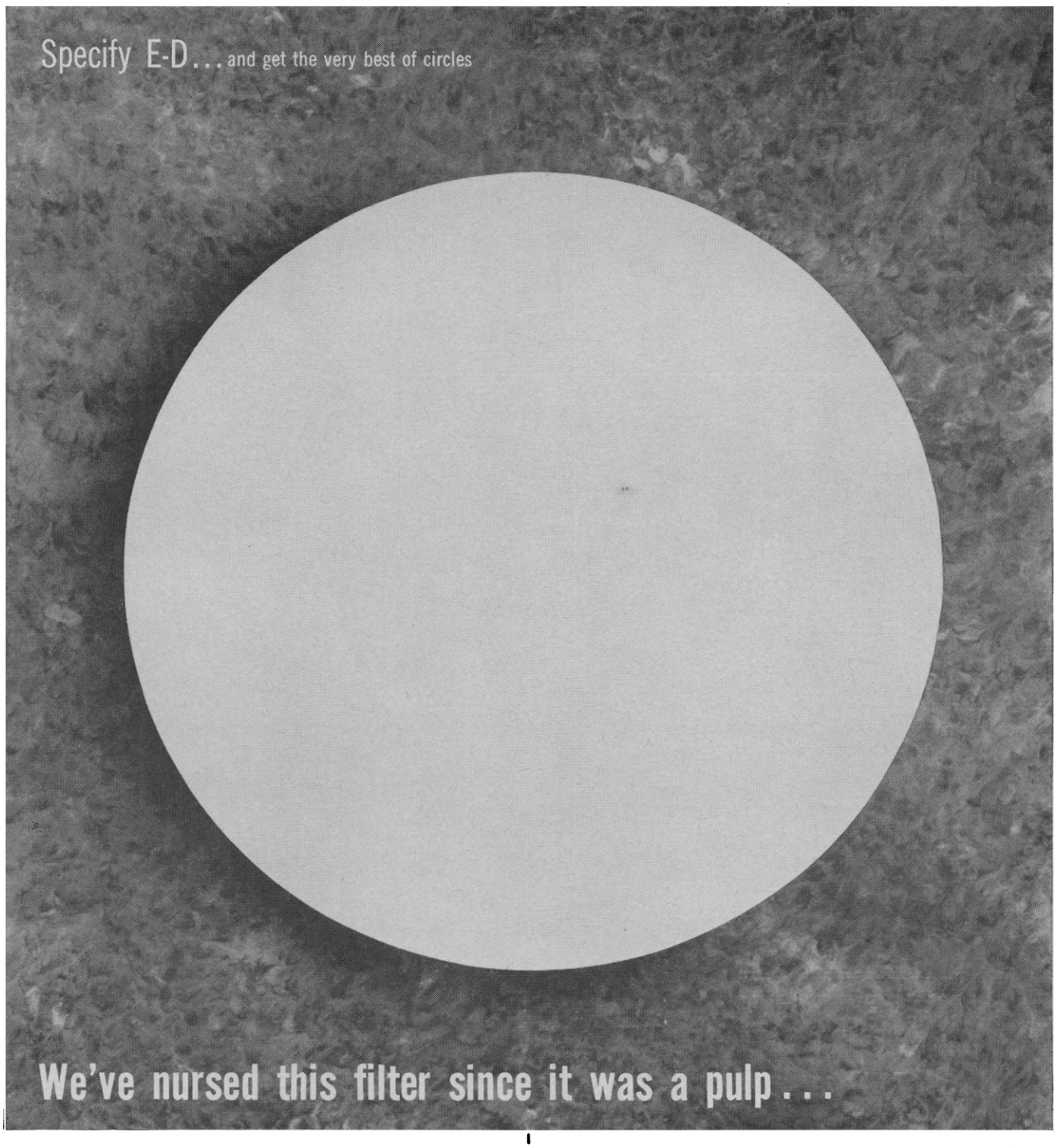

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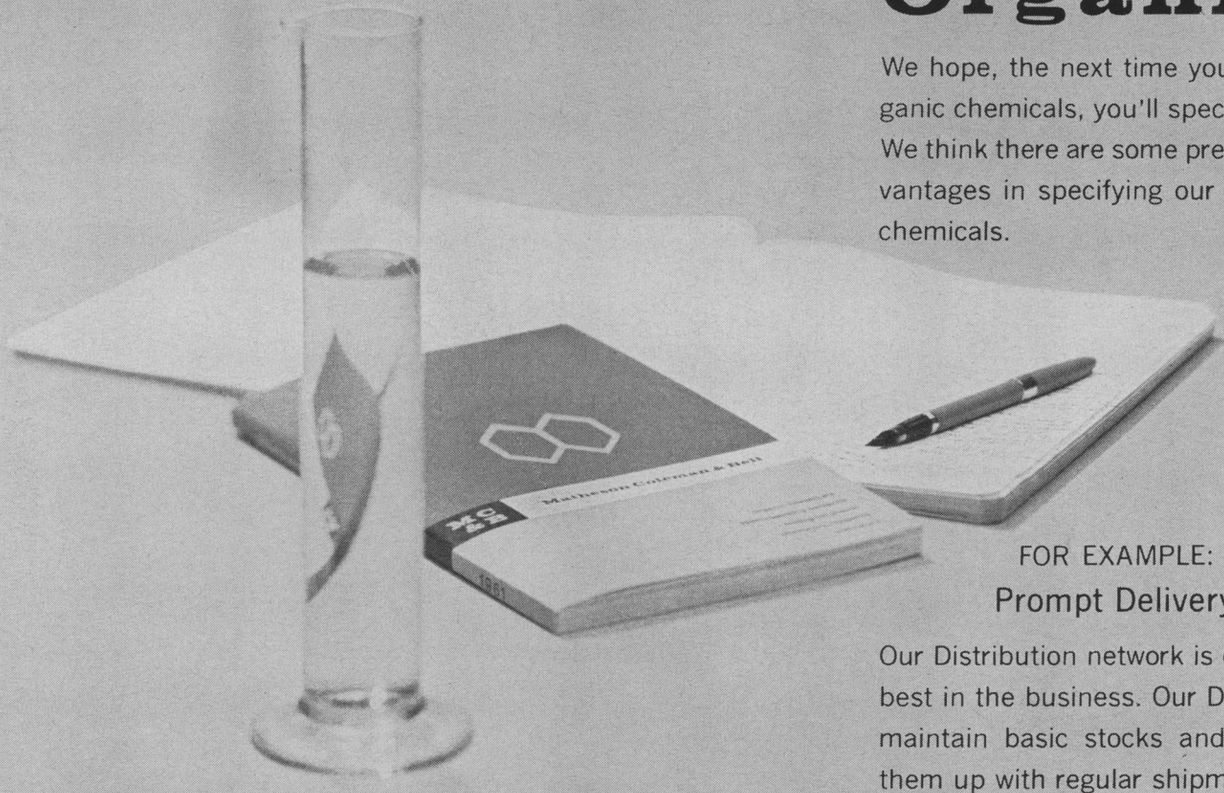

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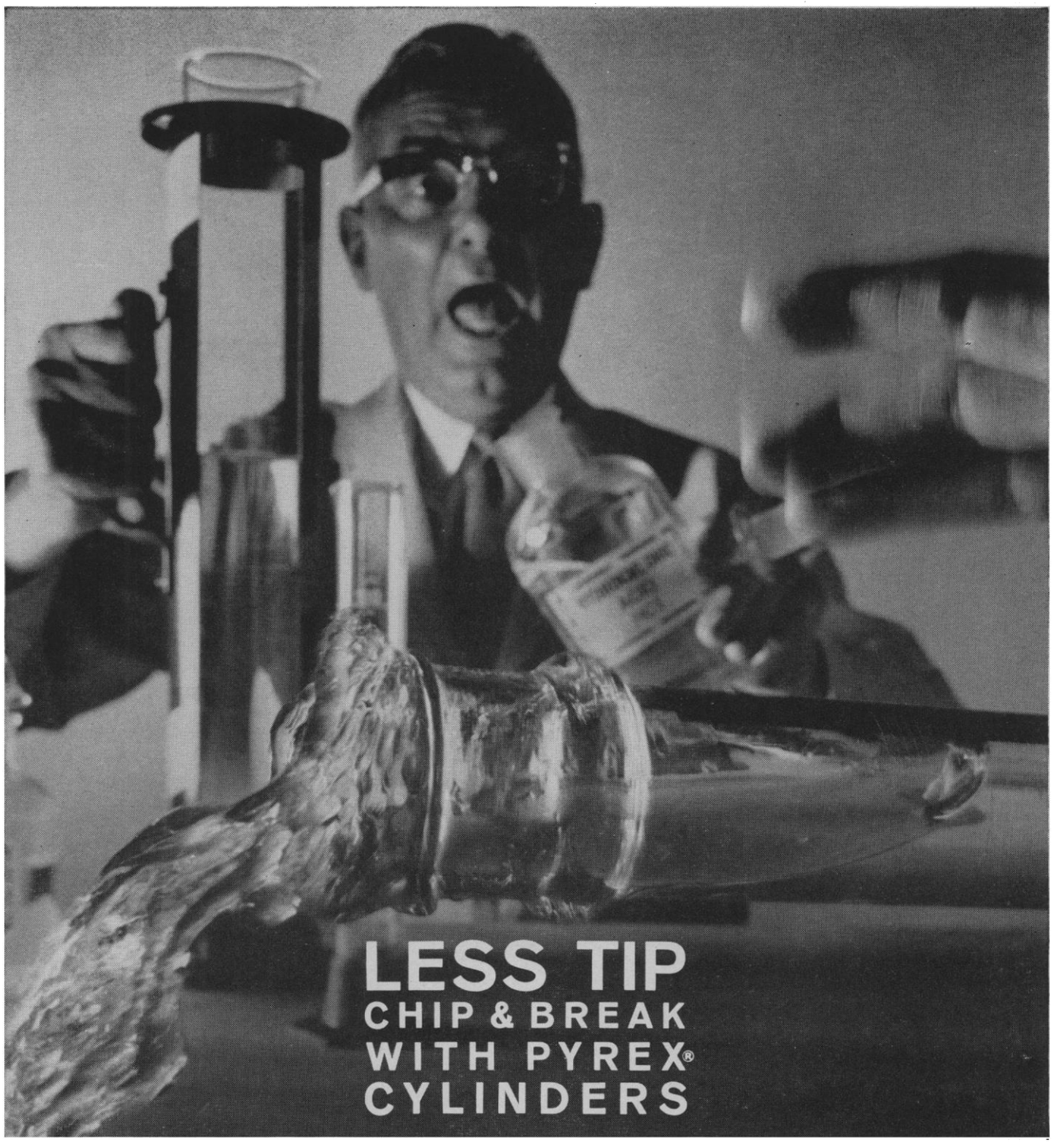

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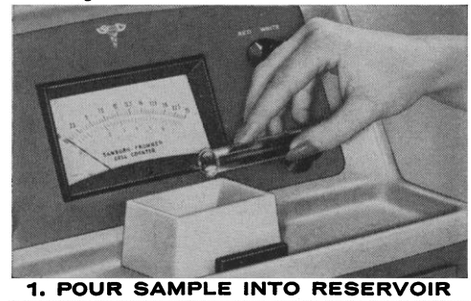

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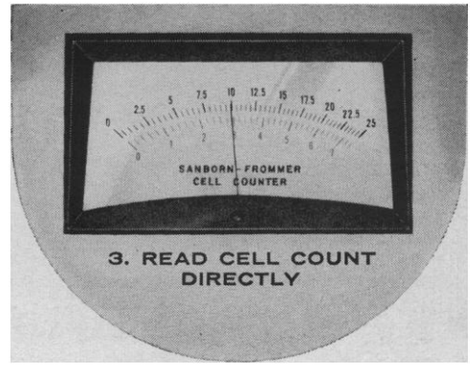
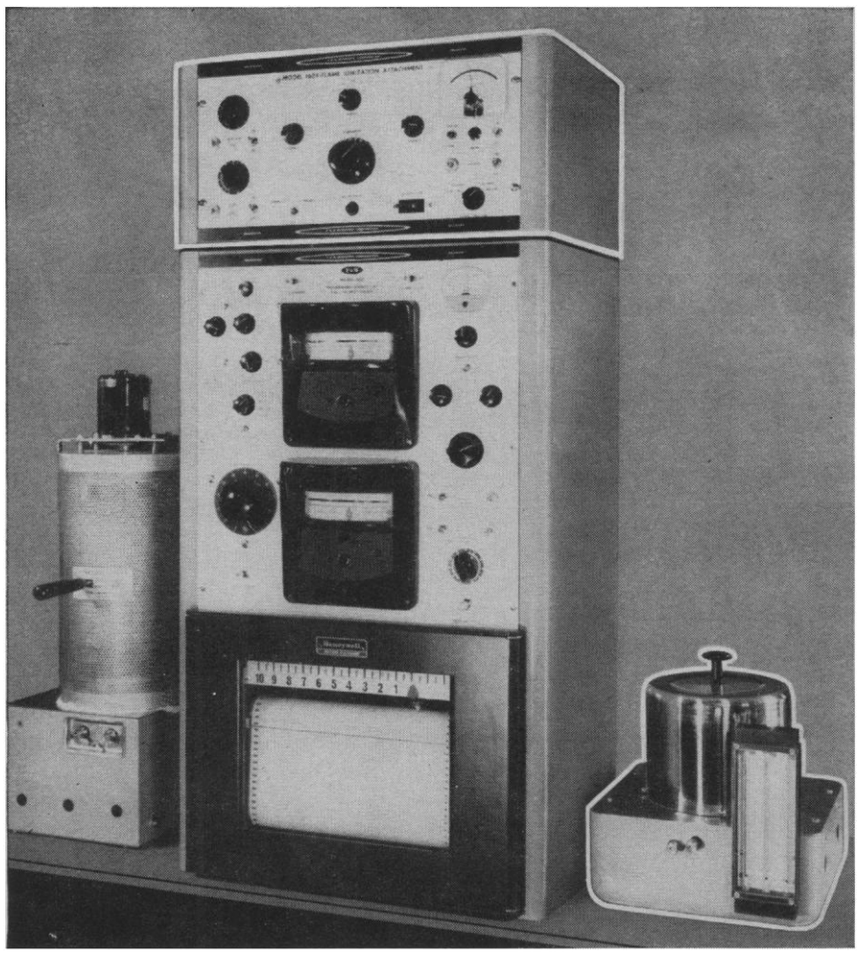


3. READ CELL COUNT DIRECTLY



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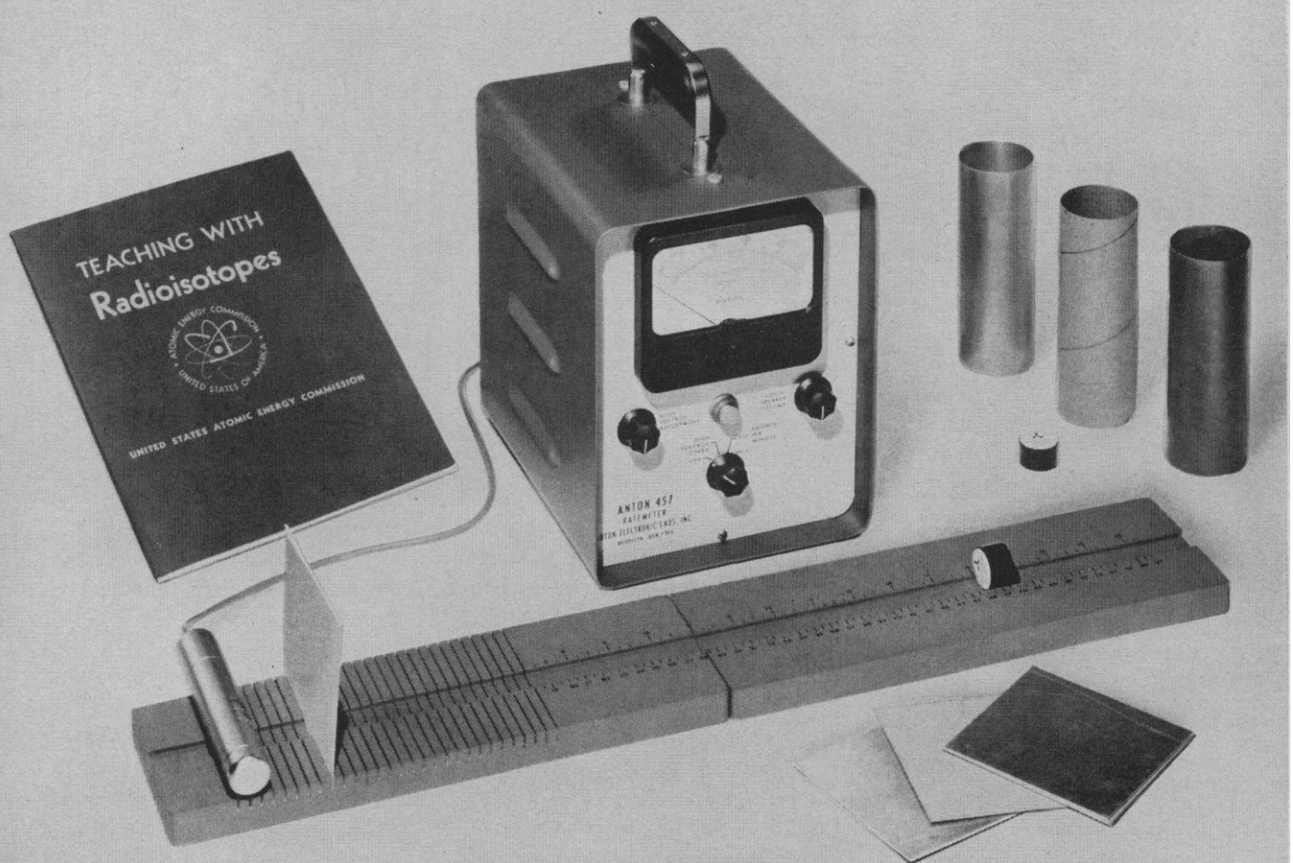

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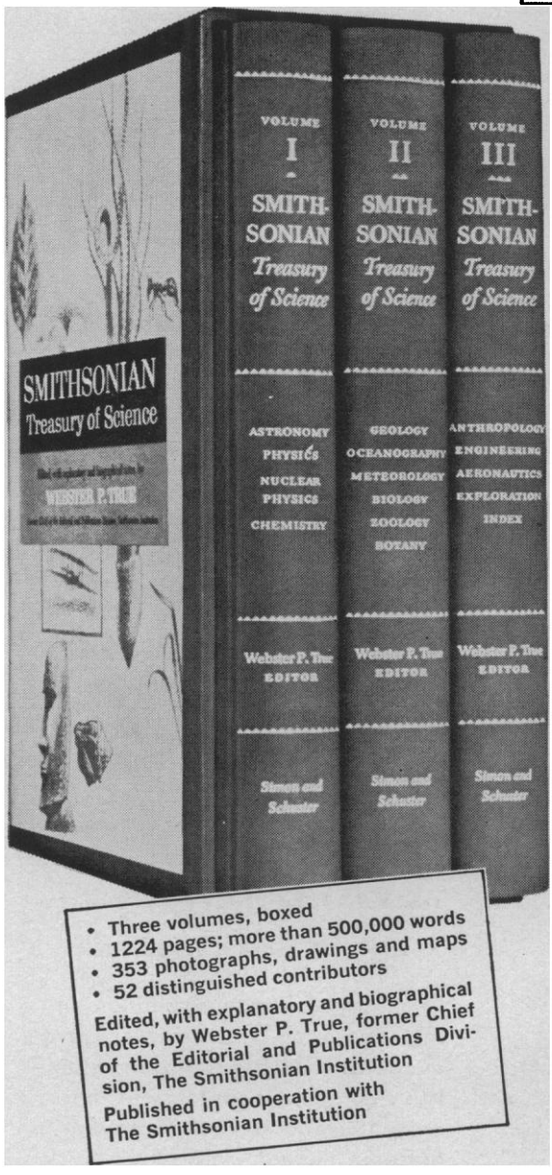

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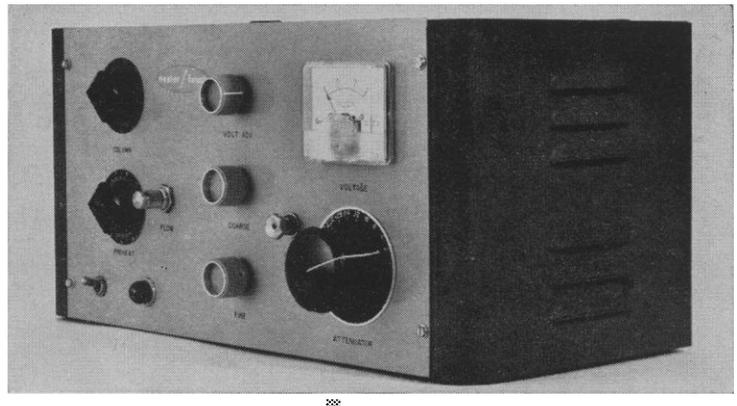

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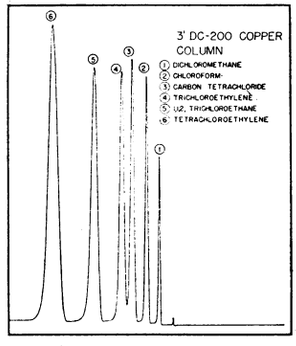

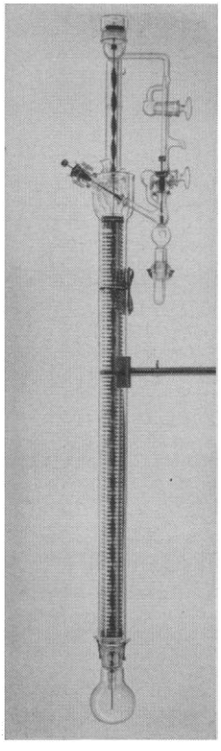

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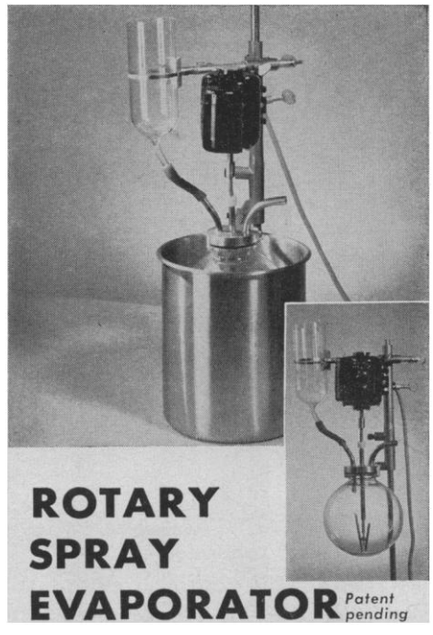

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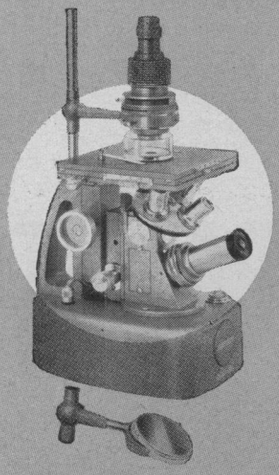

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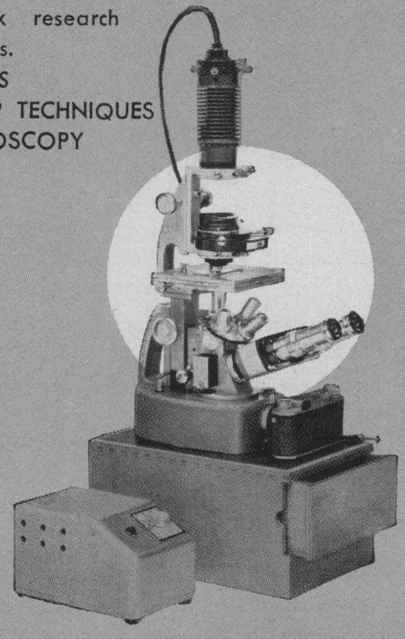

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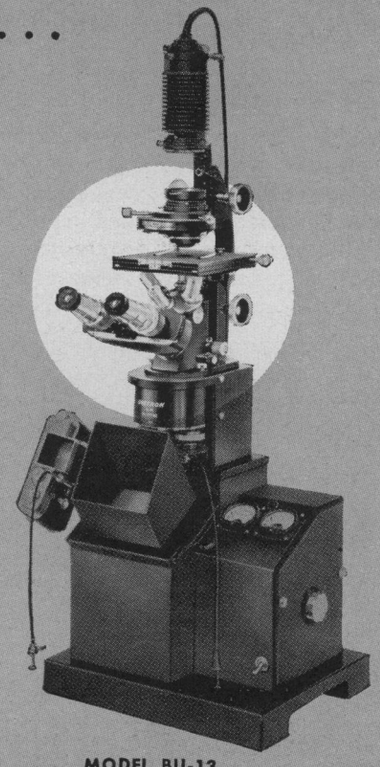

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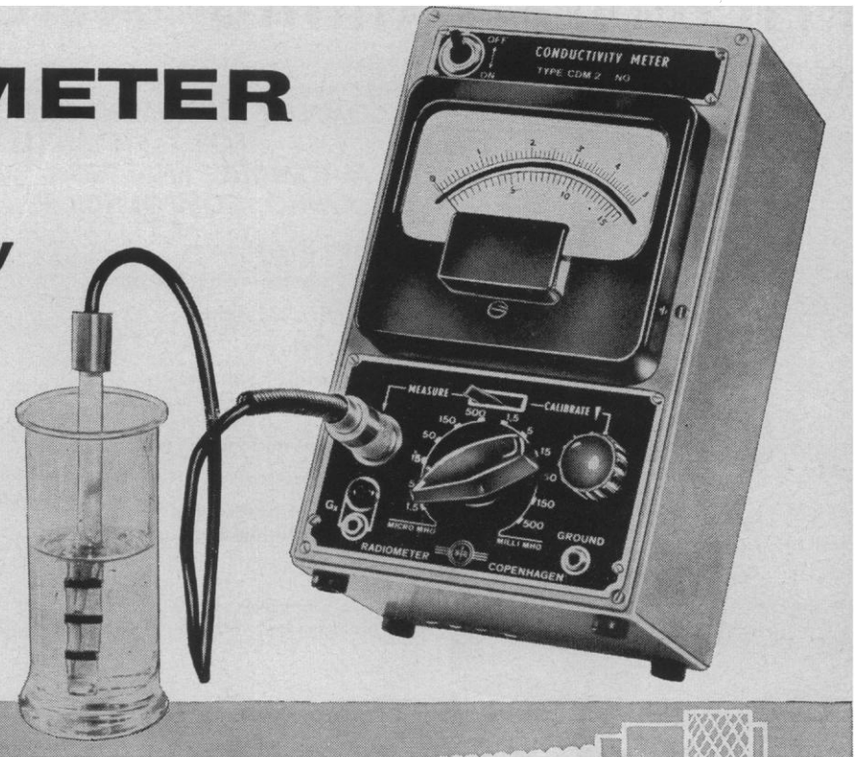

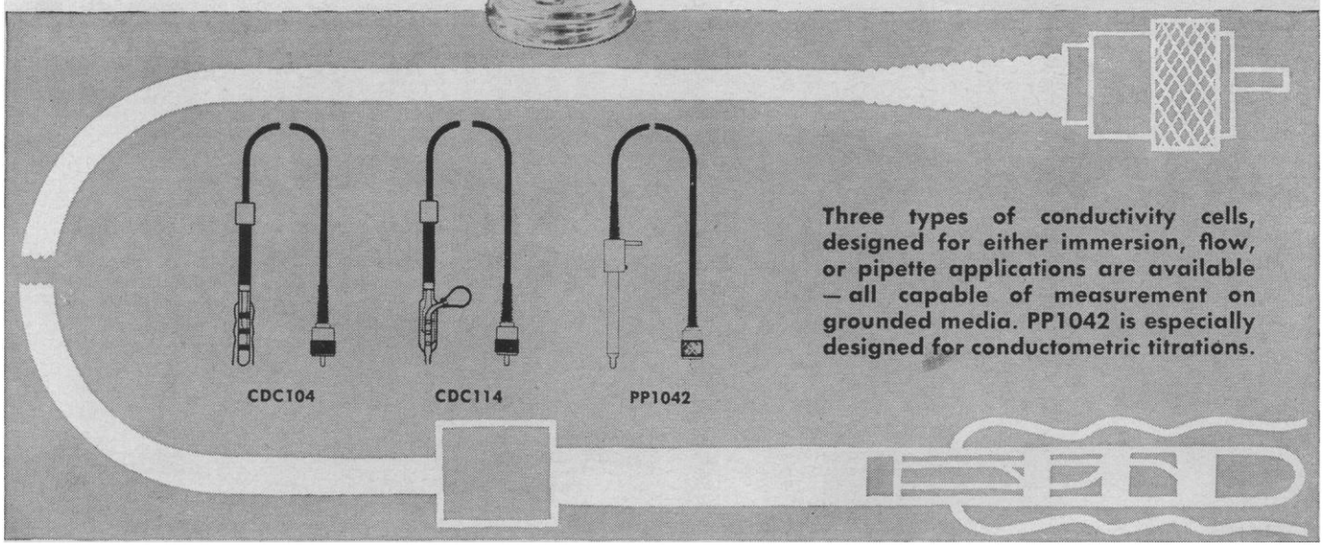

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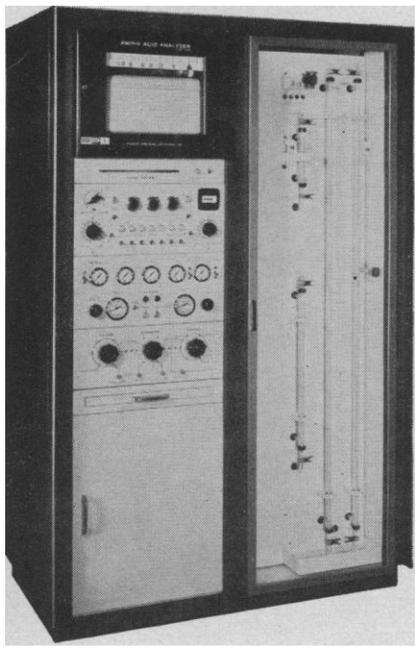

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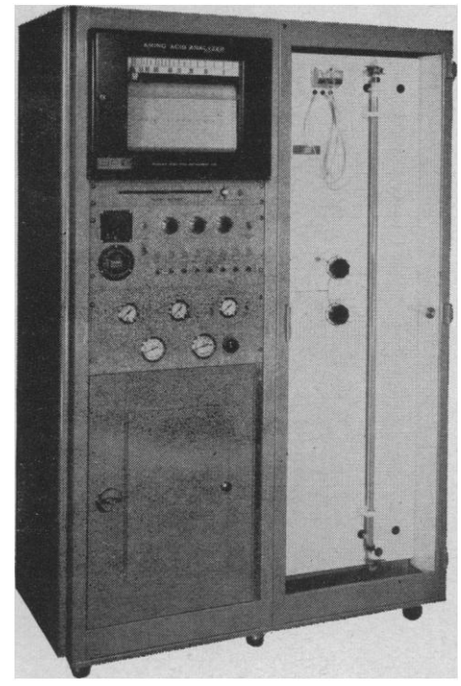

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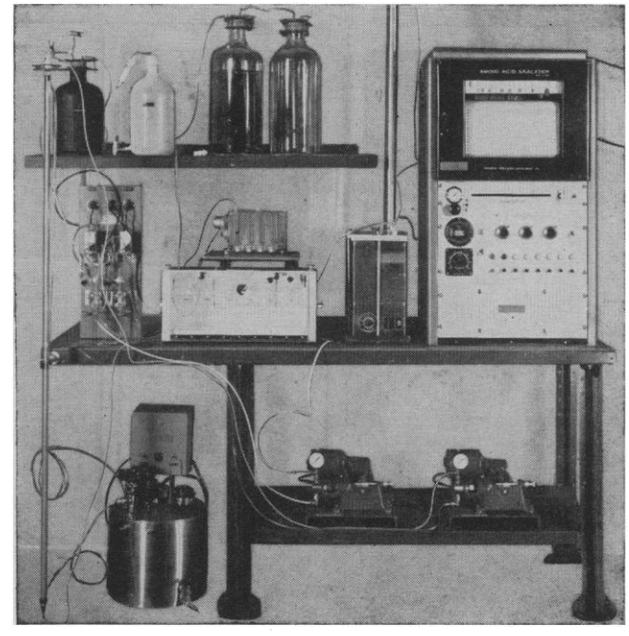

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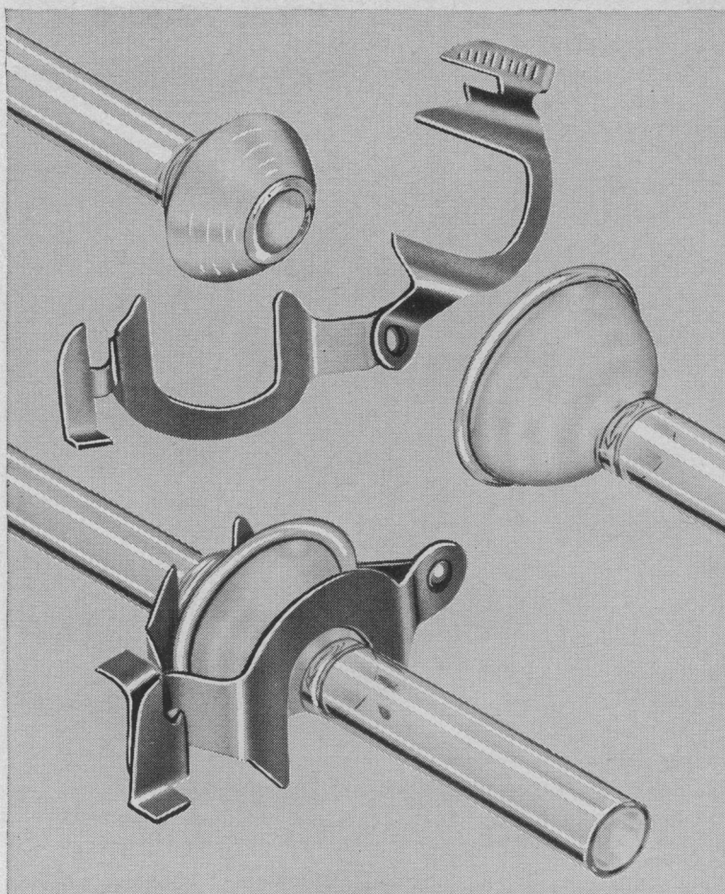

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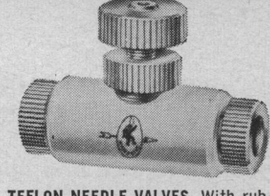

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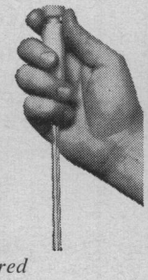

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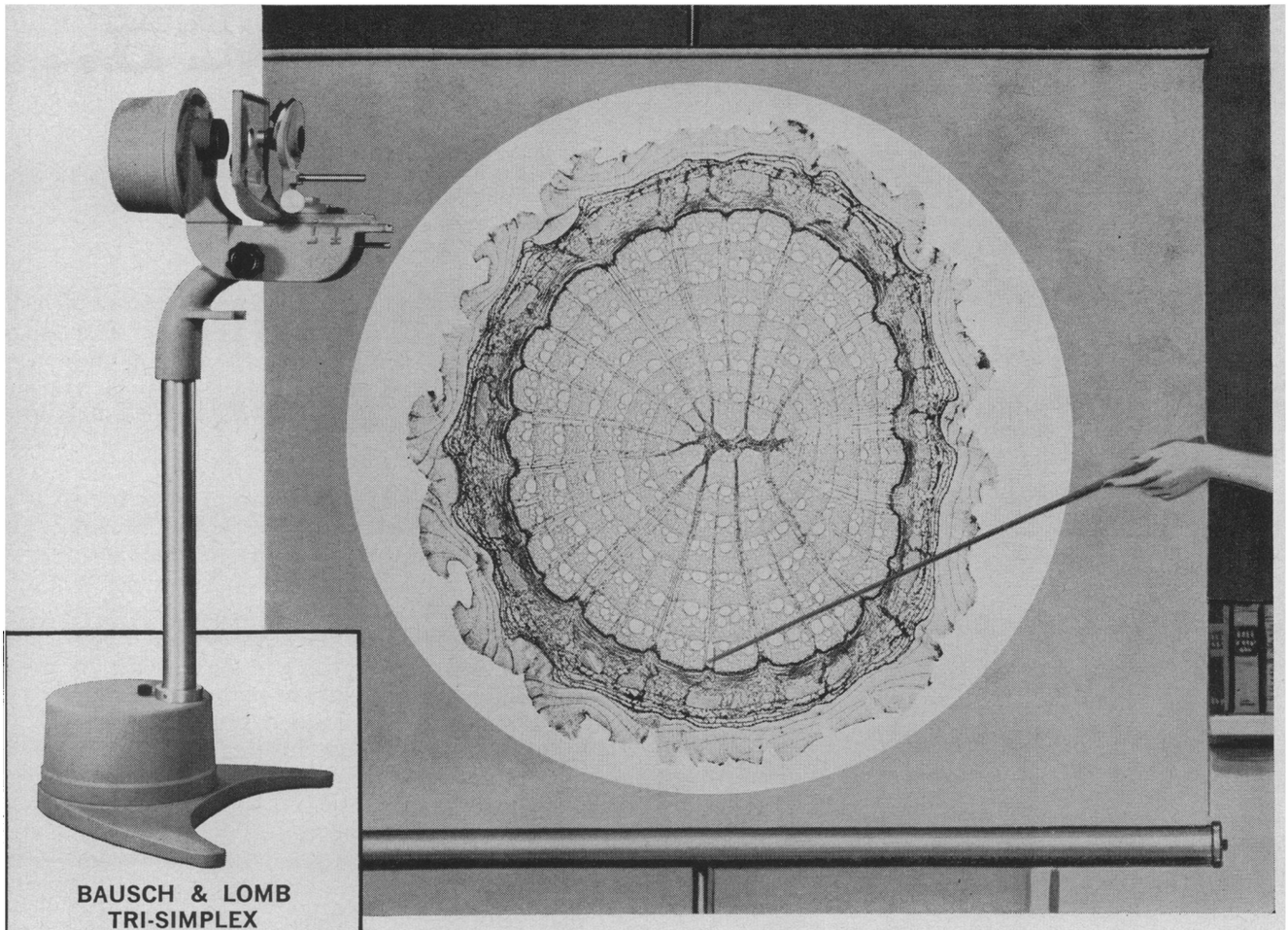

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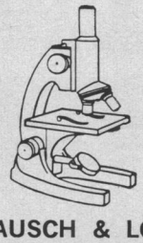

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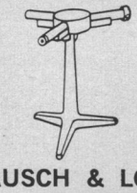

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10 November 1961, Volume 134, Number 3489 **SCIENCE**

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"Say It *Ain't* So!"

What does a lexicographer owe to the language? The critics of *Webster's Third New International Dictionary* (1961) think that a dictionary ought to make it possible for its readers to distinguish good usage from bad and that it ought to maintain useful differentiations in meaning. To some extent the editors of the new edition disagree. The status label "colloquial" has been dropped. The nonsense formation *irregardless* was called erroneous or humorous in the 1958 printing of the second edition, but is called nonstandard in 1961. The much criticized *ain't* was stigmatized as dialect and illiterate in 1958; in 1961, although it was "disapproved by many," it was said to be "used orally in most parts of the U.S. by many cultivated speakers." This we doubt. Common speech blurs some distinctions. Common speech has come to use *infer* to mean *imply*, a change reflected in the dictionary without the notation that careful writers do not make this mistake.

So much for ordinary usage. The lexicographer may not pick and choose among scientific words even though he might wish to do so. Bad formations such as *Pleistocene* and *speedometer* are with us to stay and furnish bad examples for analogous coinages. If *speedometer* had been *speed-meter* it would have been English and we might have been spared *ceilometer*, which could have been *cloud-* or *sky-meter*.

But this is by the way. A sample list of 125 new scientific words and popular words generated by science was matched against the dictionary. Of the words (not all of them appear below) that first appeared in the Addenda of the 1958 printing, almost all achieved full status in 1961. Among them are: *afterburner, antibiotics* (as drugs), *astronautics* (but *astronaut* was not listed), *analogue computer, binding energy, blue print* (as a verb), *brain washing, chromatography, fission* and *fusion* (both in the nuclear sense), *health physics, hybrid corn, narcoanalysis, nuclear reactor, operations research, pip* (radar), *radioisotope, radiation sickness, radome, tsunami,* and *servomechanism*.

Among the slow bloomers—words that achieved full status only after lingering in the Addenda from 1945 on—are: *actinomycin, ballistocardiograph, dendrochronology, fluorescent lamp, Geiger counter, gal, gramicidin, mass number, microwave, neutrino,* and *radar*.

To find the words that appear for the first time in the 1961 edition is more difficult. Here are a few: *antimatter, astronaut, astronavigation, blastoff, digital computer, fallout, free radical, gibberellic acid, information theory, imprinting* (psychology), *pad* (in the senses of both "launching pad" and "residence"), *radiocarbon, radio star, satellite* (man-made), *sputnik, strontium 90,* and *torr* (for mm-Hg).

It is even more difficult to turn up words that are not listed. Most are of recent coinage or have only recently been used in a new sense. Some are: *avoidance behavior, bionics, coesite, communications satellite, cosmonaut, optical maser* or *laser* (*maser,* however, does appear), *Mössbauer effect, reinforcement* (psychology), *systems approach, telegenesis* (biology), and *test ban*.

The editor has paid his debt to science more fully than to general culture. His working rule that accuracy "requires a dictionary to state meanings in terms in which words are in fact used, not to give editorial opinion on what their meanings are" does better for technical terms than for English in general. We hope the next edition will distinguish more sharply and with more discrimination between illiterate and literate usage, both in speech and in writing.—G.DuS.

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Program Summary

Geology and Geography

Tuesday 26 December

Ground Water Problems in the Rocky Mountains and Great Plains District, Part I. Joint symposium of AAAS Section E–Geology and Geography and the Geological Society of America, cosponsored by the American Geophysical Union. Arranged by Theodore R. Walker, University of Colorado. William G. Weist, Jr., U.S. Geological Survey, Denver, will preside. Ground water in Colorado—its importance during a national emergency, Paul T. Voegeli, Sr. How much do we know about ground water in the Colorado High Plains?, Harold E. McGovern and Donald L. Coffin. Artesian aquifers of the Denver Basin, Colorado, George H. Chase. Legal and management problems related to the development of an artesian ground water reservoir, Edward A. Moulder. Engineering and geology as an aid in solving ground water litigation, Edward D. Jenkins.

Wednesday 27 December

General Session for Contributed Papers in Geology.

Ground Water Problems in the Rocky Mountains and Great Plains District, Part II. James H. Irwen, U.S. Geological Survey, Denver, will preside. Management of radioactive waste in a basalt terrane, Idaho, Raymond L. Nace. Geological aspects of the Rocky Mountain Arsenal disposal well, Louis J. Scopel. The measurement of geohydrologic features affecting waste movement at Hanford, Washington, Randall E. Brown and John R. Raymond. Artificial ground water recharge: an aid to better water management, Dean O. Gregg. Pond water for domestic use, R. W. Stallman. Hydrologic significance of six core holes in carbonate rocks, Nevada test site, Stuart L. Schoff and Isaac J. Winograd.

Section E Dinner. John M. Parker, Kirby Petroleum Company, Denver, arranger.

Retiring Vice President's Address, Section E. Richard J. Russell, director, Coastal Studies Institute, Louisiana State University, and vice president for Section E, will preside. Some attributes of numerical data in geology, William C. Krumbein, professor of geology, Northwestern University, retiring vice president for Section E.

Thursday 28 December

Section E Committee Meeting.

Association of American Geographers, Great Plains–Rocky Mountain Division

Program chairman: M. John Loeffler, University of Colorado.

Tuesday 26 December

Contributed and Invited Papers in Geography, I. Program of the Association of American Geographers, Great Plains–Rocky Mountain Division, cosponsored by Section E. Arranged by Karl Stacey, Kansas State University. Alan D. Tweedie, Newcastle University College, New South Wales, Australia, and University of Colorado, will preside. Cascade Alp slopes and Gipfelfluren as clima-geomorphic phenomena, Will F. Thompson. Agricultural frontier in northern Alberta: a preliminary look, Thomas M. Griffiths and Clark N. Crain. The proportional relief landform map, Merrill K. Ridd. Water balance and the history of ancient Lake Bonneville, Vasyl M. Gvodetsky and H. Bowman Hawkes.

Wednesday 27 December

Contributed and Invited Papers in Geography, II. Arranged by M. John Loeffler and the department of geography, University of Colorado. Col. Joseph P. Hereford, U.S. Air Force Academy, Colorado Springs, will preside. Population growth in California: a problem in distribution, Howard F. Gregor. Population change, resource use, and income distribution, Calvin Patton Blair. Recognizing and meeting the map requirements of the population explosion in the western United States, John C. Sherman. Colorado oil shale: an undeveloped strategic resource, Harold A. Hoffmeister.

Contributed and Invited Papers in Geography, III. Arranged by M. John Loeffler and the department of geography, University of Colorado. John C. Sherman, department of geography, University of Washington, will preside. Modern Los Angeles, creature of the population explosion, Howard J. Nelson. The impact of an exploding population on a semideveloped state: the case of Arizona, Andrew W. Wilson. The changing pattern of population distribution in Texas, Stanley A. Argingast. Implications of land inventory

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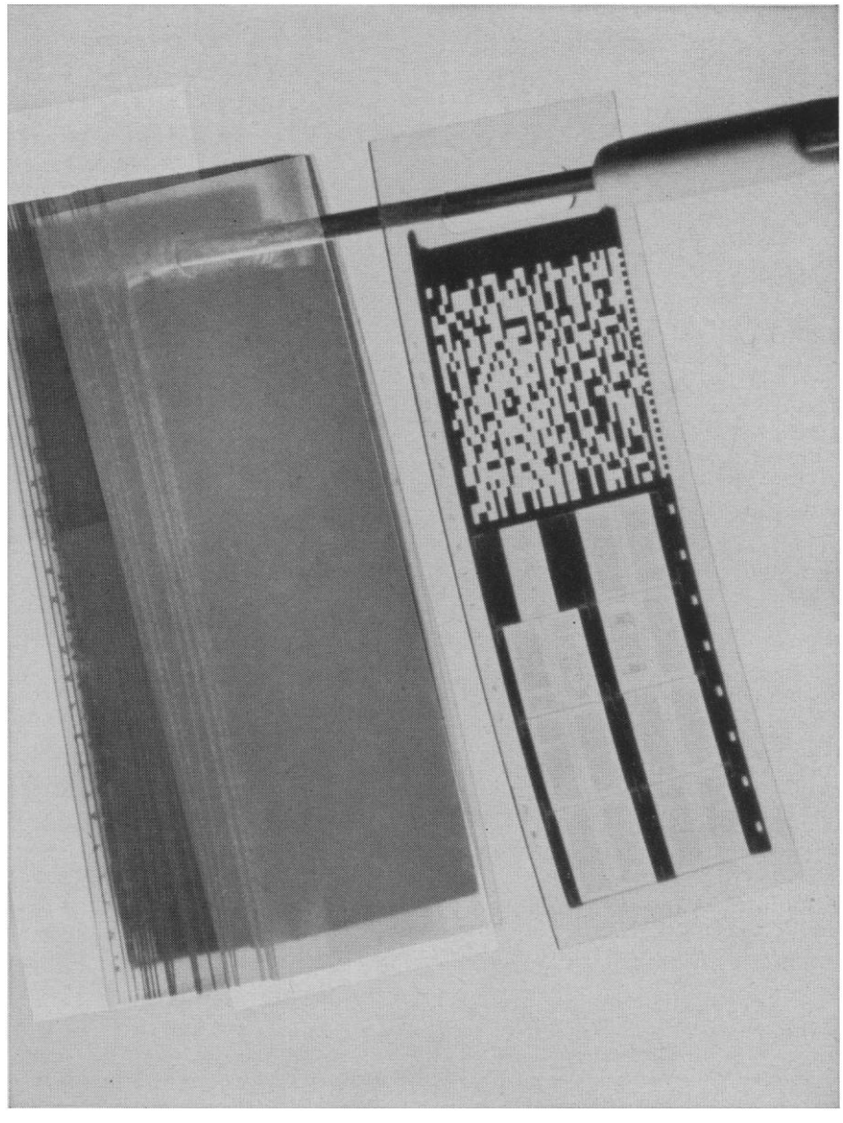

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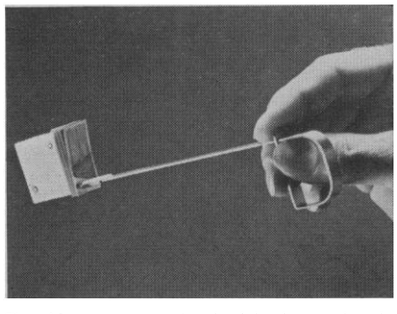

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Program Content

1. The two-session AAAS General Sessions, "Moving Frontiers of Science," Part I—Speakers: Howard A. Meyerhoff and Arthur R. von Hippel; Harrison Brown, presiding. Part II—Speakers: Halton C. Arp and E. W. Fager; Harrison Brown, presiding.
2. The 29th John Wesley Powell Memorial Lecture. Speaker: Glenn T. Seaborg; Paul M. Gross, presiding.
3. On "AAAS Day," the four broad, interdisciplinary symposia—Physics of the Upper Atmosphere; Geochemical Evolution—The First Five Billion Years; Existing Levels of Radioactivity in Man and His Environment; and Water and Climate—arranged by AAAS Sections jointly.
4. The Special Sessions: AAAS Presidential Address and Reception; Joint Address of Sigma Xi and Phi Beta Kappa by Harrison Brown; the Tau Beta Phi Address by John A. Logan; National Geographic Society Illustrated Lecture; and the second George Sarton Memorial Lecture by Joseph Kaplan.
5. The programs of all 18 AAAS Sections (specialized symposia and contributed papers).
6. The programs of the national meetings of the American Astronomical Society, American Society of Criminology, American Nature Study Society, American Society of Naturalists, American Society of Zoologists, Beta Beta Beta Biological Society, Biometric Society (WNAR), National Association of Biology Teachers, Scientific Research Society of America, Society for General Systems Research, Society of Protozoologists, Society of Systematic Zoology, and the Society of the Sigma Xi.
7. The multi-sessioned special programs of the American Astronautical Society (Hugh L. Dryden as dinner speaker), American Physiological Society, American Psychiatric Association, Association of American Geographers, Ecological Society of America, National Science Teachers Association, National Speleological Society —and still others, a total of some 70 to 80 participating organizations.
8. The sessions of the Academy Conference, the Conference on Scientific Communication, and the Conference on Scientific Manpower.
9. The sessions of the AAAS Cooperative Committee on the Teaching of Science and Mathematics, of the AAAS Committee on Science in the Promotion of Human Welfare.
10. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
11. Exhibitors in the 1961 Annual Exposition of Science and Industry and descriptions of their exhibits.

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programs in Chile, Donald D. MacPhail.

Geographers' Dinner. Arranged by M. John Loeffler, University of Colorado.

Thursday 28 December

Contributed and Invited Papers in Geography, IV. Arranged by M. John Loeffler and the department of geography, University of Colorado. Karl Stacey, Kansas State University, will preside. The impact of growing metropolitan areas on water resources planning, Robert S. Collins. The Piedmont: Colorado's expanding core, M. John Loeffler and Albert W. Smith. Area and people in political geography, Joseph Velinkonja. Water problems in eastern Australia, Alan D. Tweedie.

National Geographic Society

Saturday 30 December

Annual Lecture and Color Film of the National Geographic Society. Margaret Mead, member AAAS board of directors, will preside. The sacred well of Chichén Itzá, Matthew W. Sterling, research associate, Smithsonian Institution; Committee for Research and Exploration, National Geographic Society.

National Speleological Society

Program chairman: Brother G. Nicholas, F.S.C., University of Notre Dame.

Friday 29 December

Speleogenesis. Program of the National Speleological Society, cosponsored by AAAS Section E–Geology and Geography, and the Geological Society of America. Opportunities for geological research in caves, William E. Davis. Speleogenesis in the Marble Mountain area, Colorado, Donald Davis. Geology and speleogenesis of Porcupine Cave, Utah, Jon Haman. Crystal wedging as a factor in cavern breakdown, William B. White and Elizabeth L. White.

General Session. Brother G. Nicholas, presiding. Notes on Colorado cave insects, Robert Ayre. Origin and development of lava tubes, William R. Halliday. Recent progress in Montana speleology, Howard McDonald. Preview of 1962 Black Hills meeting of NSS, John Streich.

Program summaries for the chemistry and mathematics sections appeared in the 27 October issue of *Science,* and for the physics and astronomy sections, in the 3 November issue. Program summaries for other sections will appear in subsequent issues.

Agriculture

Land and Water Use with Special Reference to Mountain and Plains Regions. Symposium in four sessions, arranged by D. Wynne Thorne, Utah State University. One session jointly arranged by Terah L. Smiley, University of Arizona, and D. Wynne Thorne, Utah State University. Program of AAAS Section O–Agriculture, cosponsored by AAAS Section E–Geology and Geography, and the Committee on Desert and Arid Zones of the Southwestern and Rocky Mountain Division, and by the following societies: American Dairy Science Association, American Farm Economic Association, American Geophysical Union, American Society of Agricultural Engineers, American Society of Agronomy, American Society of Animal Production, American Society of Range Management, Ecological Society of America, Gamma Sigma Delta, Society of American Foresters, Soil Conservation Society of America, Wilderness Society, Wildlife Management Institute, Wildlife Society.

Wednesday 27 December

Part I: **Land and Water Resources**. Roland Renne, president, Montana State University, will preside. Population demands for land and water resources of the western hinterland, S. C. Smith. Land resources and potential use, R. D. Hockensmith. Water resources, development and uses, W. I. Palmer. Public grazing lands in the economy of the West, M. L. Upchurch.

Part II. **Optimum Uses for Resources**. E. F. Frolik, dean, College of Agriculture, University of Nebraska, will preside. Criteria and planning for optimum use, E. N. Castle. Economic priorities on water use in arid regions, Nathaniel Wollman. Agriculture as a competitive segment of multiple use, B. Delworth Gardner. Recreation as a competitive segment of multiple use, Marion Clawson.

Thursday 28 December

Part III: **Interdisciplinary Symposium in the Social Sciences: Water and Climate.** Joint program of AAAS Section O–Agriculture and the Committee on Desert and Arid Zones Research of the AAAS Southwestern and Rocky Mountain Division, cosponsored by Sections E–Geology and Geography, K–Social and Economic Sciences, M–Engineering, and P–Industrial Science, the American Meteorological Society, and the American Geophysical Union. Arranged by Terah L. Smiley, University of Arizona, and Wynne Thorne, Utah State University. Terah L. Smiley will preside. A meteorologist looks at hydroclimatology, Paul R. Julian. Capture of additional water for increasing supplies, John W. Harshbarger. Weather modification, Earl G. Droessler. Legal aspects of a national water policy, Morris K. Udall.

Friday 29 December

Part IV: **Impact of Public Policy on Land and Water Use.** W. E. Morgan, president, Colorado State University, will preside. The government's responsibility for land and water, L. B. Leopold. Problems associated with wilderness and other reserves of public lands, C. R. Gutermuth. Problems growing out of the spaciousness of the West, M. M. Kelso. Public and/or private investment in resource development, W. E. Folz.

Part V: **Projecting Management Programs.** R. E. Hodgson, Director, Animal Husbandry Research Division, Agricultural Research Service, Beltsville, Maryland, will preside. Providing for multiple use in managing land and water, J. A. Hopkin. Modifying management and vegetation of watershed areas for improved water yields, F. H. Kennedy. Management associated with complex use for wildlife, livestock, and recreation, A. L. McComb. Managing private lands in relation to changing uses of public lands, N. Keith Roberts.

Saturday 30 December

Water Improvement, Part I. Symposium of the Committee on Desert and Arid Zones Research of the AAAS Southwestern and Rocky Mountain Division, cosponsored by AAAS Section O–Agriculture. Arranged by Terah L. Smiley, University of Arizona, and Joseph A. Schufle, New Mexico Institute of Mining and Technology. Terah L. Smiley will preside. Contamination of underground water—vicinity of Denver,

William N. Gahr. New dimensions in water pollution research, Bernard B. Berger and Gordon McCullum. The salt water intrusion problems in coastal aquifers, David K. Todd. The zone of diffusion and its consequences, H. H. Cooper.

Water Improvement, Part II. John W. Harshbarger, University of Arizona, will preside. Electrochemical demineralization of water—theory and practice, George W. Murphy. Operating characteristics of ground water reservoirs occupying a trench, Robert E. Glover and Morris M. Skinner. Summary, Peter C. Duisberg.

Forthcoming Events

November

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

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

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

24–25. Federation of American Scientists, natl. council, Chicago, Ill. (D. M. Singer, FAS, 1700 K St., NW, Washington 6)

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

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

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

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

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

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

27–29. American Soc. of Hematology, annual, Los Angeles, Calif. (J. W. Rebuck, ASH, Henry Ford Hospital, Detroit 2, Mich.)

27–29. Vehicle Systems Optimization Symp., Garden City, N.Y. (Meetings Dept., Inst. of the Aerospace Sciences, 2 E. 64 St., New York 21)

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

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

(ASA, 2702 Monroe St., Madison, Wis.)

27–30. Entomological Soc. of America, Miami, Fla. (R. H. Nelson, 4603 Calvert Rd., College Park, Md.)

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

29–1. Western Surgical Assoc., San Francisco, Calif. (W. W. Carroll, 700 N. Michigan Ave., Chicago 11, Ill.)

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

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

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

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

December

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

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

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

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

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

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

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

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

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

4–9. World Federation of Neurology, Problem Commission of Tropical Neurology, Buenos Aires, Argentina. (P. Bailey, Natl. Inst. of Neurological Diseases and Blindness, Bethedsa, Md.)

4–16. Inter-American Conf. on Education and Economic and Social Development, Santiago, Chile. (U.S. National Commission for UNESCO, Dept. of State, Washington 25)

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

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

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

6–8. Conference on Document Copying by Photography, London, England. (A. J. O. Axford, Ozalid Co., Longston Rd., Loughton, Essex, England)

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

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

6–8. National Institutes of Health Symp. on Neuroendocrinology, Miami, Fla. (A V. Nalbandov, 102 Animal Genetics, Univ. of Illinois, Urbana)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10–14. Psychosomatic Medicine Symp., 6th, Philadelphia, Pa. (Miss M. R. Carmosin, Hahnemann Medical College and Hospital, 235 N. 15 St., Philadelphia 2, Pa.)

10–17. Latin American Congr. on Microbiology, 2nd, San José, Costa Rica. (J. L. De Abate, Secretary General, Apartado 1404, San José)

11. Society of Photographic Scientists and Engineers, Washington, D.C. (C. M. Bailey, Rte. 4, Box 404, Fairfax, Va.)

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

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

11–16. Ionospheric Soundings in the In-

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

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

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

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

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

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

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

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

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

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

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

The following 35 meetings are being held in conjunction with the AAAS annual meeting.

AAAS Southwestern and Rocky Mountain Div., Committee on Desert and Arid Zones Research (M. G. Anderson, University Biological Station, Pulston, Mich.). 26–31 Dec.

Alpha Epsilon Delta (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y.). 28 Dec.

American Assoc. of Clinical Chemists (R. L. Dryer, State Univ. of Iowa, Dept. of Biochemistry, Iowa City). 26–27 Dec.

American Astronautical Soc. (J. Campbell III, R.C.A., Front and Cooper Sts., Bldg. 10-7, Camden, N.J.). 26–30 Dec.

American Astronomical Soc. (H. J. Smith, Yale Observatory, 135 Prospect St., New Haven, Conn.). 27–30 Dec.

American Economic Assoc. (J. W. Bell, Northwestern Univ., Evanston, Ill.). 26 Dec.

American Educational Research Assoc. (G. T. Buswell, 1201 16 St., NW, Washington 6). 30 Dec.

American Meteorological Soc. (J. M. Austin, Dept. of Meteorology, Massachusetts Inst. of Technology, Cambridge 39). 26–31 Dec.

American Nature Study Soc. (B. Schultz, Dept. of Biology, Western Michigan Univ., Kalamazoo). 26–30 Dec.

American Physiological Soc. (R. G. Daggs, APS, 9650 Wisconsin Ave., Washington 14). 28 Dec.

American Political Science Assoc., (E. M. Kirkpatrick, 1726 Massachusetts Ave., NW, Washington 6). 27 Dec.

American Psychiatric Assoc. (M. Ross, APA, 1700 18 St., NW, Washington 9). 27 Dec.

American Soc. of Criminology (J. Chwast, New York Inst. of Criminology, 115–117 W. 42 St., New York 36). 29–30 Dec.

American Soc. of Naturalists (E. L. Green, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine). 27 Dec.

American Soc. of Zoologists (C. B. Metz, Dept. of Oceanography, Florida State Univ., Tallahassee). 28–30 Dec.

American Sociological Assoc. (T. Parsons, Emerson Hall, Cambridge 38, Mass.). 28–29 Dec.

American Statistical Assoc. (D. C. Riley, ASA, 1757 K St., NW, Washington 6). 29–30 Dec.

Association of American Geographers, Great Plains–Rocky Mountain Div., (M. F. Burrill, AAG, 1785 Massachusetts Ave., NW, Washington, D.C.). 29–30 Dec.

Beta Beta Beta Biological Soc. (F. G. Brooks, Box 515, Ansonia Station, New York 23). 27 Dec.

Colorado-Wyoming Acad. of Science (R. G. Beidleman, Zoology Dept., Colorado College, Colorado Springs).

Ecological Soc. of America (J. E. Cantlon, Dept. of Botany and Applied Pathology, Michigan State Univ., E. Lansing). 26–30 Dec.

Institute of Management Sciences (W. Smith, Inst. of Science and Technology, Univ. of Michigan, Ann Arbor). 29 Dec.

Mathematical Assoc. of America, Committee on Undergraduate Program in Mathematics (H. L. Alder, MAA, Univ. of California, Davis). 30 Dec.

National Assoc. of Biology Teachers (H. C. Kranzer, Temple Univ., Philadelphia 22, Pa.). 26–30 Dec.

National Assoc. for Research in Science Teaching (H. A. Branson, Dept. of Physics, Howard Univ., Washington 1). 26–30 Dec.

National Assoc. of Science Writers (D. J. Dunham, Cleveland Press, Cleveland 14, Ohio).

National Science Teachers Assoc. (M. T. Ballou, Ball State Teachers College, Muncie, Ind.). 26–30 Dec.

National Speleological Soc. (D. N. Cournoyer, 2318 N. Kenmore St., Arlington 1, Va.). 29 Dec.

Scientific Research Soc. of America (D. B. Prentice, 51 Prospect St., New Haven, Conn.). 29 Dec.

Sigma Delta Epsilon (B. L. McLaughlin, 702 Butternut St., NW, Washington 12). 26–30 Dec.

Society of Protozoologists (N. D. Levine, College of Veterinary Medicine, Univ. of Illinois, Urbana). 27–30 Dec.

Society of the Sigma Xi (T. T. Holme, 51 Prospect St., Yale Univ., New Haven, Conn.). 29 Dec.

Society of Systematic Zoology (R. T. Abbott, Acad. of Natural Sciences, Philadelphia 3, Pa.). 27–30 Dec.

Tau Beta Pi Assoc. (R. H. Nagel, Univ. of Tennessee, Knoxville). 29 Dec.

United Chapters of Phi Beta Kappa (C. Billman, 1811 Q St., NW, Washington 9). 29 Dec.

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

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

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

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

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

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

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

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

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

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

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

(See issue of 20 October for comprehensive list)

New Products

Horizon sensors, the series 13–160, are infrared scanning instruments that can detect the sharp thermal discontinuity between the earth's relatively warm atmosphere and the cold background of outer space. Equipped with germanium-immersed thermistor detectors, they are sensitive to far-infrared wavelengths while filtering out visible and near-infared radiation. Thus, the sensors are responsive only to the earth's self-emitted radiation and not to reflected solar emission. They operate from the minimum altitude at which orbits are possible up to the 22,000-mile altitude of 24-hour orbits.

Sensor heads search for, acquire, and track the thermal horizon with changes in vehicle attitude and altitude. Incoming radiation is reflected successively by a tracking mirror and a vibrating mirror into an error-sensing detector. In the search mode, the tracking mirror is slewed over a wide field while the vehicle is commanded to roll or pitch to increase the area scanned. When the earth's thermal gradient appears, the vibrating mirror oscillates the horizon image across the detector. The detector's output pulses initiate the tracking mode and then continuously drive the tracking mirror to image-centering positions. The sensors are said to establish a local vertical to within 0.1-deg accuracy; they will sense pitch and roll errors relative to this reference axis and will produce control signals proportional to these errors. (Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.)

Circle 1 on Readers' Service card

Instrument carrier (Fig. 1) that is used in making oceanographic measurements is said to remain at the desired depth regardless of changing speed of the tow ship. Complete stability is said to be achieved at speeds up to 20 mi/hr. Data gathering instruments are carried in a compartment measuring 12 by 2½ by 1⅛ in. The compartment can be sealed watertight, or the electronic instruments and circuitry can be potted. Data gathered by the instruments are transmitted to the towing ship through a 3/32-in. coaxial towing cable. When used for underwater acoustic measurements, the carrier can have a hydrophone mounted in its nose and an impedance matching transistorized preamplifier in the instrument compartment. Hydrophone sensitivity is −88 db. (Braincon Corp., P.O. Box 312, Marion, Mass.)

Circle 2 on Readers' Service card

Wave-form translator operates with an *x-y* recorder to produce a permanent record of repetitive functions displayed on an oscilloscope at high speed. Operation is based on recurrent simultaneous sampling of both vertical and horizontal oscilloscope deflection plate voltages at intervals equal to, or almost equal to, the wave-form period. The sample signals are fed to the translator's high-impedance input, and each signal is then applied to an individual sampling clamp. An amplitude comparator equates the signal to a slowly varying reference voltage derived from a ramp generator, and the resulting strobe pulse is used to drive the clamps. As the strobe traverses the trace, the outputs of the x and y clamps are measurements of the instantaneous coordinates of the scanning strobe point. These d-c signals are applied to the axes of the *x-y* recorder to produce a permanent record of the wave form. For identification purposes, the strobe pulse is also transmitted to the intensity (or z) axis of the oscilloscope to form a bright spot on the trace at the point being sampled.

The translator also provides a manual sampling mode. Strobe position is selected by varying a single-turn potentiometer that controls the reference voltage applied to the amplitude comparators. If desired, the translator can be operated directly from the test device without an intermediate oscilloscope. In this case, the electrical signal characteristics must be of the same form and amplitude as those supplied by an oscilloscope, and an external trigger signal is required. (F. L. Moseley Co., 409 N. Fair Oaks Ave., Pasadena, Calif.)

Circle 3 on Readers' Service card

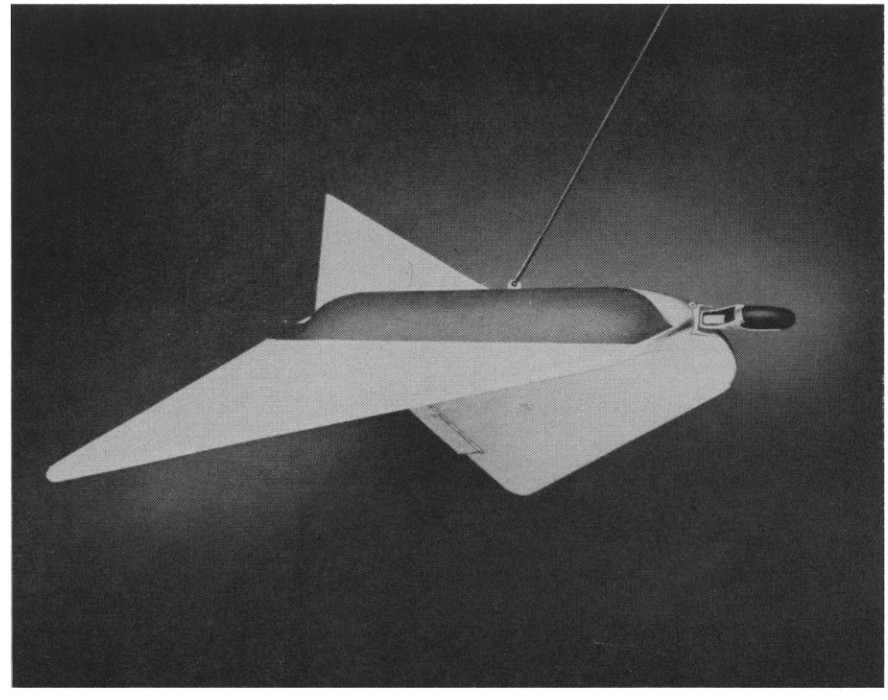


Fig. 1. Instrument carrier used for oceanographic investigation.

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writer assumes responsibility for the accuracy of the information. A Readers' Service card for use in mailing inquires concerning the items listed is included on pages 1465 and 1563. Circle the number of the items in which you are interested on this card.

Color measurement and sorting is performed automatically by a combination of a colorimeter with a small-scale digital computer. In the colorimeter head, rotation of a filter wheel causes a sequence of green, amber, and blue light pulses, reflected from the sample at a 45° angle, to impinge upon a phototube. Each output pulse has an amplitude corresponding to the reflectance of the sample weighted by the spectral characteristics of the lamp, filter, and phototube. The weighting is designed to approximate the theoretical CIE curves multiplied by illuminant C. A photocommutator wheel, mounted on the same shaft as the filter wheel, provides timing signals for system operation.

A shutter segment interrupts the light beam once each revolution to allow the sample to be changed. The underside of this shutter segment is a reference reflectance surface spectrally similar to the products being sorted. While this surface is in the viewing area, a second set of filters rotates through the beam to provide reference signals for system calibration. The phototube supply voltage is adjusted automatically to provide a constant output for the green reference signal. The amber reference signal provides information for manual adjustment of the lamp's color temperature.

The analog-signal amplitudes are assigned to discrete categories necessary for the sorting process by a voltage digitizer. The measurements are stored in binary form until the measurements for a single sample are completed. The stored information is examined electronically to assign a color category to the sample, and a selection matrix assigns various exits to selected color categories. As many as 30 color determinations per second can be made, but the degree of color resolution obtained is inversely proportional to the rate of operation. (Allied Research Associates, Inc., 43 Leon St., Boston 15, Mass.)

Circle 4 on Readers' Service card

Electron beam systems, the series LB-100, cover a range of powers from 3 kw at 10 kv to 9 kw at 30 kv. The systems include electron guns, power supplies, and controls. Magnetic deflection of the beam is provided over a 3-in.-square area. Beam energy may be pulsed, regulated over a wide range, and varied in focus. The systems may be adapted for programmed automatic operation by using the deflection capability to produce desired welding or etch patterns on a work piece. A wide range of standard pumping systems,

manipulating devices, and monitoring systems can be provided as optional equipment. (GVC Electron Heating Corp., 81 Hicks Ave., Medford, Mass.)

Circle 5 on Readers' Service card

Resistance thermometer provides direct digital reading of temperature from −100° to +900°C with accuracy said to be ±0.25°C or ±0.2 percent, whichever is greater. By means of a special circuit in the Wheatstone bridge, the reading of the balancing variable resistor is made to follow a second-degree relationship corresponding with the change in resistance of platinum with temperature. Each resistance bulb and bridge is individually calibrated. Resistance bulbs have vacuum-sealed platinum elements and leads and hermetically sealed heads with choice of stainless-steel or quartz jackets. A plug-in controller accessory said to provide ±0.2 percent reproducibility is also available. (Manostat Corp., 26 N. Moore St., New York 13, N.Y.)

Circle 6 on Readers' Service card

Physiological stimulator, for research and clinical work in human vision, generates a high-intensity burst of light controlled in several modes. The light source is a glow tube with an essentially white spectrum. In continuous-wave (CW) mode, the light flickers continuously at flicker frequency adjustable between 0.1 and 60 cy/sec. In gated-CW mode, an external pulse turns the flicker generator on and off. In gated-pulse mode, the source is turned on by an external signal and does not flicker. Source diameter is 1/16 in. (Industrial Control Co., Central Ave. at Pinelawn, Farmingdale, N.Y.)

Circle 7 on Readers' Service card

Digital integrator, recorder, and controller accepts the output signals from a variety of analytical instrumentation detectors and converts them to digital records of both time of occurrence and relative area of signal peaks. Output may be in digital-printer or typewriter format, punched cards or tape, or magnetic tape. Integration is performed digitally. The control unit of the instrument senses the start and end of data output signal peaks and also the instant of maximum signal. Logic circuits program the application of integral and peak-time values to the recording equipment. The system operates with an input of 100 mv full scale. Input impedance may be specified in

the 10- to 100-kohm range. Integrator capacity is six digits, but additional capacity is available. Accuracy is said to be ±0.1 percent of full scale. Sensitivity to rate of change of detector voltage is said to be better than 0.1 mv/sec, adjustable to allow maximum precision compatible with freedom from nuisance readouts. Signal peaks spaced as closely as 2 sec apart can be processed. (Infotronics Corp., 1401 S. Post Oak Rd., Houston 27, Tex.)

Circle 8 on Readers' Service card

Cathode-ray display system will simultaneously display on a 7-in. tube up to eight input signals superimposed on an electronically generated coordinate system. The signal wave forms and the coordinate system are displayed simultaneously to eliminate errors from distortion and nonlinearity. Accuracy of plotting is said to be ±0.2 percent. Full-scale deflection is provided by ±100 volts. An optional preamplifier permits expansion and zero-shifting of small signals. A choice of display periods ranges from 25 msec to 50 sec. Input signals and voltages for producing coordinate lines are sampled every 62.5 μsec for display. The time reference is provided by a crystal oscillator that triggers a vertical flying scan deflection system. (Philbrick Researches, Inc., 127 Clarendon St., Boston 16, Mass.)

Circle 9 on Readers' Service card

Neutron detector is a solid-state device with low gamma sensitivity and millimicrosecond response. The detector is available in two sizes, 5 by 5 or 10 by 10 mm, and with uranium, boron, lithium, or hydrogenous material coatings. A three-pin connection arrangement sockets into standard transistor bases. Operation is at 25 volts. (Solid State Radiations, Inc., 9926 W. Jefferson Blvd., Culver City, Calif.)

Circle 10 on Readers' Service card

Photographic exposure repeater, designed for production of precise photomasks required by the transistor industry, is built around a two-coordinate comparator. The equipment permits positioning of patterns with accuracy of ±0.0004 in., precise focusing, and precise setting of reduction ratio. The apparatus has a programming mechanism capable of performing various combinations of step-and-repeat operations for automatic exposures; operation can also be manual. (Geophysics Corporation of America, Bedford, Mass.)

Circle 11 on Readers' Service card

Bi-directional counter is designed for machine position readout. An incremental pulse transducer provides a wide range of resolutions with self-contained bi-directional logic. Capacity of the instrument is 5 or 6 digits with numerical readout tubes at count rates up to 5000 counts per second. Selector switches permit setting numbers into the counter. (Veeder-Root Inc., Danvers, Mass.)

Circle 12 on Readers' Service card

Accelerometers, the series PAL-1S and PAL-1P, are self-contained instruments said to provide accuracy of 0.1 percent. They operate on the force-balance servo principle in which the d-c current required to restrain a pendulous seismic mass measures the acceleration. Natural frequencies to 600 cy/sec or higher are available in ranges as low as ±2 grav. Total power requirement is ⅓ watt. (Palomar Scientific Corp., Palo Alto, Calif.)

Circle 13 on Readers' Service card

Galvanometer servo system combines a D'Arsonval movement with a precise film-type potentiometer. A signal fed into the meter is compared to a voltage obtained from the feedback potentiometer. If the meter movement position does not correspond to the position called for by the magnitude and polarity of the input signal, an error signal results which, after amplification by a self-

contained transistorized amplifier, drives the meter movement to correct the error. Response time of 50 msec full scale is said to be achieved by virtue of the high ratio of torque to inertia. Power required for position indication is 1 watt; maximum accelerating power is 1.5 watts.

By use of a meter movement with a conventional pointer and calibrated meter face, the device is converted to a voltmeter with 1-megohm input impedance and full-scale accuracy said to be ±0.25 percent, independent of stray magnetic fields and effects of shock and vibration. The instrument can be programmed by the addition of a set of front-panel upper and lower limits; each limit setting consists of an additional potentiometer element. The output of a limit potentiometer is compared with the output of the moving-coil system. When crossover is detected, a Schmitt trigger circuit switches in a power relay. (Computer Instruments Corp., 92 Madison Ave., Hempstead, N.Y.)

Circle 14 on Readers' Service card

Microincinerator burns 5-μ-thick slices of tissue on microscope slides by keeping the slides in a fixed position and passing the heat source over them. Fifty slides are set in position at one time, and an infrared furnace moving at a rate of 0.5 cm/min passes over them. This increases the temperature gradually to 680°C softening the glass surface and sintering the ash to the slide. As the furnace moves on, the slides are slowly cooled to room temperature. The residual ash may then be examined by dark-field microscopy. (Procter & Gamble Co., Cincinnati 1, Ohio)

Circle 15 on Readers' Service card

Interference filters selected to isolate visible-spectrum wavelengths important in laboratory and industrial work are available in calibrated sets. Each set contains ten filters in the range 404 to 706 mμ, four neutral density filters, and one continuously variable wedge filter covering the range 400 to 750 mμ. (Optics Technology, Inc., 248 Harbor Blvd., Belmont, Calif.)

Circle 16 on Readers' Service card

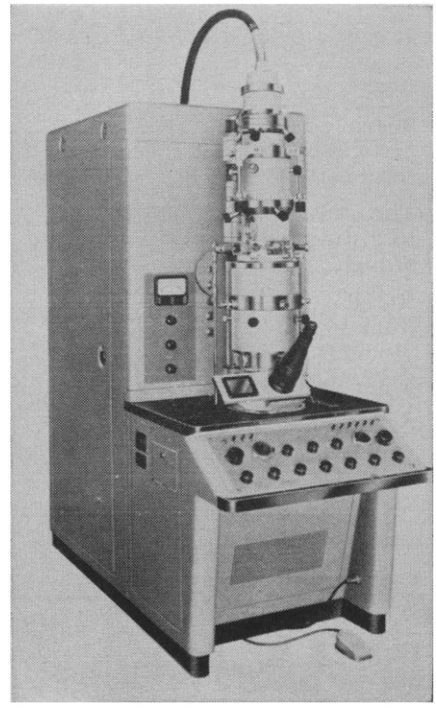
Pressure switches operate in the differential pressure range from 0.25 to 16 in. of water. The devices operate by means of a spring-biased diaphragm. At preselected pressures, the diaphragm actuates a rod that in turn operates a switch mechanism. Actuation pressure is set by a direct-reading dial; overpressures up to 250 lb/in.^{2} are tolerated. Actuation of the units is said to be completely independent of absolute working pressure. (Pall Corp., Glen Cove, N.Y.)

Circle 17 on Readers' Service card

Count-rate meter is a transistorized instrument for use with Geiger-Mueller tubes, proportional detectors, or scintillation detectors. Five count-rate ranges up to 10^5 counts per minute are provided with probable-error settings of 2, 5, 10, and 15 percent for each range. Input sensitivity is said to be better than 1 mv. The instrument is capable of driving both 0- to 1-ma and 0- to 100-mv recorders. A 3000-volt power supply is included. (Nuclear Corporation of America, Denville, N.J.)

Circle 18 on Readers' Service card

Electron miscroscope, manufactured by Japan Electron Optics Laboratory Co., Ltd., features a magnification range continuous from 600 to 200,000. Resolving power is said to be 6 A. Facilities are provided for effecting chemical and physical transformation of specimens within the microscope. A tensile-deformation attachment can be used to probe points in metal, and a heating attachment can raise the specimen temperature to 1000°C. A built-in 16-mm cine camera makes continuous motion pictures of changes that take place in the specimen. Available at-



tachments include cooling, heating, and reflection apparatus; specimen tilter; charge neutralizer; x-ray shadow camera; a vacuum evaporator for metal shadowing to reveal relief and to prepare thin carbon support films; and an ultra microtome. (Fisher Scientific Co., 717 Forbes Ave., Bellport, N.Y.)

Circle 19 on Readers' Service card

Rotary acceleration generator produces centrifugal fields from 3 to 500 grav. Rotational speed of the 20-in. table ranges from 10 to 2000 rev/min. Twenty slip rings of hard coin silver provide for communication with instruments mounted on the rotating table. Slip ring noise is 1 μv (max.) at 1 ma. System accuracy is said to be $\pm$0.1 percent over the full range with regulated line voltage. For speeds above 40 rev/min, wow is 0.5 percent and drift 0.1 percent. Vibrational resolution is 0.02 grav. A tachometer generator provides direct indication of speed on a panel meter, and a magnetic pickup and 20-tooth gear provide a signal for an electronic counter. (Pacific Southwest Instrument Laboratories, 5705 Centinella, Culver City, Calif.)

Circle 20 on Readers' Service card

Resistance network analog is designed to solve problems involving Poisson's, Laplace's, and special cases of Maxwell's equations. Over-all network accuracy is said to be better than one part in 10,000. The analog is a self-contained system including the resistance network board, 150 current injection potentiometers, three regulated d-c power supplies, a digital voltmeter, and a vacuum-tube voltmeter. It may be combined with a digital computer for accurate calculation of electron trajectories. Programs for the IBM 704, and 7090, and Philco 2000 digital computers are available. (Litton Industries, 960 Industrial Rd., San Carlos, Calif.)

Circle 21 on Readers' Service card

Log-frequency converter provides a d-c voltage output that varies in proportion to the logarithm of the frequency of an input signal. The input may vary from 0.5 to 100 volts and may have high harmonic content without affecting accuracy. Full-scale outputs are 100 mv at 400 ohms or 10 mv at 40 ohms. Interchangeable plug-in discriminator networks with one-, two-, or three-decade ranges cover the range from 5 cy/sec to 20 kcy/sec. Accuracy is said to be better than $\pm$1 percent for two-decade

ranges and ±0.5 percent for one decade. A three-decade unit covering the range from 20 cy/sec to 20 kcy/sec provides an accuracy of ±2 percent. A plug-in oscillator permits alignment of span and zero. (Houston Instrument Corp., P.O. Box 22234, Houston 27, Tex.)

Circle 22 on Readers' Service card

Thermocouple reference junction is a temperature control device that provides a constant thermocouple reference temperature of 250°F with a 24-channel capacity. Uniformity between junctions is 1°F, and ripple is less than ±1°F. Regulation through the ambient range −65° to +165°F is said to be less than 3°F. The device measures 3¼ by 3¼ by 5¼ in. and weighs less than 4 lb. Nominal power consumption is less than 5 watts. (Astra Technical Instruments Corp., 12930 Panama St., Los Angeles 66, Calif.)

Circle 23 on Readers' Service card

Fetal-heart monitor provides constant visual and audible monitoring of the fetal heartbeat during labor and through delivery. Any irregularity, or a drop below the danger level of 100 beats per minute, is instantly recorded. Monitoring is performed by means of electrodes attached to both the mother's body and to the fetus, still contained within the womb. The heartbeat is displayed on an oscilloscope screen; a meter indicates heart rate. A permanent trace may be recorded by attaching a standard electrocardiograph. (Hemathermatrol Corp., 5334 Rockville Rd., Indianapolis, Ind.)

Circle 24 on Readers' Service card

Depth recorder surveys depth in three ranges—400 ft, 400 fathoms, and 4000 fathoms—at repetition rates of 360, 60, or 6 per minute, respectively. Resolution on the 400-fathom range is said to be better than 1 fathom. The fully transistorized instrument has a display width of 19 in. Recording is made with a resilient helix and stainless-steel endless loop electrode and electrosensitive paper. (Alden Electronic & Impulse Recording Equipment Co., Westboro, Mass.)

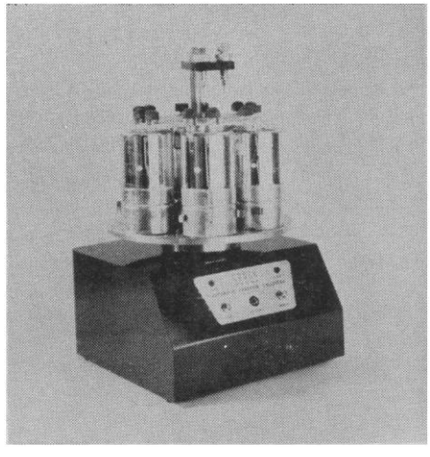
Circle 25 on Readers' Service card

Scintillation detector kit for educational use consists of a probe housing, a multiplier phototube, and a set of interchangeable phosphor scintillators. The basic kit includes a sodium iodide crystal for gamma detection, a sodium

iodide well-type crystal, a plastic phosphor for general purpose detection, a thin zinc sulfide crystal for alpha detection, and an anthracene crystal for beta detection. Seven additional crystals are available for neutron detection and other special applications. Since the crystals are interchangeable only one multiplier phototube is required for use with the 12 different phosphors. (Radiation Equipment and Accessories Corp., 665 Merrick Rd., Lynbrook, N.Y.)

Circle 26 on Readers' Service card

This **automatic fraction collector,** designed especially for gas chromatography, can be placed on bench space next to a chromatograph to receive fractions through a heated gas transfer tube. Each of six tubes can be automatically or semiautomatically rotated into collecting position, directed either by a panel control button or by a signal from a strip-chart recorder when the indicator pen reaches a preset level. Total cycling time from one tube to the next is 6 sec. The individual collector tubes are immersed in Dewar-type vacuum flasks containing dry ice to



condense the fraction before the carrier gas is exhausted. The collector measures about 1 ft square and less than 20 in. high. (Central Scientific Co., 1700 Irving Park, Chicago 13, Ill.)

Circle 27 on Readers' Service card

Oximeter recording system can be used to make dye-dilution curves indicative of heart function with either Evans Blue or Cardio-Green dye, as well as for immediate, continuous determination of blood oxygen saturation. As an oximeter, the system has a standard deviation from Van-Slyke analysis of approximately 2 percent in the 90- to 100-percent saturation range, with somewhat greater deviation at lower

saturation levels. It is said to be insensitive to changes in flow rate and hematocrit, and to be relatively unaffected by age, color, blood hemoglobin content, or ear thickness. (Waters Corp., P.O. Box 529, Rochester, Minn.)

Circle 28 on Readers' Service card

Very-low-frequency timing receiver is a solid-state instrument that may be used, through front-panel selection, at 16, 18, or 20 kcy/sec to receive timing signals from stations GBR, Rugby, England; NBA, Balboa, Canal Zone; and WWVL, Sunset, Colorado. The signal selected is automatically correlated with a signal derived from a local standard by means of internal regenerative divider circuitry, giving an output of approximately 1 cy each 50 sec for a frequency difference of one part in a million. Sensitivity is said to be better than 1 μv with a rejection of 50 db at 200 cy either side of the selected channel and greater than 80 db at image frequencies. An output meter indicates the beat difference frequency, and a $\pm$0.5-volt output is available for use with an external recorder. Other outputs include a 2-kcy/sec audio signal and a time-tick consisting of a 5-msec pulse. This pulse is synchronized to the incoming very-low-frequency pulse and may be used for starting clocks, counters, or other external equipment. (Interstate Electronics Corp., 707 E. Vermont, Anaheim, Calif.)

Circle 29 on Readers' Service card

Translucent magnesium oxide is said to come within 2 percent of the maximum density possible. Strength, when chemically polished, is stated to be 45,000 lb/in^2. Its melting point of 2800°C suggests its use in such high-temperature applications as heat-exchange medium in wind-tunnel, pebble-bed heaters and electrical insulation at elevated temperatures. (Minneapolis-Honeywell Regulator Co., Ridge Ave. at 35 St., Philadelphia, Pa.)

Circle 30 on Readers' Service card

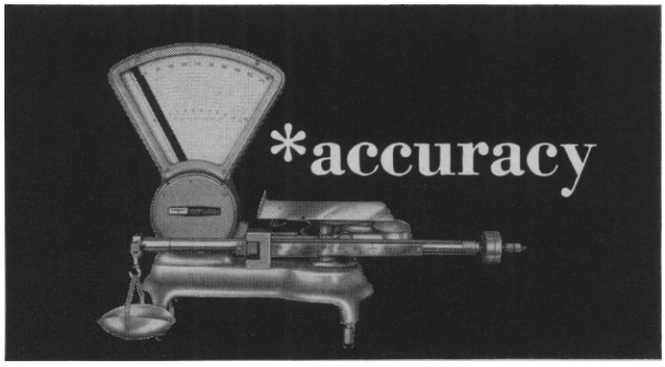
Dosimeter combines a small glass-rod detector of silver-activated material with a fluorescence measuring instrument. Range of the instrument is 10 to 10,000 rad, and accuracy is said to be $\pm$4 percent. To perform a measurement, the operator inserts the 1- by 6-mm detector into the reader and determines the changes in fluorescence that have taken place as a result of exposure to high-energy radiation. The detector rods are small enough to permit implants to be made in normally inaccessible areas. (Bausch and Lomb Inc., Rochester 2, N.Y.)

Circle 31 on Readers' Service card

Monopulse high-energy gamma source is available in several models with differing gamma intensity and pulse width. The sources are linear accelerators. Electrons produced by a heated cathode are injected at one-half the velocity of light and are accelerated by riding the crest of a traveling wave. After reaching about 0.99 *c*, increase in energy is obtained by increase in mass. The high-energy electrons strike a target to produce gamma radiation by the bremsstrahlung method. Peak intensities produced are 3×10^6, 6×10^6, and 10^7, respectively, in three models. Corresponding pulse durations are 1, 0.1, and 0.01 μsec. Power source is a 5-Mw (peak) magnetron. (Hughes Aircraft Co., P.O. Box 90515, International Aircraft Station, Los Angeles 45, Calif.)

Circle 32 on Readers' Service card

JOSHUA STERN
National Bureau of Standards, Washington, D.C.



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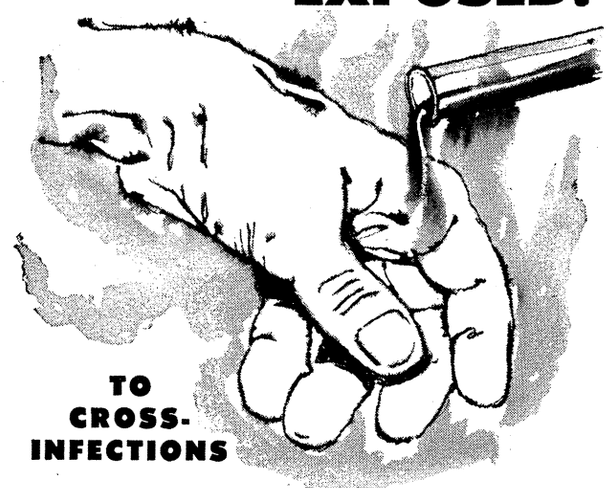

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with the "over-all view of the book." The book was prepared in close consultation with the individuals listed as contributors to the book. During the course of these consultations they were free to voice their dissent with the "over-all view." Not a single one did; not a single one has done so since.

5) The same article contains the following statement: "This report, perhaps unavoidably, has given the entire movement associated in one way or another with the Forward Strategy a more monolithic character than it actually has."

I know of no movement—"monolithic" or otherwise—associated with the "Forward Strategy." I herewith state categorically that the Foreign Policy Research Institute is not associated with any "movement." A political movement —and the author of the article can have no other movement in mind—must be organized in order to justify the term. This institute has no connection with any political movement aimed at promoting any particular set of political doctrines or strategic concepts. Members of this institute, like most Americans, are members of one of our two great political parties and of a variety of civic, professional, and scientific organizations. The Foreign Policy Research Institute has no affinities except those that are explicit in its status as a research group within the University of Pennsylvania.

6) The author of the two articles seeks to establish a covert relationship between *A Forward Strategy for America* and another book published previously by the Foreign Policy Research Institute—namely, *American Strategy for the Nuclear Age*. According to H.M., the purpose of the latter book was to soften and prepare the way for *A Forward Strategy for America*, which, according to him, maintains that the U.S. must prepare for launching a surprise attack against the Soviet Union. Although this assertion is made repeatedly, H.M. is careful to protect himself by an ingenious literary device against the charge of having disregarded the actual text of both books. He concedes that the book does not contain a proposal for a policy of striking "a surprise knock-out blow" at the Soviets. Yet he has mastered this problem by writing as follows:

> This policy is not specifically stated in the book; it is merely the only realistic policy that follows from the premises of the book, and the members of the Foreign Policy Research Institute consider themselves, above all else, as realists.

His conclusion thus boils down to an attempt to read our minds rather than our writings. This procedure can be characterized in various ways; it cannot be mistaken for scientific method.

ROBERT STRAUSZ-HUPÉ
Foreign Policy Research Institute, University of Pennsylvania, Philadelphia

I could argue with a number of the points in Strausz-Hupé's letter, but overall there is no doubt that the articles contain substantial flaws. I think the letter of censure is well deserved.—H.M.

Drugs and the Kefauver Bill

The following statement appeared recently in "Science and the news" [*Science* **134**, 89 (14 July 1961)]: "Kefauver has produced evidence that a sizable proportion of the new drugs patented and put on the market are not in any significant way new. They involve merely minor changes in the molecular structure of an already avail-

able, and perhaps unpatented, drug; their only advantage is that they can be patented, promoted as a new drug, and thus be relieved of direct competition with similar drugs identical in their medical effects. The Kefauver bill would require that a drug be significantly different in its effects as well as in the details of its molecular structure in order to be patentable."

I wish to call attention to the fact that Senator Kefauver's generalization does not apply to most psychoactive drugs, for the brain is more sensitive than any other organ to the chemical structure of a drug. Let me say in the first place that in most instances the first member of useful groups of drugs was found by accident, as a trained worker took advantage of a chance observation. Further development, however, came from the application of the principle of molecule manipulation. This applies to meprobamate (trade names, Miltown and Equanil), one of the drugs most widely used in the management of the neuroses, and chlorpromazine (Thorazine), a member of the phenothiazine group of drugs, which is employed more than any other in the treatment of the psychoses.

Mephenesin was synthesized to provide a drug affording muscular relaxation. In the course of clinical study it was noted that the muscular relaxation was sometimes accompanied by tranquilization. This finding led to the synthesis of meprobamate, which has stronger central effects than its parent substance, and today this drug is widely used as a mild tranquilizer, especially for the treatment of the neuroses, as it relieves anxiety and tension. Further development of meprobamate—namely, the formation of mebutamate—yielded a drug with less marked tranquilizing action but with intensified power to lower blood pressure. Additional molecule manipulation yielded carisoprodel, which evokes more pronounced muscular relaxation than mephobamate.

Largactil, known as chlorpromazine in the United States, was administered to disturbed psychotic patients in France because of its sedative action. This new drug, however, showed a capacity to reduce psychotic excitement not found in earlier drugs, and it has achieved wide usefulness as a strong tranquilizer. The sedatives previously employed could not relieve hyperactivity and calm the patient, nor could they reduce the intensity of hallucinations and delusions without inducing sleep. The other

phenothiazine drugs now used were developed by molecular manipulation, and they perform the same actions but to different degrees. The stronger ones require a smaller dosage and evoke lower degrees of sedation and fall in blood pressure. Convulsions and rashes are less frequent, while jaundice and a decrease in white blood cells occur more rarely than with the weaker phenothiazine derivatives. But for the advantages of the more potent members of the phenothiazine group, and their greater stimulating powers, we must pay the price of an increase in undesirable neurological effects such as tremor, motor restlessness, spastic muscular contractions, and involuntary muscular movements. The wide variations among the various phenothiazine drugs permit the discerning psychiatrist to select the one most suitable for an individual patient, through his knowledge of the greater tranquilizing action of the weaker phenothiazines, the greater stimulating effect of the stronger phenothiazines, and the characteristic intensities of the side reactions, which differ with each member of the phenothiazine group.

Altering the molecular structure of some parts of the phenothiazine molecule yields drugs which produce behavioral effects not evoked by phenothiazines. The substitution of a diethylene linkage ($-CH_2-CH_2-$) for the sulfur atom (S) produces imipramine (Tofranil), and instead of a tranquilizer we have an antidepressant drug.

These facts, and many more like them, reveal the importance of molecule manipulation in research but do not answer specifically Senator Kefauver's objection to patenting drugs which seem to have similar actions despite molecule manipulation. The diversity of reactions to the same drug by different patients is well known. It is true that most patients react in similar ways to a given phenothiazine, but it is a remarkable fact that psychotic patients who are not improved by one of two apparently equivalent phenothiazines may receive benefit from the other. Clinical use of new phenothiazine reveals that some patients who were not helped by the previously known phenothiazines respond to the new one. It would seem that, with enough patience, a phenothiazine derivative could be found to improve every schizophrenic to some degree. Such a prospect could not be realized if drugs that produce similar effects in most patients were not

developed and administered to patients whose reactions differ from those of the majority. If the restrictions suggested by Senator Kefauver were adopted, they would hinder the development of many useful drugs. This would change our present situation, so full of promise, to one of restricted output, not conducive to future progress.

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Being a research chemist in a drug firm I am perhaps biased, but I feel that a protest should be registered against Howard Margolis's account of the hearings on the Kefauver omnibus bill for regulation of the pharmaceutical industry. Margolis does not report on Senator Kefauver; he propagandizes for him.

The tenor of the article is indicated by the last two sentences: "For all these reasons a far more intense controversy surrounds the bill than a casual reading of Kefauver's bill would suggest. For the bill, on a casual reading, appears to contain nothing more than a series of minor technical changes in laws of whose existence the public is scarcely even aware." Now the changes proposed by the bill are not minor, and what is so troubling about the account in *Science* and the attitude of Kefauver is the complete failure to understand that these changes are a grave threat to the future of research in medicinal chemistry. One may just as well expect the modern theater to flourish without copyright protection.

The pharmaceutical industry has been accused of excessive price-charging by Kefauver. The industry has replied that prices are generally not excessive, and that one factor which the senator has failed to take into account with regard to new drugs is the high cost of research. Kefauver answers in his omnibus bill with licensing regulations which will effectively eliminate research. Drug prices will drop if research is stopped, but there is a catch —there will be no new drugs.

Senator Kefauver will not pay for progress. He has the viewpoint of Ortega y Gasset's "hyperdemocrat," who "wants his motor-car, and enjoys it, but believes that it is the spontaneous fruit of an Edenic tree. In the depths of his soul he is unaware of the artificial, almost incredible, character of civilization, and does not extend his enthusiasm for the instruments to the principles which make them possible" (*Revolt of the Masses*, chap. 9).

Margolis repeats, with apparent approval Kefauver's contemptible suggestion that the American Medical Association has come to the defense of the drug industry solely to protect the advertising revenues of its journals.

One expects a better understanding of science in *Science*.

EDWARD F. ROGERS
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The point of the article was exactly the one made in Rogers' letter: namely, that, as the two sentences he has quoted suggest, the bill is designed to have a profound effect on the drug industry even though a casual reading might suggest merely a series of minor technical changes. The article did not say, and so far as I can see did not suggest, that the sole reason the AMA supported the industry was to protect its advertising revenues.—H.M.

Rainfall Singularities

This letter has been prompted by the appearance of a recent lead article in *Science* [**134**, 361 (11 Aug. 1961)]. Survey articles of this type, touching as they do on research problems which fire the public imagination, serve a useful purpose in presenting a comprehensive picture of the state of the art. It is unfortunate that Fletcher was not aware of the difficulties in the analysis of the rainfall data which he discussed, and their implications. There is now a good deal of evidence to suggest that there are no world-wide rainfall singularities. In the conclusion to his article Fletcher states, "If, however, as appears to be the case, the rainfall singularities are real, then the meteor hypothesis is the only one which has been advanced as yet which seems capable of explaining them." Logically, if the rainfall singularities are not real, then no hypothesis or speculation is necessary. Let us look at the observational evidence for the existence of rainfall or other geophysical singularities.

As Fletcher has noted, it is difficult to estimate statistically significant departures when a number of records have been arbitrarily lumped together. This is particularly true when there has been no effort to select observations that are independent of one another in time or space. Bowen's original work combined data from 300 stations for about 50 years ("15,000 station years"). The geographical distribution of stations is shown in Table 1.

Table 1. Geographical distribution of stations.

Area	Stations (number)
Argentina	10
Australia	50
Great Britain	100
Japan	32
Netherlands	5
New Zealand	58
Union of South Africa	10
United States	48

As is well known to meteorologists, the spatial correlation of rainfall over small regions (for example, Great Britain) is quite high. Not only does this spatial correlation decrease the number of the degrees of freedom of the resulting curve (see Fletcher's Fig. 6), but it introduces a bias into the estimation of what constitutes "world-wide" rainfall. Therefore the "15,000 station years" are equivalent to only a small fraction of this number of independent observations. This criticism is as valid now as it was when Bowen's work was first published.

However, Bowen's evidence seemed to be supported by the later work of Brier. Comparing two rainfall time series, independent of each other and of Bowen's original data, Brier stated that "these results [Brier's] lead to the conclusion that there has been a strong tendency for precipitation anomalies (both high and low) to occur on specific calendar days." Recently, R. Shapiro and N. J. Macdonald [*J. Meteorol.*, in press], using Brier's data, showed that the relationships between the rainfall series were due solely to a coincidence of days of average rainfall. This led to the conclusion that "Brier's results may be said to show a weak tendency for the association of nonanomalies of precipitation on specific calendar dates." Therefore, Brier's work cannot be considered evidence in support of the existence of rainfall singularities.

Fletcher indicates that Dmitriev and Chili also found rainfall peaks that corresponded to those in the Bowen data. Unfortunately, no reference is given.

Again, according to Fletcher, "Bowen found a correlation between his rainfall peaks and intense meteor showers occurring about 30 days previously, as shown in [Fletcher's] Table 1." Because of the number of showers, their duration, and the 28 to 32 days that Bowen actually allows for verification, the results shown could easily be obtained by chance, as a simple chi-square test will show.

As further support, Fletcher goes on to cite the cirrus-cloud study by E. K. Bigg [*J. Meteorol.* **14**, 524 (1957)]. Bigg claimed some association between the mean percentage of sky covered by cirrus and Bowen's 300-station rainfall curve. A simple calculation shows that the linear correlation coefficient between the two curves in Bigg's paper is only + 0.24. Even if the observations were completely independent of one another (which they are not), the correlation does not even approach the 5-percent significance level. It is not surprising, then, as Fletcher has also noted, that Braham failed to find any confirmation of Bigg's results.

It is quite apparent that the evidence for the existence of rainfall singularities will not stand careful scrutiny. It seems irrelevant, then, to speculate on physical explanations.

NORMAN MACDONALD
FRED WARD

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The comments of Macdonald and Ward emphasize the fact that controversy still rages over almost all aspects of the meteor hypothesis. It is perhaps unfortunate that decisive physical tests of the theory are lacking and that most arguments concern the statistical significance of apparent correlations between various time series. It is a notorious fact that statistics can be made to support almost any proposition in a sufficiently complicated situation, and both the proponents and the opponents of the theory have often erred in drawing unwarrantedly strong conclusions from inadequate sets of data.

The criticism of the data upon which Bowen's world rainfall curve was based appears to have a certain validity. Ideally, some sort of weighting should be introduced to take account of the clustering of sets of stations, but any such doctoring of the raw data brings with it further possibilities of bias. It would, however, be most instructive to see the results of some such independent and impartial treatment of the same data.

It is impossible to comment on the criticism of Brier's conclusions until the paper referred to has been published. The reference to the Russian work was omitted as not being readily available to readers. It is as follows: A. A. Dmitriev and A. V. Chili, *Trudy Inst. Morskogo Gidrofizicheskogo* **12**, 181 (1955?).

As my original article was intended to imply, I do not believe that the existence of world-wide rainfall singularities has been either unequivocably demonstrated or finally discounted. The same must be said of the meteor hypothesis itself.

N. H. FLETCHER

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Complete Disarmament

The editorial "Arms control and self control" [*Science* **134**, 249 (28 July 1961)] speaks of "present efforts to show how the Soviets put up obstacles to disarmament." The value of these efforts appears to be questionable as long as we continue to dismiss the Soviet 4-year plan for complete and universal disarmament as unrealistic or as propaganda. Our present attitude toward this Soviet proposal would suggest that it is we who do not wish to disarm, espe-

cially in view of evidence that the U.S.S.R. intends this proposal seriously and considers complete disarmament to be a realistic policy.

Some of this evidence might be summarized as follows: (i) Public speeches by Soviet leaders indicate that they, like some of our own leaders, are worried about the consequences of a continued arms race—notably the increasing probability of war. The U.S.S.R. experienced widespread devastation and the death of some 25 million people as a result of the German attack in World War II. Present Soviet leaders apparently wish to avoid a repetition of this experience; the new 20-year program of the Soviet Communist Party is reported to give top priority to "saving mankind from devastating world war." (ii) Under the Soviet system of nationalized industry, continued expenditures on armaments represent a wasteful drain on the national economy, with no particular profit to anyone. (iii) The detailed disarmament plan submitted by the U.S.S.R. to the United Nations in 1960 provides for international control and inspection of all stages of disarmament as well as an international police force and does not include any veto on control measures. Premier Khrushchev has recently repeated his statement that the U.S.S.R. is prepared to accept any control measures proposed by the Western nations if we in turn agree to the Soviet proposal for general and complete disarmament.

Regardless of our opinions about the U.S.S.R., most of us would agree with the Soviet leaders that a world free from wars and the fear of wars would be desirable. If we do not wish to be condemned by "uncommitted persons and nations," we cannot now afford to dismiss the Soviet disarmament proposal without more serious consideration than that of its propaganda value.

The question of complete disarmament involves the decision whether the products of scientific research are to be used for the destruction or for the enrichment of human life. If this choice is open to us now, scientists themselves bear both individual and collective responsibility for the decision.

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Exporting Universities

Although I do not totally disagree with the ideas of Arthur F. Burns and H. V. Fairbanks [see *Science* **133**, 1557 (1961); **134**, 225 (1961)], I wish to make the following observations as a foreign student under the Fulbright program.

Very often the foreign student finds it difficult to locate an educational institution offering a suitable program of training bearing on the needs of his country. Perhaps for financial reasons he is forced to enter a school which offers him support, no matter what the nature of the training is going to be. This does not depend on whether or not he makes the choice of the institution before he arrives in this country; when he arrives in this country he has a high hope of making his training most profitable to his country. The choice of a wrong institution results in waste of the talent and resourcefulness of the individual concerned. It is probably for this reason that a foreign student gets discouraged and dissatisfied when he returns home, and not because he is unable to "teach what he has learned."

Further, it is not entirely true that a lack of identical scientific and educa-

tional facilities in the home country would prevent a student trained abroad from teaching what he has learned. I feel that it is the principles one learns that are most important, rather than what tools he uses to learn them. As long as the student is able to adapt these principles to conditions at home, he will feel no dissatisfaction when he returns home. Besides, what the student learns outside the classroom and the laboratory goes a long way toward educating the individual and ultimately, through him, many others. In this sense, I feel, students should always be encouraged to visit foreign countries to further their own education and ultimately be useful to their countries.

The idea of "exporting universities," however, is a good one, but it would create more problems than we imagine.

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Discovery and Obligation

The editorial "The jinni in the bottle" [*Science* **134**, 359 (11 Aug. 1961)] ends with the curious questions whether the scientist can be expected "to differentiate his role as a scientist from his role as a citizen," and what can fairly be asked of a scientist in relation to anticipated social consequences of his discoveries. It is implied in these questions that his scientific activity divorces the investigator from his responsibilities as an ordinary human being. No such assumption is ever made, nor is its necessity felt, if the economic and social consequences of discoveries are pleasant ones, conferring benefit on humanity. It is even taken for granted, and justly so, that a scientist shall, if necessary, battle the vested interests, academic or otherwise, and openly oppose entrenched ideas and practices once his discoveries have convinced him that doing so is required by the public welfare. Many of our greatest scientists have assumed this responsibility at a heavy cost in personal comfort and peace. Why should the situation be different if the potential consequences of a discovery bode ill for humanity?

Your editorialist concludes reasonably that there is little point in recoiling from a discovery and in putting "the jinni back into the bottle," since, "if he stops, someone else will continue." Un-

less scientists arrogate to themselves ethical standards apart from others, their duty cannot be in doubt. Discoveries are made at the risk of the investigator. Knowledge confers obligation. It is not enough for the scientist to make his discovery public; it is his clear duty to set forth any evil consequences that may be brought about by it, to give warning to those most likely to be able to forestall harmful effects, and to enlighten the public.

WALTER LANDAUER
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With reference to the editorial "The jinni in the bottle," we should never allow any jinni (new knowledge) to be kept in the bottle.

Neither war nor peace is an act of God; both are caused by man, and it is important to realize that knowledge used to fabricate weapons to wage war may ultimately be useful for the waging of peace. The nitrogen mustards and organic phosphates, gases for war, ultimately proved to be of value in cancer chemotherapy and insect control, respectively. Atomic energy itself has also led to weapons for peace heretofore visualized only by the prophets of science.

What man has made for war man can also use for peace.

R. H. ADAMSON
Bethesda, Maryland

The writer of the excellent editorial "The jinni in the bottle" begins with the interesting pastime of undoing history in order to rewrite it, but proceeds to the very real question of whether a scientist can separate his role of scientist from his role as citizen.

The question is raised in connection with the development of nuclear weapons, resulting from basic scientific work in nuclear physics, and extends to the possibility of undesirable effects if large-scale control of weather, genetic material, and so on should become possible.

The dichotomy, it seems to me, is not between the scientist as scientist and as citizen but between the scientist as scientist and as human being. If a scientist anticipates abuse of his discoveries as a probable future event, he should discontinue his work; otherwise, he personally becomes morally and socially responsible for this abuse. The mere fact that, if he discontinues, somebody else may pick up the threads and continue does not absolve him from his

responsibility. If this reasoning were to hold, it would absolve any driver arrested for a traffic violation because he could say if he had not speeded, somebody else would have.

In former times, this sense of personal responsibility was strongly developed, and it may be well to remember that Leonardo refused to disclose the invention of a submarine because he foresaw the evil use to which such an invention might be put.

VICTOR PASCHKIS
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Classroom Teaching and Research

Your editorial "The system," in a recent issue of *Science* [**134**, 159 (21 July 1961)] deals with what I regard as one of the most important and troublesome problems facing our universities, but one which is generally ignored. Partly as a result of our desire to increase research activity and partly because of the availability of research funds in nearly all fields, the best minds in our universities are being diverted from undergraduate teaching to research and graduate teaching.

Our energetic young staff members try to get out of beginning courses as soon as possible in order to have more time for research. If the present trend continues, only those staff members lacking the initiative and imagination to obtain research grants will be left to do our undergraduate teaching. We can scarcely expect such people to be effective in attracting bright young students into graduate school. In fact, they cannot even give the general student body the kind of background it needs.

The effects on undergraduate teaching of our excessive preoccupation with research on university campuses is seen in the fact that most of our graduate students come from colleges where little research is done, and relatively few come from universities where research occupies much of the time and energy of the staff.

You suggest that perhaps undergraduate teaching will be left largely to the four-year colleges, but they also are beginning to develop research programs which will divert an increasing proportion of the time and energy of their staff members away from teaching. As I hear college administrators asking for money to develop research programs, I wonder if they realize how this may affect their teaching programs.

Good undergraduate teaching and good research are not incompatible, but they are competitive, and whichever promises the most rewards is likely to take precedence. Young college staff members distrust the claims of administrators that they will reward good teaching, because they have seen too much evidence that research and publication are rewarded even better. It takes many years for an individual or a department to build a reputation for good teaching, but a few good papers will establish a reputation for research rather quickly.

I doubt if many of our university administrators have given serious attention to this problem. Most of them have encouraged staff members to take as much research money as they can obtain and have shut their eyes to the consequences. Perhaps administrators need to reconsider their objectives and the value scales used for determining pay and promotion. It seems possible that a well-taught freshman course and a few good students inspired to go into graduate school may be a greater accomplishment for most of us than our research.

PAUL J. KRAMER

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Your editorial entitled "The system" is the sort of challenge that I envisaged in a recent article [*Queen's Quarterly* **68**, 249 (1961)]. Writing on "Double standards and the university professor," I said the following: "To teach, even to teach well, is not by itself enough for the university professor. This has come to be accepted so widely and without question in top-ranking academic circles that it has assumed the proportions of sacred dogma. As with most dogmata, its very danger lies in its demand for blind faith. Such demands lead in turn to a very natural reaction—an ever-enlarging group is certain to appear sooner or later to challenge the dogma, or to cast it aside as untenable, or perhaps to replace it with a new and diametrically opposite one. Such a challenge seems to be looming in general attitudes toward the rôle of the university professor. As the pressure of increasing enrollments grows more and more acute, should we revise our concept of the ideal university teacher and adopt more firmly the tacitly accepted double standard of many inferior colleges?"

Needless to say I was surprised at the source of reaction. The difficulty stems not so much from the dichotomy in the responsibility of the professor but rather