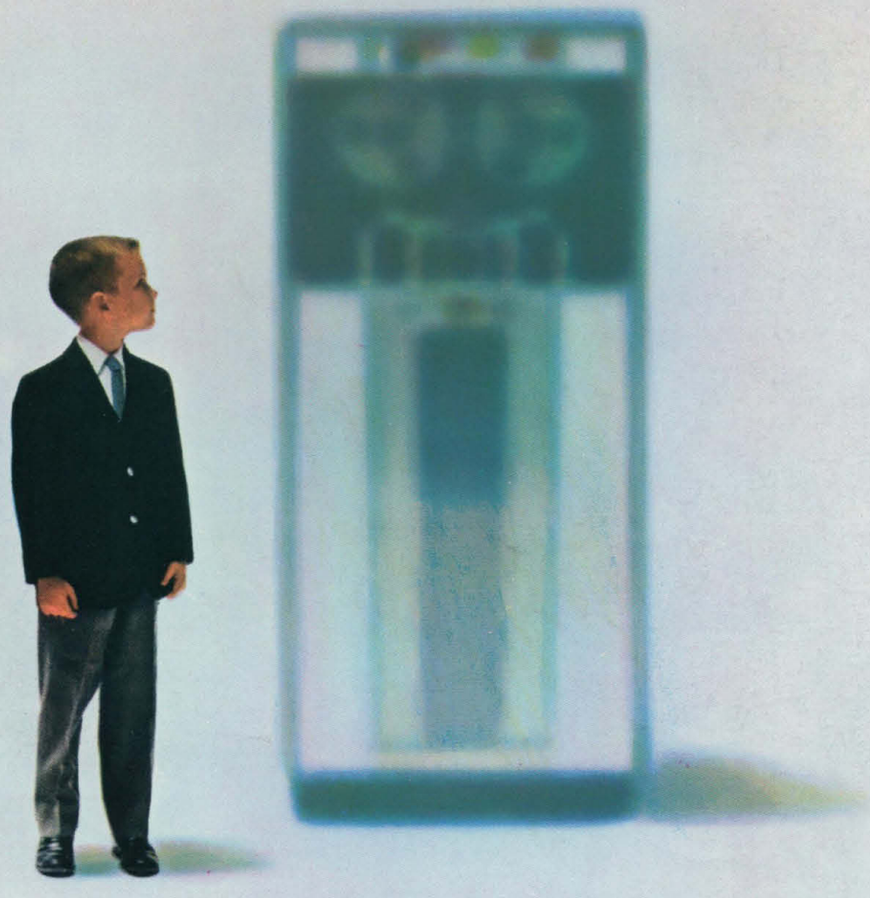
SCIENCE

8 June 1962

Vol. 136, No. 3519

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

What kind of computers will be needed tomorrow?



As man reaches further for knowledge, the problems he meets become more complex. IBM is developing new computers to help solve them.

Some modern electronic computers can make a million calculations a second . . . store information bits in the multimillions.

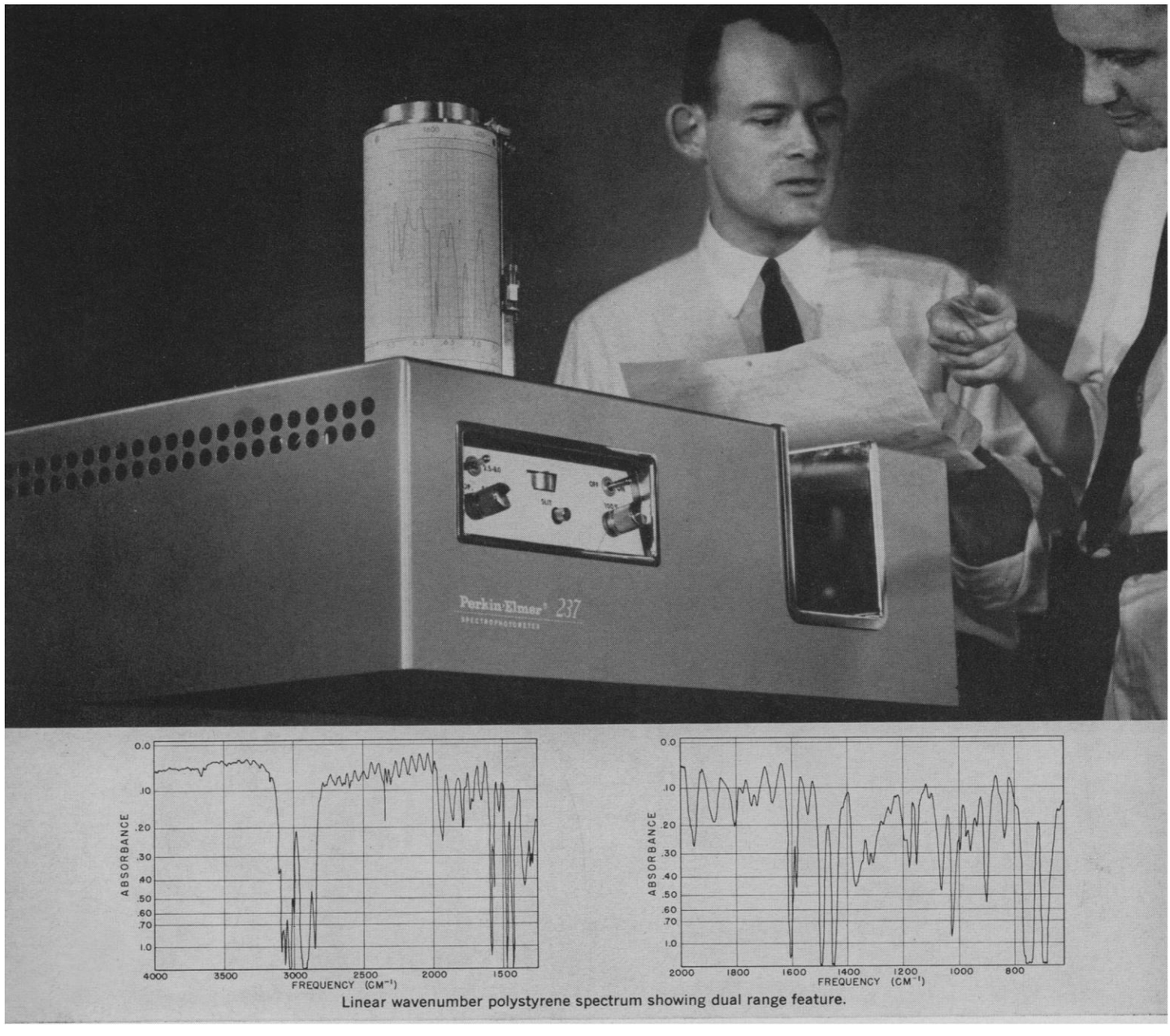
Even this is not always enough. The problems that computers are being given to solve grow more complex every day. They point to the eventual need for faster speeds and greater capacities. After years of dealing in millionths of a second, IBM scientists now talk of billionths of a second.

How do they hope to achieve such speeds? By tapping completely new principles for the operation of computer circuits. IBM scientists and engineers, for example, are developing computer circuits and high-speed memories of thin magnetic films of metal. They also are investigating the application to computers of tunnel diodes, and of cryogenic circuits which function at temperatures approaching absolute zero.

From these research directions will come new generations of computers. IBM is exploring them all now, to assure businessmen and scientists that computer technology will be ready for new generations of information-handling problems.

IBM

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



Linear wavenumber polystyrene spectrum showing dual range feature.

NOW... GRATING RESOLUTION OVER FUNDAMENTAL IR RANGE WITH NEW MODEL 237 SPECTROPHOTOMETER

You now can have the advantages of high-resolution analysis over the entire infrared spectral range of fundamental analytical importance—4000 to 625 wavenumbers (2.5 to 16 microns)... even if your budget is limited. The new Perkin-Elmer Model 237 Double-Grating Spectrophotometer, latest in P-E's low-cost Infracord line, makes this possible.

Basic to this high performance at low cost is the Model 237's grating-filter design: the dispersing power of gratings, used only in their first orders, is complemented by filters to eliminate higher orders of radiation. The result is outstanding spectral purity achieved with simplicity and dependability of mechanical operation previously not available.

Flexible Presentation. You can specify a Model 237 recording in either linear wavelength *or* linear wavenumbers, as you prefer. Full wavelength coverage is divided into two ranges — 4000-1300 and 2000-625 wavenumbers (see spectrum above); *or* 2.5-7.7 and 5.0-16 microns. The analyst selects the range he desires by the flick of a panel switch, thus assuring maximum legibility of fine structural detail.

Two scanning rates for each range are available: *fast* (8 minutes) rate for survey scans or spectra of materials with relatively few narrow spectral bands; *slow* (24 minutes) rate provides details of very complex spectra. Here, too, a panel switch puts both speeds at the analyst's fingertips.

Optional auxiliary recorders are available to give you continuous spectra at fixed wavelengths or to let you expand or compress ordinate or abscissa. The 15-centimeter chart ordinate provides high accuracy in recording band intensities.

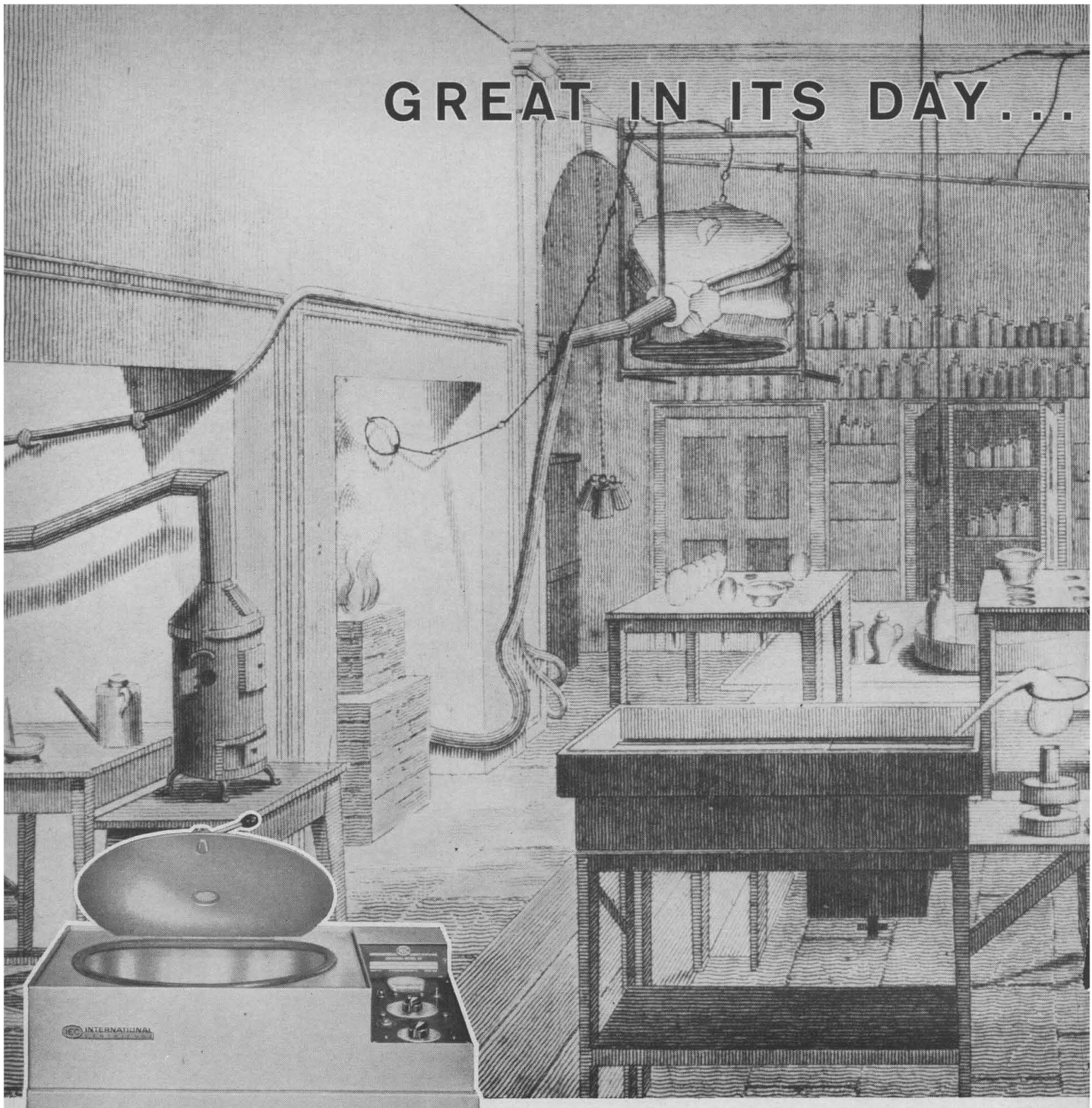
Write us at 910 Main Avenue, Norwalk, Connecticut for complete information and sample spectra.

INSTRUMENT DIVISION
Perkin-Elmer *Corporation*
NORWALK, CONNECTICUT

8 June 1962, Volume 136, Number 3519 **SCIENCE**

Cover Wave shadows on the bottom of a swimming pool. For a discussion of large submarine sand waves, see page 839. [Victor B. Scheffer, 14806 S.E. 54th St., Bellevue, Wash.]

GREAT IN ITS DAY...



MODEL UV CENTRIFUGE

Once the pride of its times, it served Sir Humphrey well but today is hopelessly outmoded.

Centrifuges become obsolete, too... even if still serviceable. But under today's pressures, mere serviceability is insufficient reason for retaining a machine. A laboratory's ability to maintain high standards of quality and service is related directly to its equipment.

That's why there is so much interest in International's modern design CS & UV general purpose centrifuges. They're extremely versatile and convenient, handle a wide range of work easily, efficiently and reliably day after day over a heavy schedule.

Sir Humphrey Davy's Laboratory

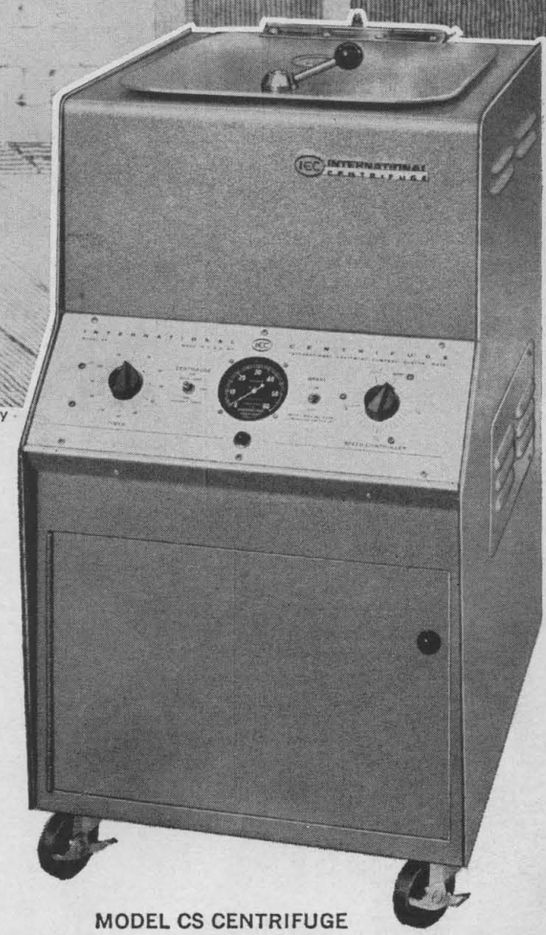
Illustration courtesy Harvard Library

Which to select? It's largely a matter of matching your work with centrifuge characteristics. Both are low cost. The CS takes 75 different accessories. Speeds up to 5600 rpm, has an electric brake, 2 hour timer, stainless steel guard bowl, speed controller, continuous reading tachometer and numerous other features. Excellent for swinging medium size volumes.

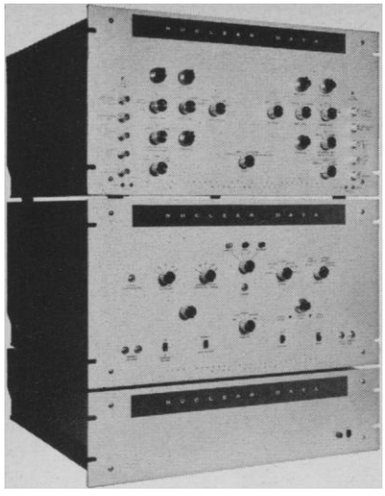
The UV has all these features but accepts more accessories, swings larger volumes, and handles a greater variety of work. Send for bulletins FC and I and make your own comparison.

INTERNATIONAL (IEC) EQUIPMENT CO.

1284 SOLDIERS FIELD ROAD • BOSTON, MASSACHUSETTS



MODEL CS CENTRIFUGE



from Nuclear Data . . .

VERSATILE INSTRUMENTATION CONSERVATIVE ENGINEERING

The Model ND150FM is the newest, most sophisticated medium-capacity radiation analyzer available today. It is soundly engineered, sensibly priced, versatile.

Here are *some* of the things that the new Nuclear Data Model ND150FM does, does well, and does well without the use of expensive "optional" equipment.

SINGLE PARAMETER ANALYSIS

Highly accurate and stable, this analyzer is capable of part-in-a-thousand resolution of signals from high resolution detectors even in day-long measurements. Four megacycle addressing speed and a one word address buffer provide efficient operation in difficult counting rate situations.

MULTIPLEX OPERATION

Time-sharing of one analyzer for two measurements, without linear mixing of analog signals, is provided. The use of two separate converters and address registers permits analysis of coincident or unrelated signals, with automatic routing to proper memory location.

TWO PARAMETER ANALYSIS

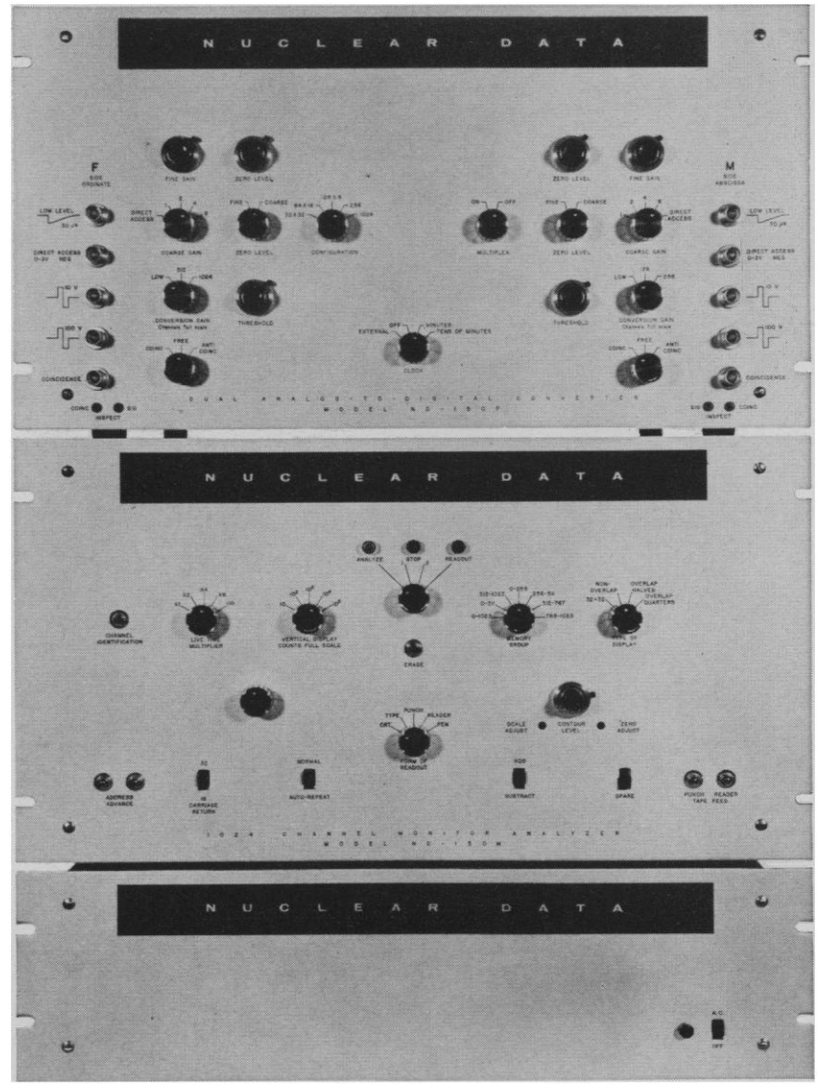
This mode of operation provides for a wide range of different types of measurements. Either parameter may be represented by pulse height, pulse width, or d.c. voltage. These may represent time, energy, velocity, magnet current, angle, or other dimensions. Configurations: 32 x 32, 64 x 16, or 128 x 8.

TYPEWRITER READOUT

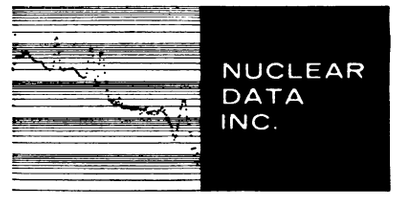
Readout in 32 x 32 format gives 1024 data points with position in correspondence with parameter values on energy-energy plane. Readout in 16 x 64 format for single parameter data. Non-significant zeroes suppressed for higher speed operation. Locked channel identification in octal from at end of each line.

PUNCHED TAPE INPUT AND OUTPUT

Several formats available at no extra cost. Speed 7½ channels/second.

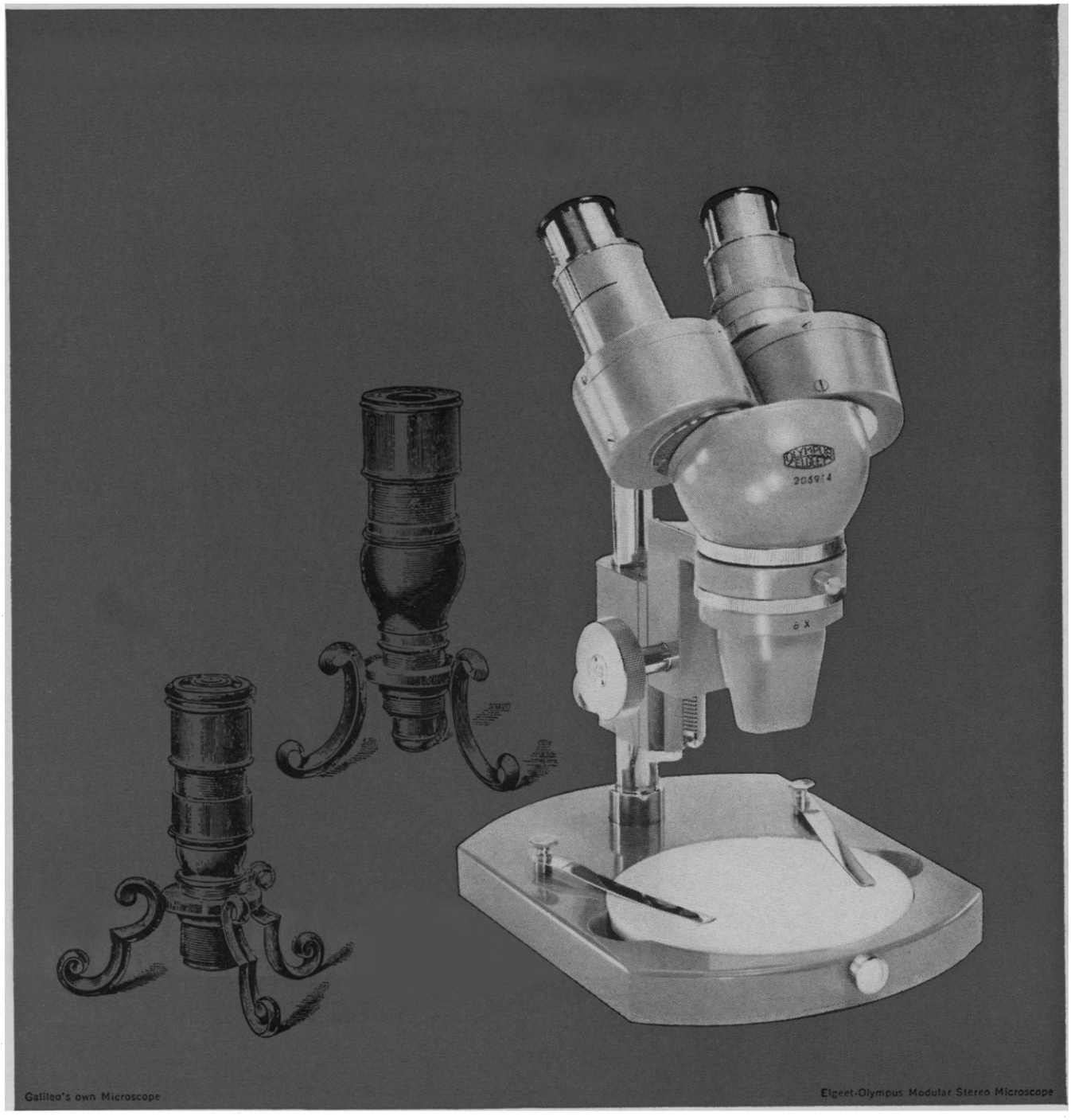


$22,500* complete with typewriter, perforator, reader and scope.
* domestic price, FOB Madison, Wisconsin



3833 W. Beltline Hy., Madison 5, Wisconsin

From Nuclear Data means sensible pricing, on-time delivery, real dependability, and performance better than published specifications.



IMAGINE IF...

GALILEO, who in the year 1610 invented a "telescope which magnified things so much as 50,000X, so that one sees a fly as large as a hen"...imagine if GALILEO had available the unprecedented research performance capability of this new ELGEET-OLYMPUS modular stereo microscope with all of its features for 3-dimensional viewing. This outstanding series of microscopes is ideal for inspection, identification, quality control, research, metallurgy, dissection, pathology, botany, bacteriology, biology, petrography, textiles and gem stone study. Binocular body inclined 45° for comfort and ease while viewing. Rotatable head. Long working distance objectives. Diopter adjustment to compensate for differences in visual faculties. Maximum wide field of vision. Priced from $159.50. Write for Illus. Booklet SM761. **ELGEET**

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

Model R7 Recipro-Glide Shaker
Variable speed range: 65-200 strokes per min. Uniform 1½" reciprocal stroke. Available with box carrier (illustrated), as well as with a variety of shaker platforms. Larger capacity model also offered. Holds 40/250-ml flasks*.

What Type of Shaker Do You Prefer?

Gyrotory®, reciprocating, water bath or incubator... there is a New Brunswick shaker to meet your particular requirements.

Over 25 different models are available with numerous holding devices and interchangeable shaking platforms for flask sizes from 10-ml to 6 liters, test tubes, separatory funnels, 5-gallon carboys, or other containers.

Ranging in size from bench-top shakers to large, 4-tier industrial models, this apparatus is available in a wide range of speeds and strokes. Some units are equipped with facilities for gassing; others are refrigerated and illuminated for low temperature and photosynthesis studies.

NBS shakers are precision-built with powerful drives for *continuous* operation and long life. Performance is smooth, quiet, and dependable regardless of speed and loading conditions. The apparatus is unconditionally warranted for one full year.

WRITE FOR CATALOG GRS/682

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

Manufacturers and Distributors of Precision Laboratory Apparatus

Model S-3 Gyrotory Shaker
Variable speed range: 85-285 rpm or 140-400 rpm. Uniform ¾" stroke. Holds 25/250-ml flasks*.

Model G76 Gyrotory Water Bath Shaker
Speed ranges: 85-285 rpm or 140-400 rpm. ½" stroke. Temperature adjustable to 100° C ± 0.5 C. Cooling coil and gassing hood optional. Models available with reciprocal agitation. Holds 9/250-ml flasks*.

Model G10 Gyrotory Shaker
Variable speed range: 140-400 rpm or 50-150 rpm. Uniform 1" stroke. Holds 40/250-ml flasks*. Larger platform holds 70/250-ml flasks*.

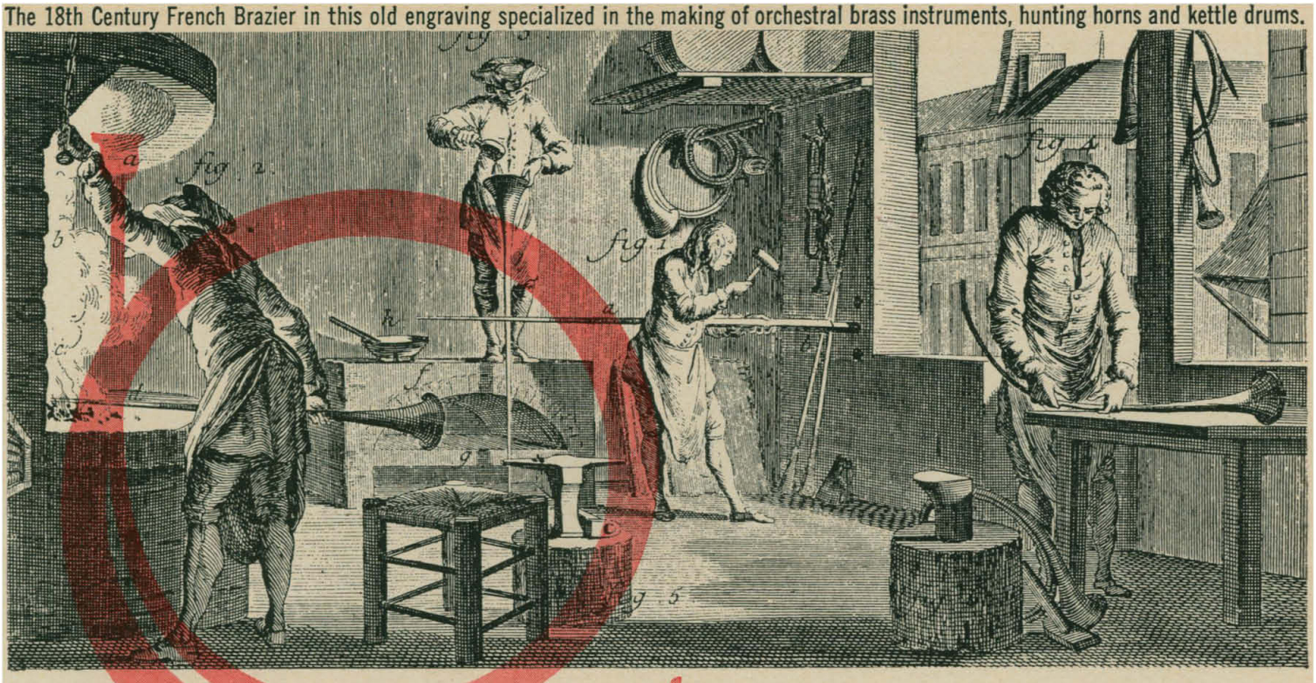
Model G25 Gyrotory Incubator-Shaker
Variable speed range: 140-400 rpm or 50-150 rpm. Uniform 1" stroke. Thermostatic temperature control to 60° C ± 0.5° C. Optional connections for gassing. Larger refrigerated models also available. Holds 40/250-ml flasks*.

Model R82 Reciprocating Tier Shaker
Speed range: 35-200 strokes per min. Continuously adjustable stroke from 0-4". Holds 192/250-ml flasks on 6 removable trays*.

Model V Rotary Flask Shaker
Variable speed range: 160-400 rpm or 100-250 rpm. 1" stroke. Holds 40/250-ml flasks*.

*** Accommodates a variety of flask sizes. 250-ml size used for comparing shaker capacities.**

The 18th Century French Brazier in this old engraving specialized in the making of orchestral brass instruments, hunting horns and kettle drums.

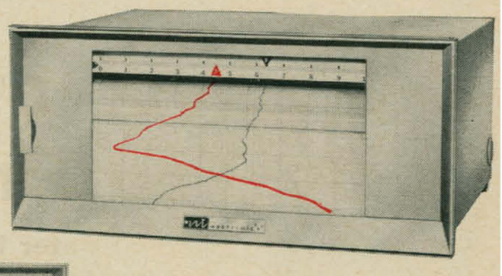


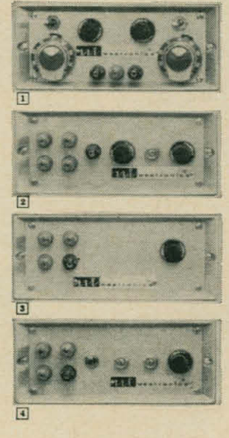
HOW MANY TUNES FROM ONE HORN?

HOW MANY JOBS FOR ONE RECORDER?

No musician uses a different horn for each tune he plays . . . why should scientists, researchers and engineers use a different instrument each time they record a different variable? Or, spend precious hours, sometimes even days in modifying existing conventional recorders or the added expense of another recorder? Westronics now offers totally new, quickly interchangeable, EXTERNAL INPUT MODULES that will convert a standard Westronics Universal recorder from any given application to another in a matter of minutes.

Get the full story on Westronics Recorders . . . free catalog on request. Westronics, Inc. has 30 sales-service representatives throughout the United States, Canada and Europe.





WESTRONICS UNIVERSAL RECORDER WITH QUICK CHANGE EXTERNAL INPUT MODULES ALLOWS ONE STANDARD RECORDER TO DO A MULTITUDE OF JOBS

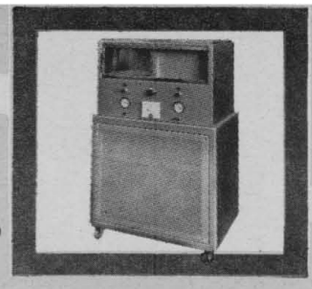
1. PLUG-IN ASZ-1 FOR ADJUSTABLE SPAN AND ZERO
2. PLUG-IN SG-1 FOR STRAIN GAGE
3. PLUG-IN RB-1 FOR RESISTANCE BLUB
3. PLUG-IN RB-2 FOR WHEATSTONE BRIDGE
4. PLUG-IN PF-1 FOR PRESSURE OR POTENTIOMETER FOLLOWER

WESTRONICS INCORPORATED

TWX FT 8248 U • 3605 McCART STREET • FORT WORTH, TEXAS

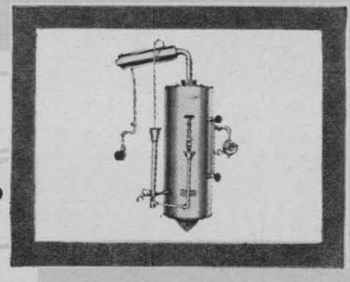
62-B

AMSCO
Microbiological Equipment



FREEZE DRY EQUIPMENT

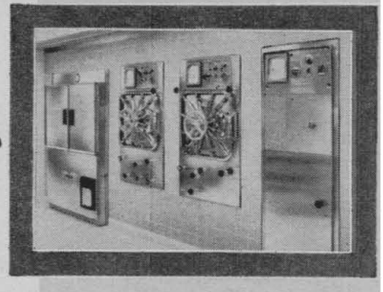
Models for laboratories and pilot plants. Used for the preservation and concentration of labile substances.



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.

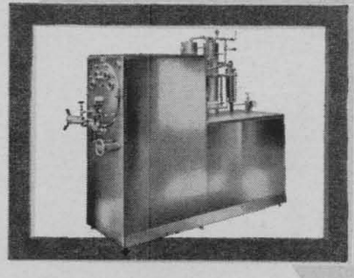


STERILIZERS

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.

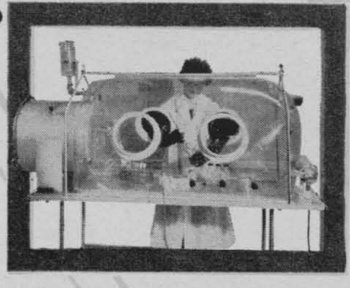


DRY BOXES

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

GERM-FREE LIFE APPARATUS

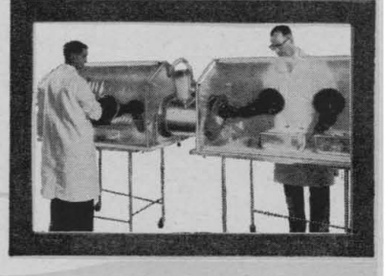
Flexible Film Isolators for operating, rearing and transfer of germ-free animals. Economical, disposable chamber.



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.

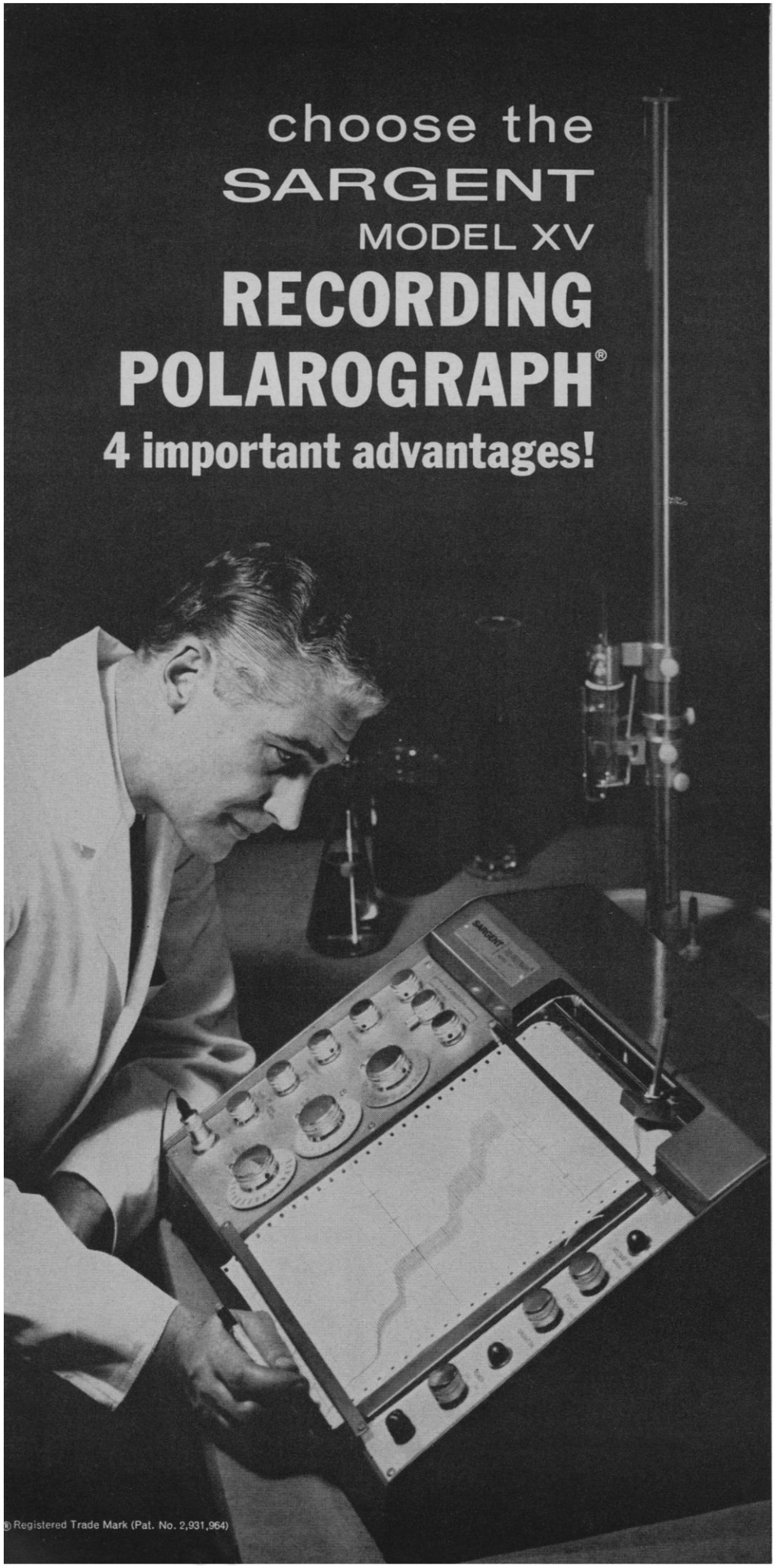
Meanwhile we'll be happy to send along literature on any of the equipment illustrated.



SCIENTIFIC AND INDUSTRIAL DEPARTMENT

AMERICAN STERILIZER
ERIE • PENNSYLVANIA

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



1. Full 10″ Chart

2. 1/10% Accuracy of Measurement

3. 10 Standardized Polarizing Ranges

4. Low Cost

This 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 meeting these specifications.

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.

SPECIFICATIONS

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: ⅛%

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 inches.

Net Weight: 65 pounds.

S-29310 Sargent Model XV Recording Polarograph with accessories and supplies.....$1585.00

For complete information write for Sargent Bulletin P.

E. H. SARGENT & CO., 4647 W. FOSTER AVE., CHICAGO 30, ILLINOIS
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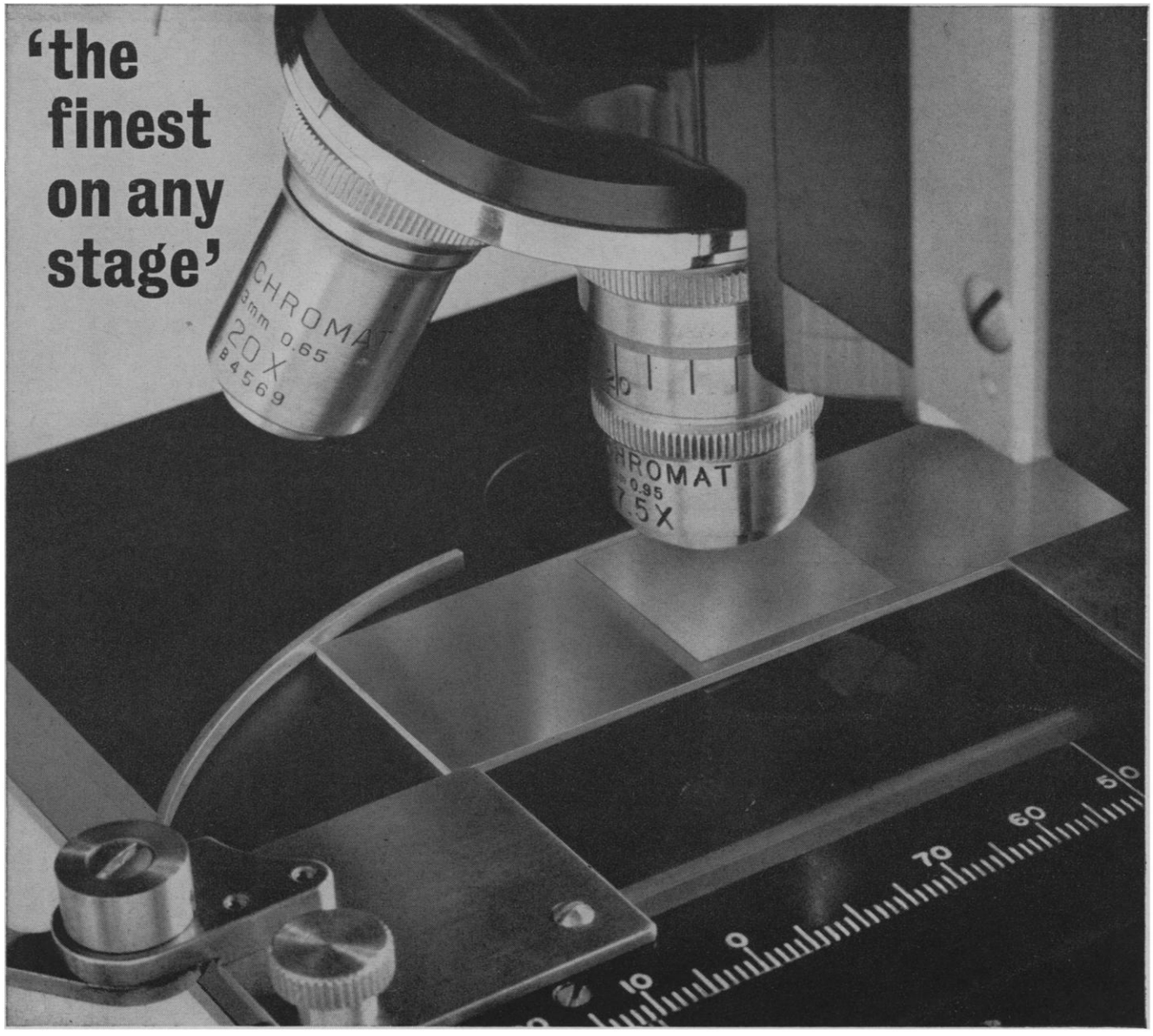
SARGENT

Scientific Laboratory Instruments
Apparatus • Supplies • Chemicals



GOLD SEAL® SLIDES and COVER GLASSES

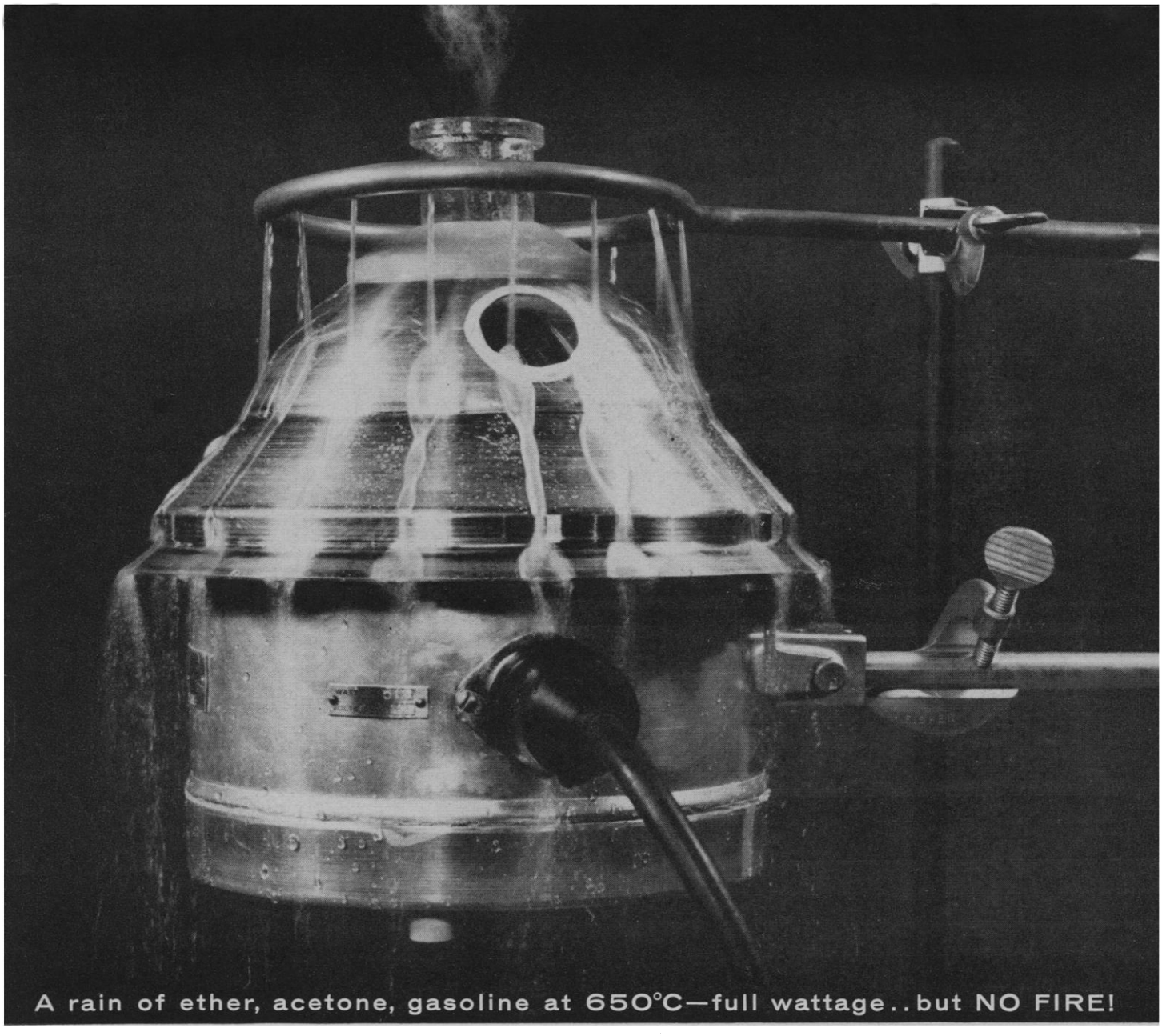
Microslides and cover glasses bearing the familiar "Gold Seal" label have set standards of quality for many years. They are as perfect as painstaking manufacturing processes can make them. And as a final safeguard, they are individually inspected before being packaged.

"Gold Seal" microslides are made of flawless, colorless, non-corrosive glass. Each slide is of uniform thickness, length, and width and has ground, polished edges. Each is precleaned and ready for use. A special-edged Stand-Rite dispenser box, used to pack all "Gold Seal" microslides, keeps slides upright, permits finger-tip removal without smearing or fingerprinting.

"Gold Seal" cover glasses are of equal excellence. Carefully selected and guaranteed perfect, they are made of rigidly specified, non-corrosive, nonfogging glass of uniform thinness. Available in every convenient size and thinness, "Gold Seal" cover glasses are dispensed clean from lint-free plastic boxes holding one ounce of glass.

Your dealer carries "Gold Seal" microslides and cover glasses and a large selection of microslide boxes, cabinets, and other accessories. Illustrations and full details of all items may be found in the Clay-Adams catalog No. 106. If you do not have a copy, write today on your institutional letterhead to:

Clay-Adams
New York 10, N. Y.



NEW PONCHO*

HERE'S THE PONCHO..

a shield that *seals* the flask *into* the heating mantle. It *greatly* reduces fire hazard in the distilling of dangerously flammable chemicals.

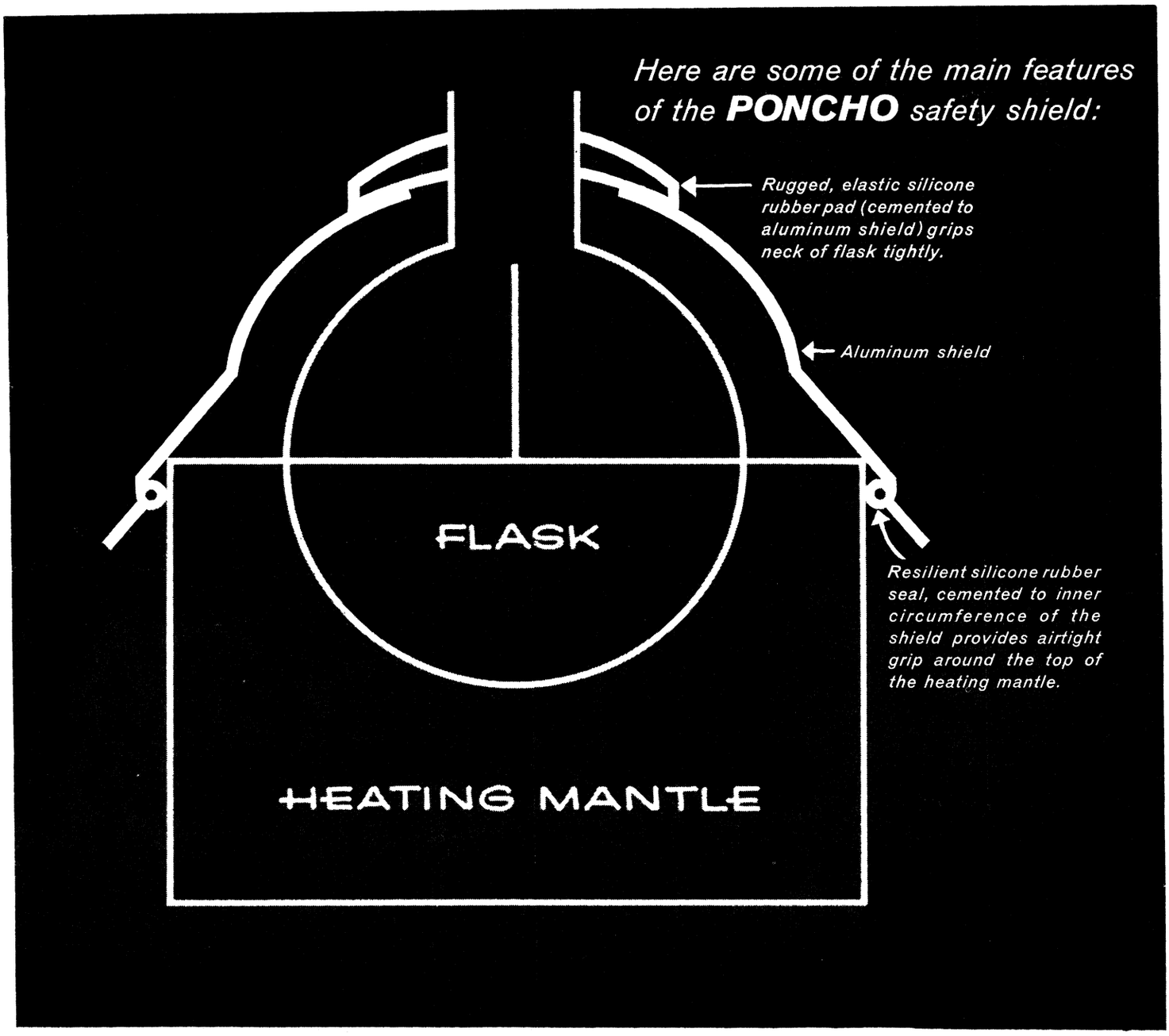
HERE ARE SOME OF THE PONCHO'S ADVANTAGES:

- It eliminates damage to the heating mantle by spillage.
- It protects the flask against damage by falling objects . . (pliers, screwdrivers, clip-boards, etc.)
- It protects personnel from flying glass should a flask implode under high vacuum distillation.
- It also gives considerable protection if a flask should explode.
- It serves as a very efficient heating top.
- Built-in glass ports permit visual inspection of flask.

HERE'S HOW THE PONCHO WAS TESTED:

Water was heated in the flask with the heating mantle operating at full capacity. Gasoline, acetone, and ether

*Patents Pending



safety shield makes heating of flammable liquids safer than ever!

were then showered on the heating mantle for 15 minutes. In no case did a fire result. These tests were all the more conclusive in view of the fact that the heater was a quartz high wattage heating mantle.

HERE ARE SIZES AND PRICES:

Flask sizes 500 to 200,000 ML (single or multiple neck). Prices, $10.00 to $205.00.

22 YEARS OF SAFETY!

Glas-Col developed the first, the original heating mantle . . . which (made of glass fabric) destroyed itself if pushed to unsafe temperatures. Half-a-million have been sold since 1940 . . and NOT ONE FIRE has ever been reported from their use!

Every major heating mantle improvement since, has also been developed by Glas-Col. Zoned heating is one; the high-wattage quartz mantle is another.

GLAS-COL

HEATING MANTLES

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

TOTAL RANGE MAXIMUM ACCURACY

KINNEY VACUUM GAUGES

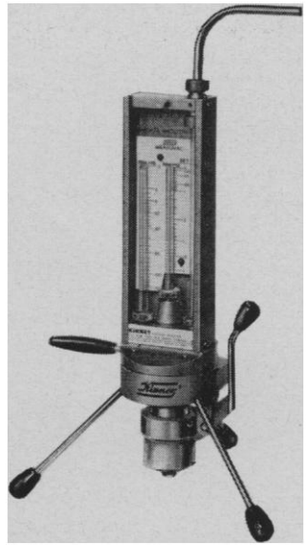
Kinney's complete line of vacuum products is exemplified by these gauges covering the range from 150 torr to 2 x 10^{-7} torr. Constant research, development, and quality control make Kinney gauges, systems, pumps, evaporators, furnaces, valves, baffles, and all Kinney high vacuum equipment the most respected in the industry.

DISCHARGE VACUUM GAUGE . . . MODEL KDG

The Model KDG Discharge Gauge utilizes printed circuitry and a small, rugged, easy to clean gauge tube to cover the range between 10^{-2} torr and 2 x 10^{-7} torr — supplied in a cabinet or on a standard 19″ panel. Accurate readings — unaffected by line-voltage variation. It may also be combined in a single unit with one through six station thermocouple gauges.

THERMOCOUPLE VACUUM GAUGE . . . MODEL KTG

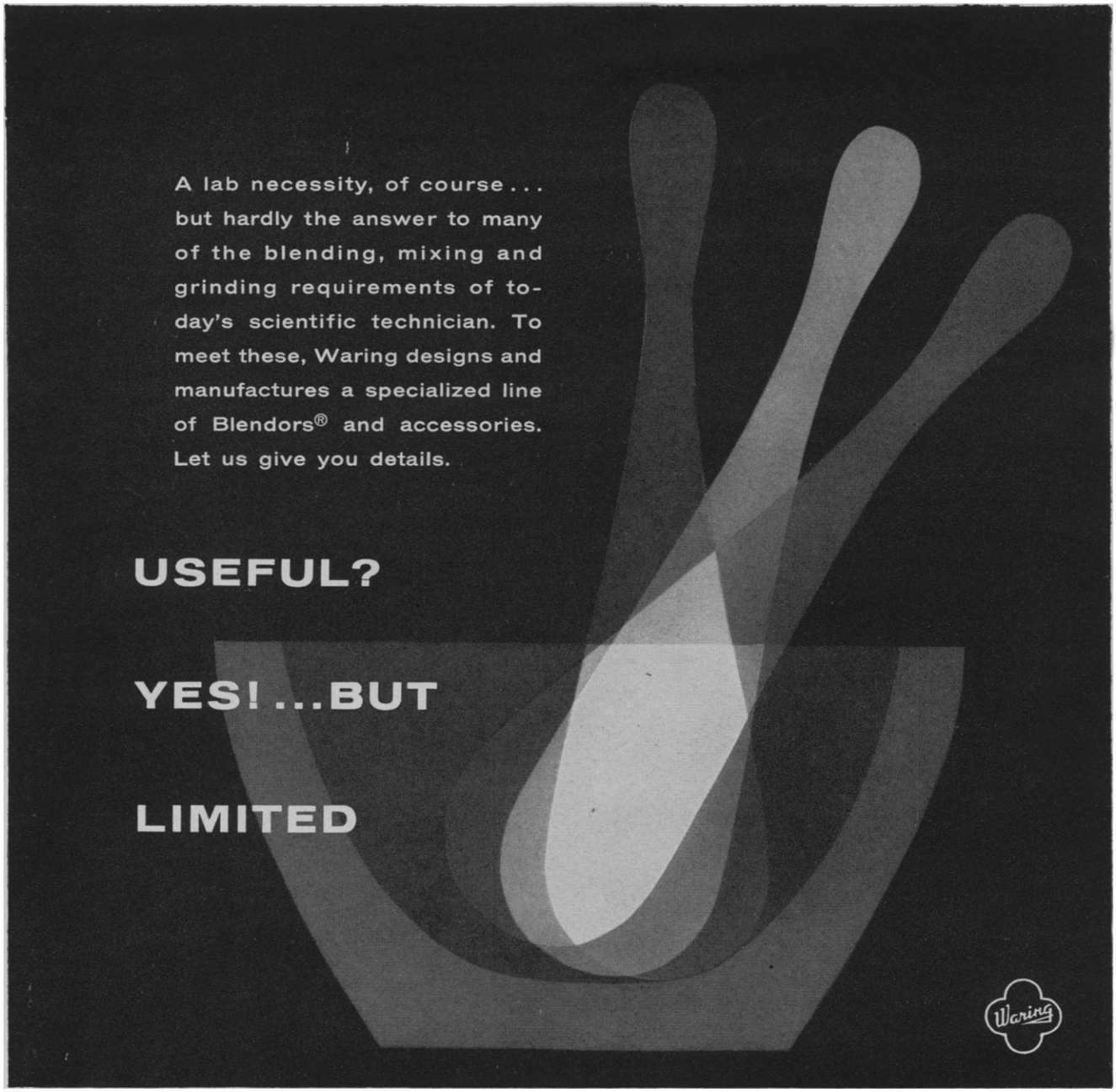
The Model KTG Thermocouple Gauge features a transistorized control circuit and printed circuit wiring, in one through six station units, to indicate pressures from 3000 microns to one micron. The control unit is pre-calibrated and all thermocouple tubes are matched to allow complete interchangeability without recalibrations. Available in cabinet or panel mounting.



McLEOD GAUGE . . . MODEL TD1

The Model TD-1 McLeod Gauge accurately indicates pressures between 150 torr and one micron, easily and without adjustment. It is light weight, sturdily constructed, and more compact than most comparable gauges. It requires less than ½ lb. of mercury, and is readily disassembled for cleaning. Available in portable or fixed mounting.

KINNEY VACUUM DIVISION THE NEW YORK AIR BRAKE COMPANY
3529 WASHINGTON STREET • BOSTON 30, MASS.



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INKS—Detergents to reduce pen clogging

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CERAMICS—Kaolin and clay slurries

COATINGS—Films, TV tubes, recording tape, adhesive compounds, duplicating machine emulsions

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

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INSECTICIDES—Repellents and killers

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

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

PAPER—Waste paper evaluation, pulping wood fiber, coatings

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

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

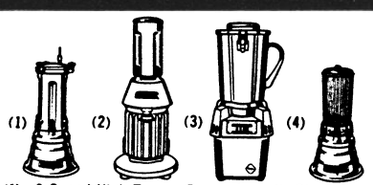
PRINTING INK—Color blending, waterproof inks, engraving fluids

RUBBER—Latex, sponge, synthetic

TEXTILES—Strength tests for synthetics, Nylon, Orlon, Dacron, wool and cotton

TOBACCO—Chemical analyses, homogenized, experimental blends, mixtures

VINYL—Upholstery bases color sampling



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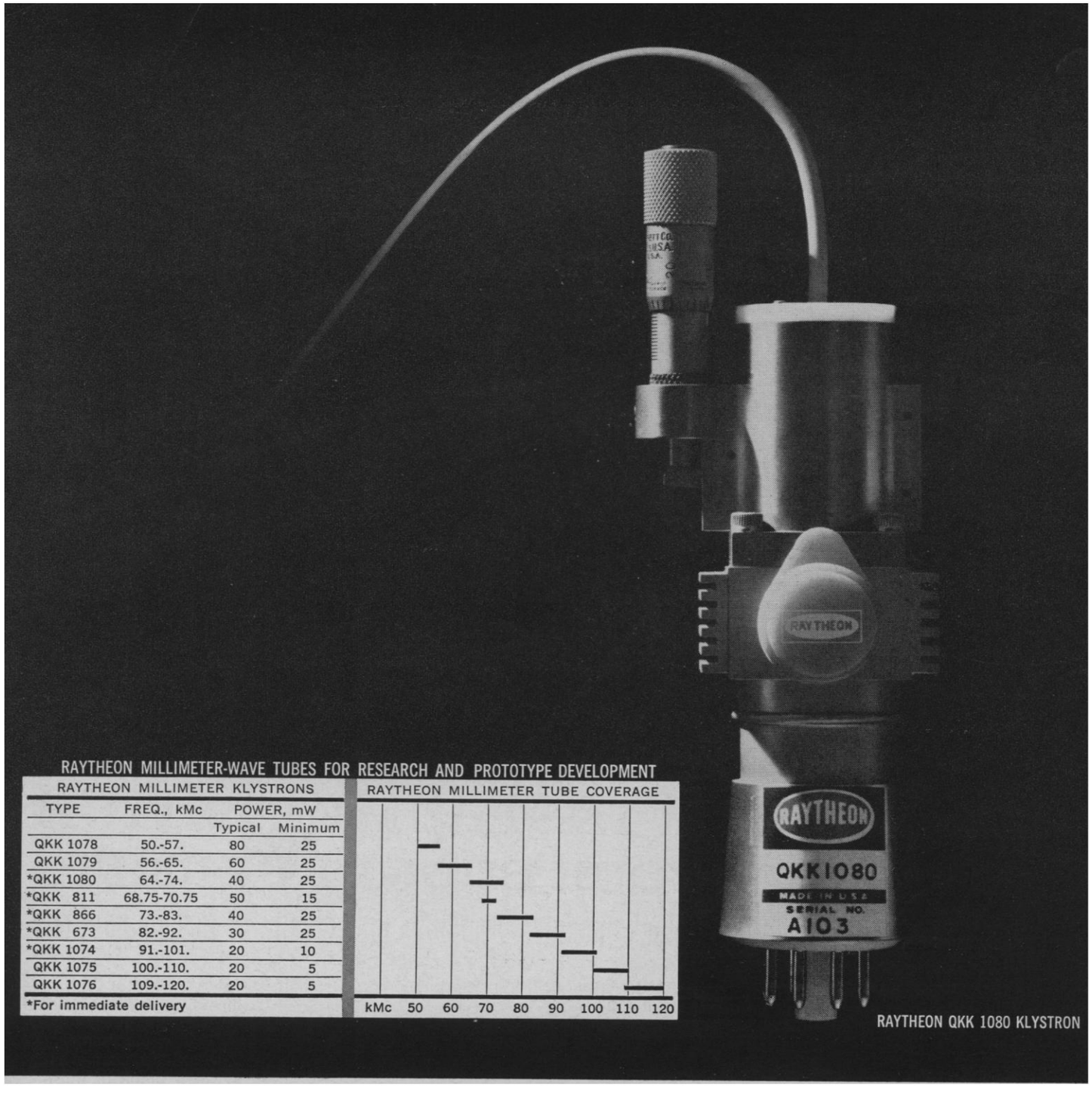

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*QKK 1080	64.-74.	40	25
*QKK 811	68.75-70.75	50	15
*QKK 866	73.-83.	40	25
*QKK 673	82.-92.	30	25
*QKK 1074	91.-101.	20	10
QKK 1075	100.-110.	20	5
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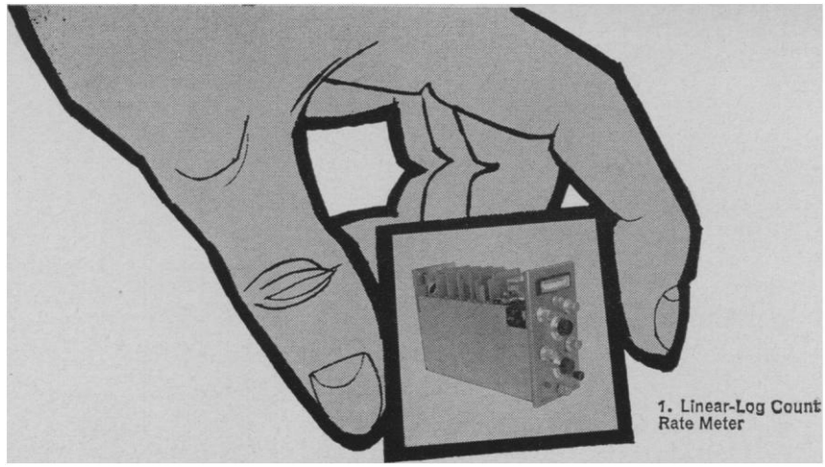
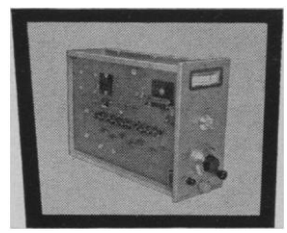
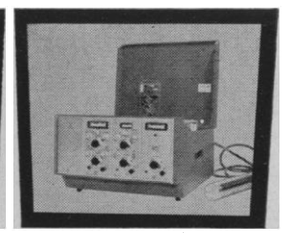


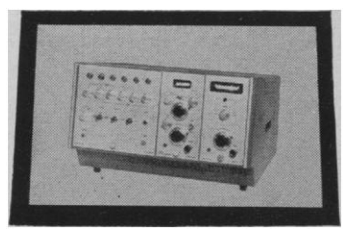
1. Linear-Log Count Rate Meter



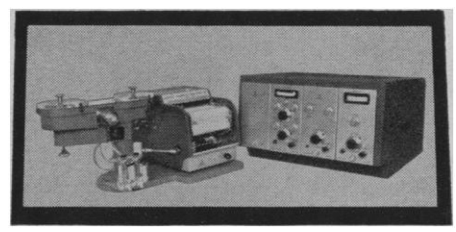
2. High Voltage Power Supply



3. Blank Panel, Linear Count Rate Meter, Single Channel Analyzer, High Voltage Power Supply



4. Printing Scaler-Timer, Single Channel Analyzer High Voltage Power Supply



5. Chromatograph Scanner, Linear-Log Count Rate Meter, Linear Amplifier, High Voltage Power Supply

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Model PL-2
Capacity 2000 g. • Accuracy ± 0.15 g.
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ADDITIONAL FEATURES

True Weight even when out of level

Zero point does not shift even when balance has been moved to a position that is out-of-level.

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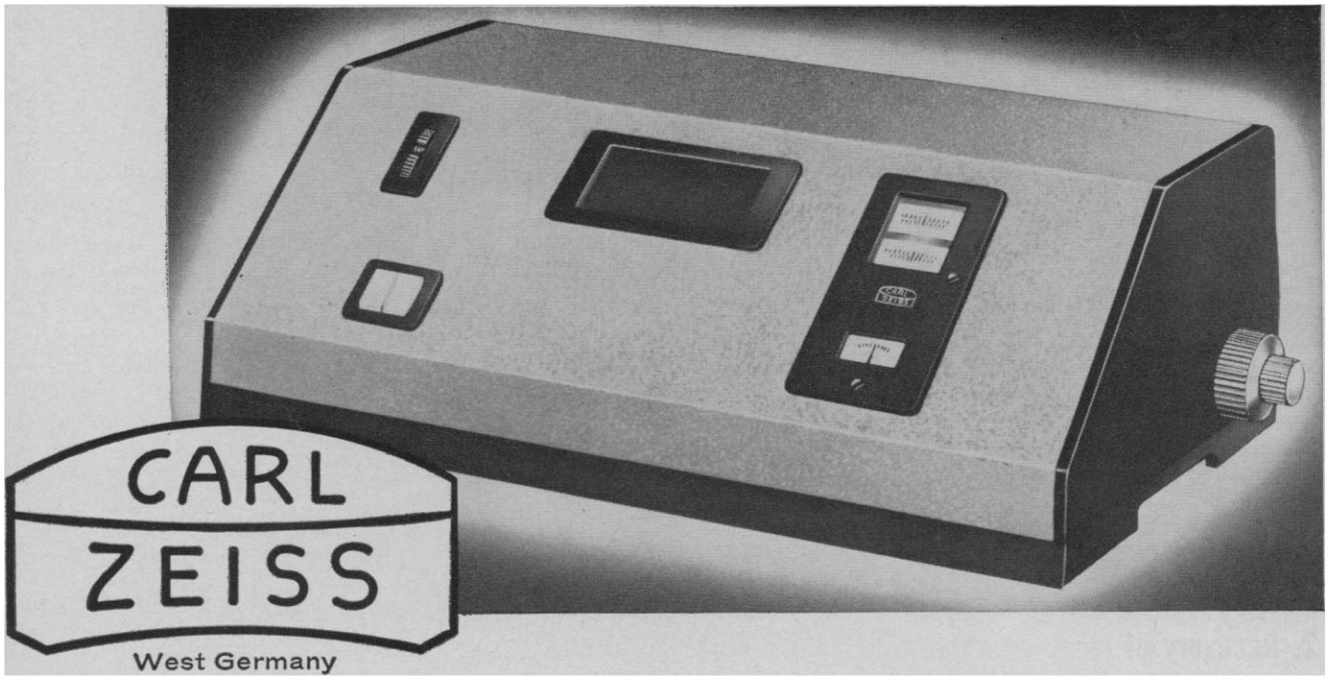

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The polarimeter tubes, with a path length of 10, 20, 50 and 100mm, are automatically lowered into the housing and brought into the path of rays. The electric indicator instrument is set to zero by conveniently located knobs for coarse and fine adjustment,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

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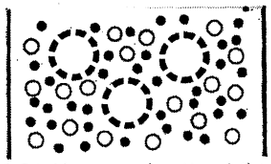
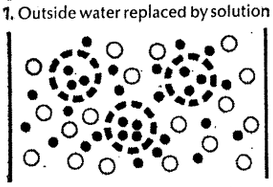
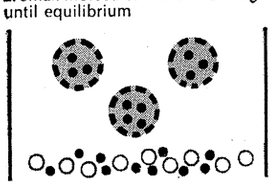


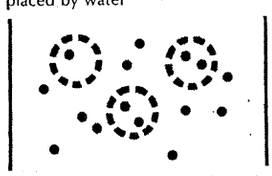
1. Outside water replaced by solution



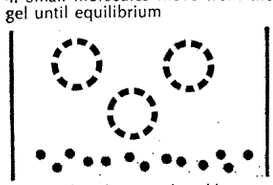
2. Small molecules move into the gel until equilibrium



3. Volume outside gel particles replaced by water



4. Small molecules move from the gel until equilibrium



5. Outside volume replaced by water to empty gel particles completely

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GEL FILTRATION

To prepare proteins for electrophoresis, ion-exchange chromatography, crystallization, etc., it is, as a rule, necessary to transfer the protein into a proper buffer medium.

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The SEPHADEX procedure is:

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- equivalent to an exhaustive dialysis

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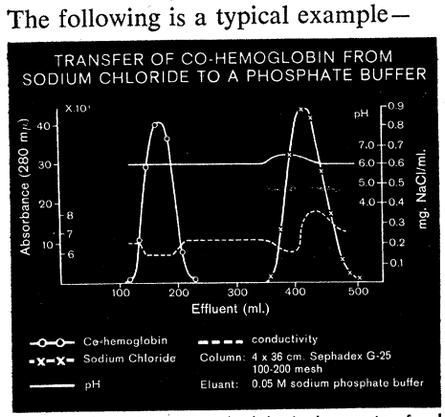

Reference: Flodin, P.: Methodological aspects of gel filtration with special reference to desalting operations, J. Chromatog., vol. 5, pp. 103-115, 1961.

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a) Desalting colloid solutions—SEPHADEX allows rapid and complete desalting, eliminating time-consuming, imperfect dialysis methods.

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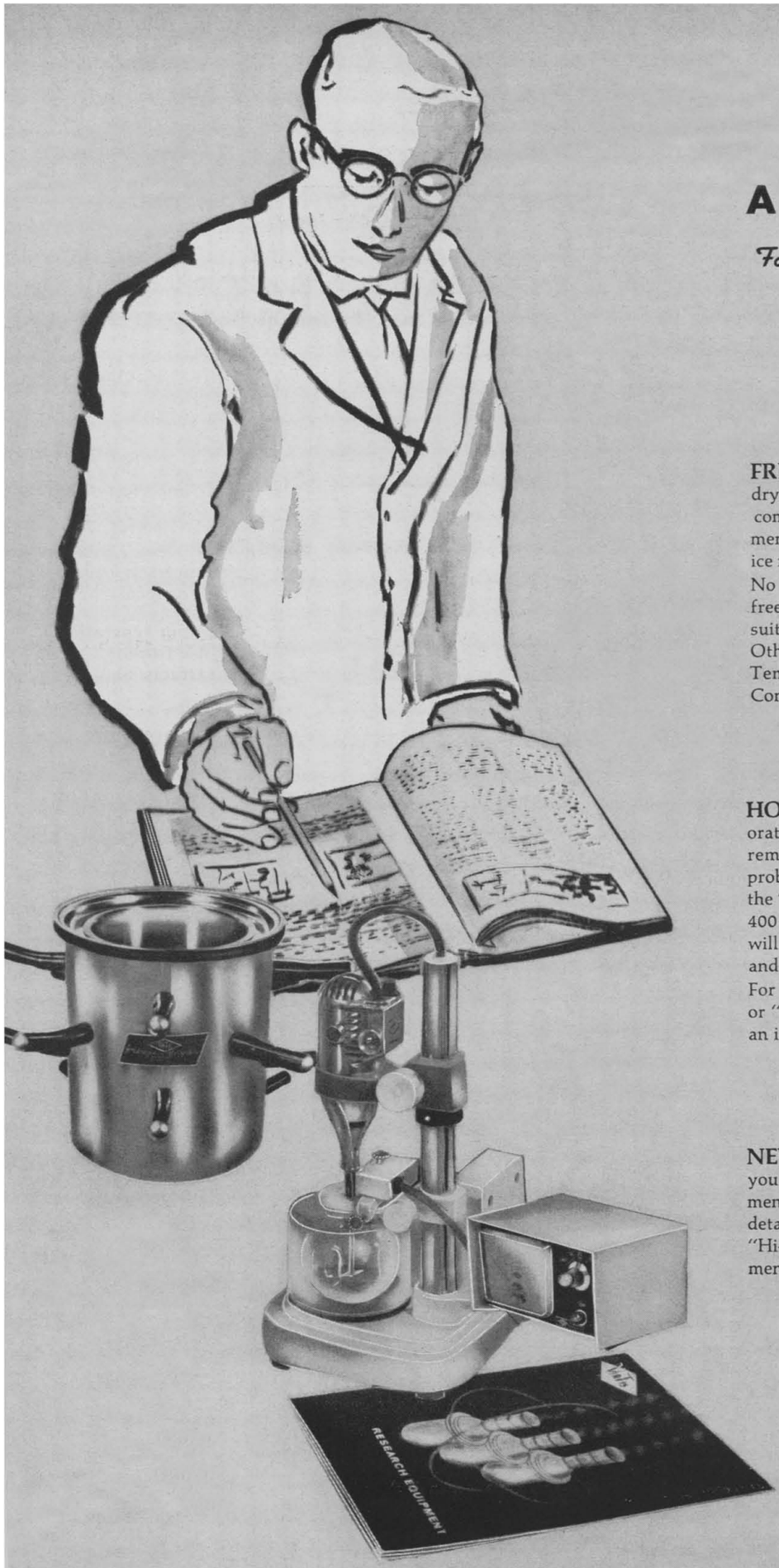

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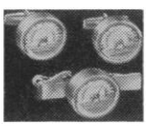

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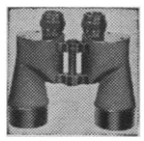

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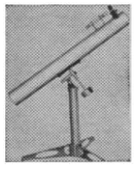

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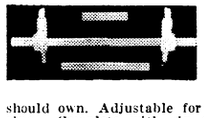

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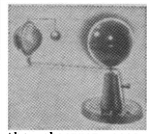

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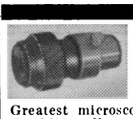

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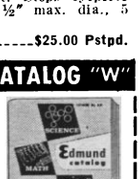

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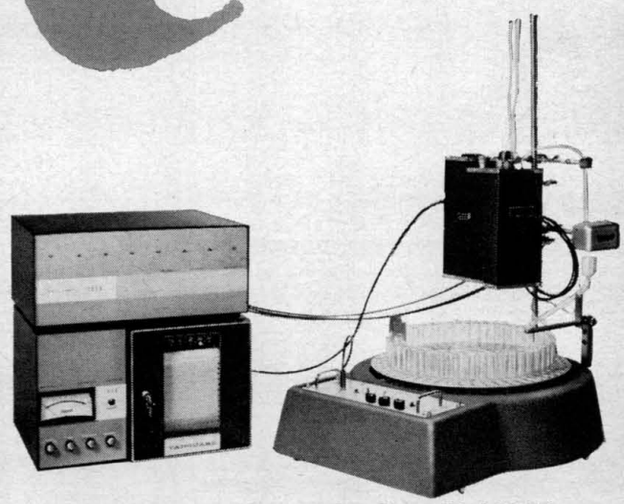

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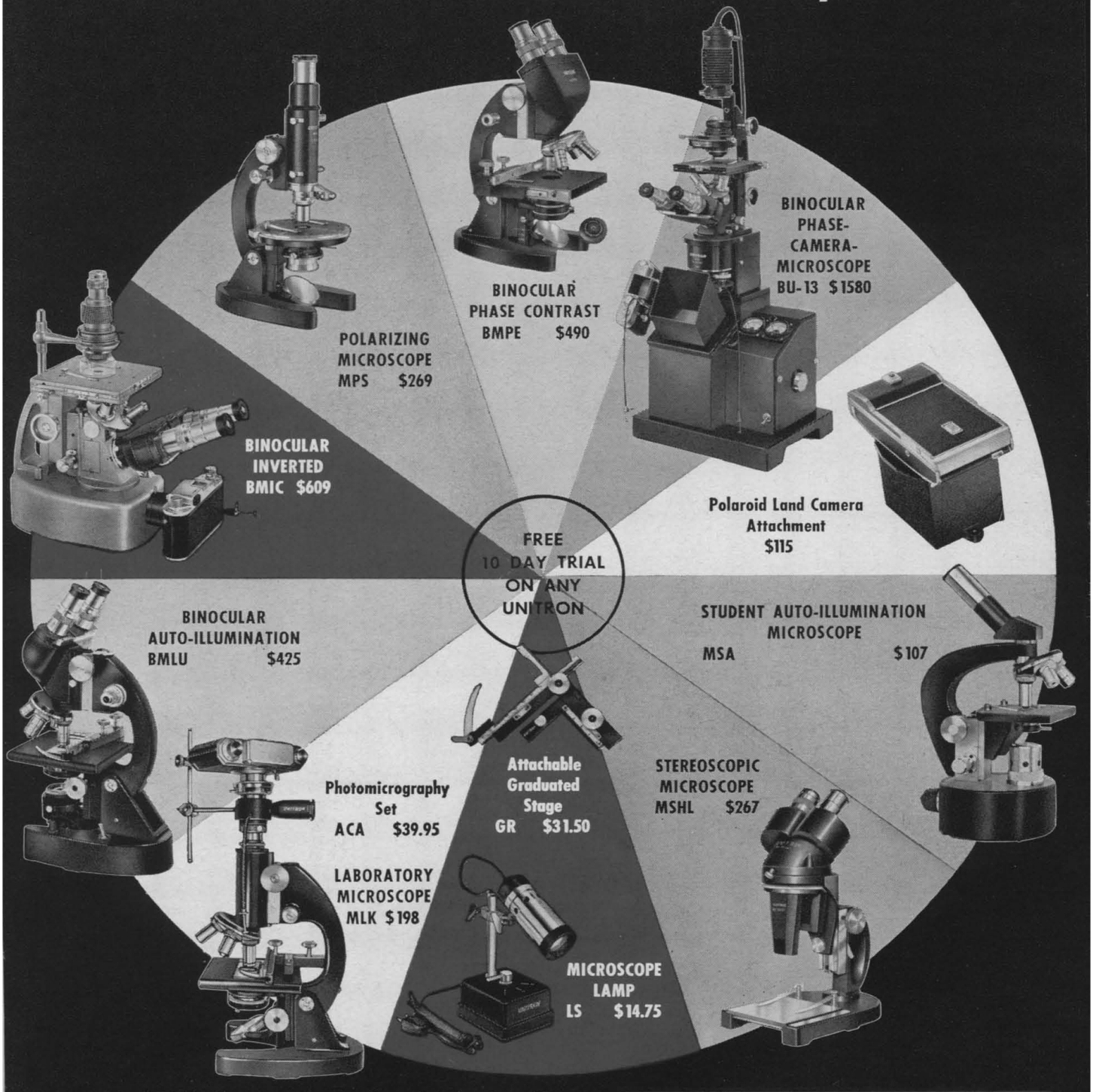

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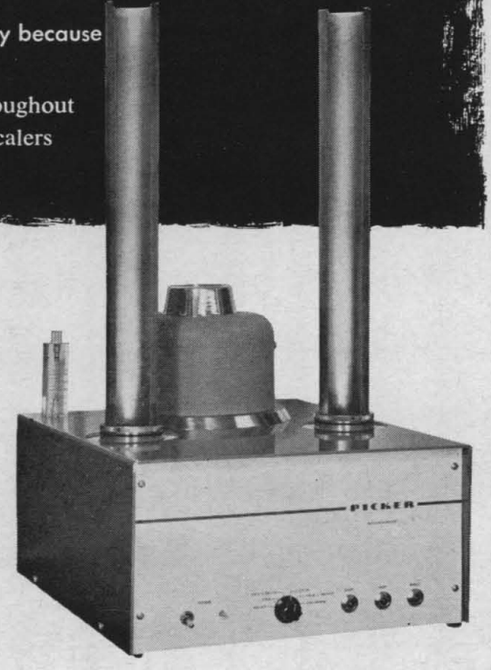

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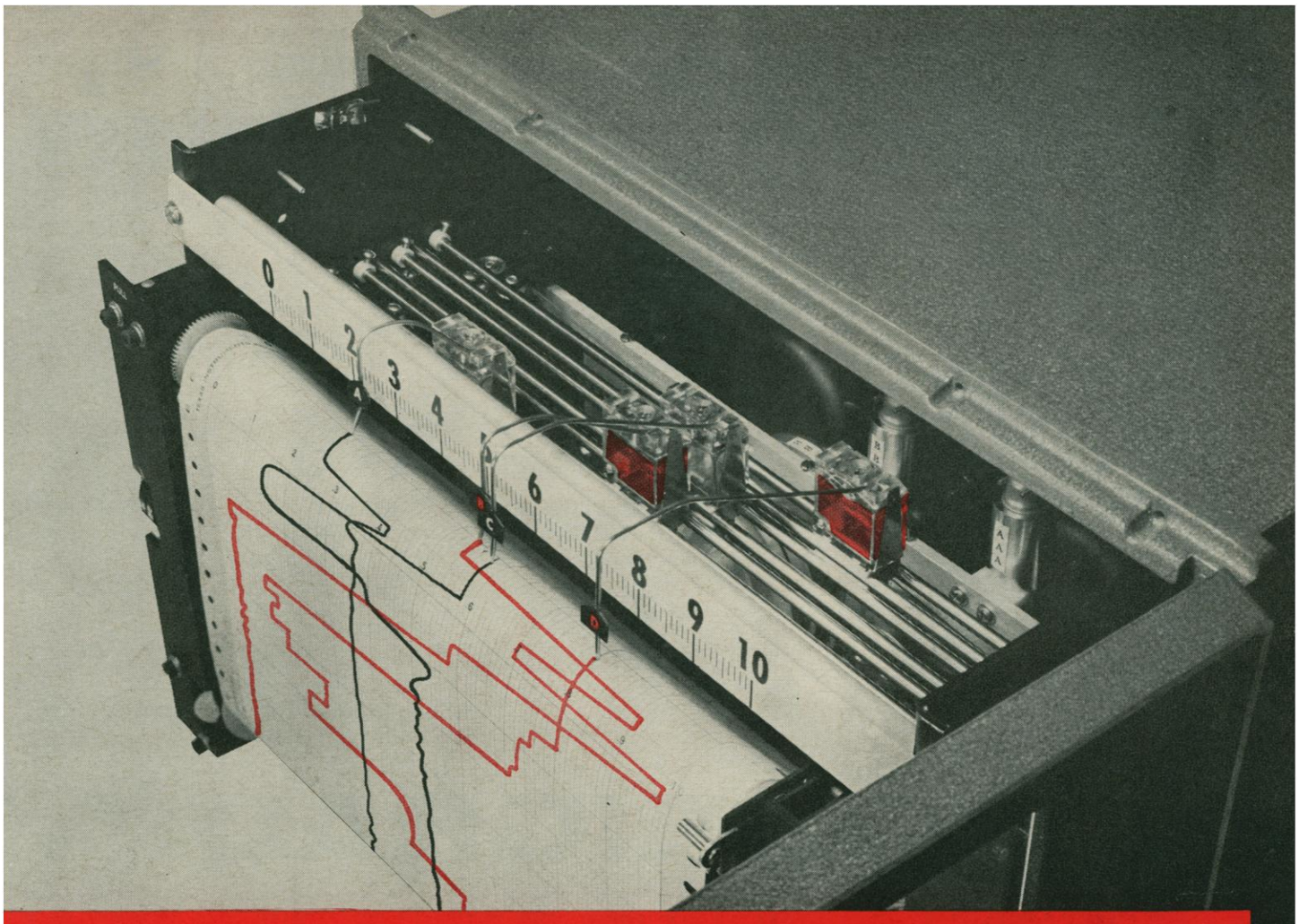

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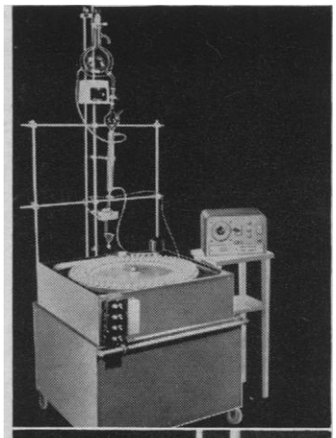

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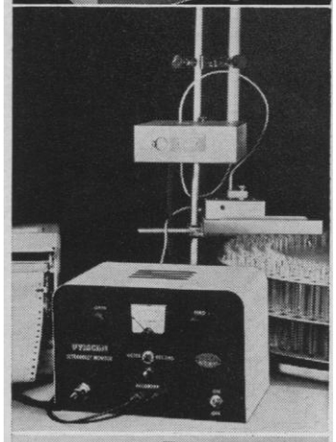

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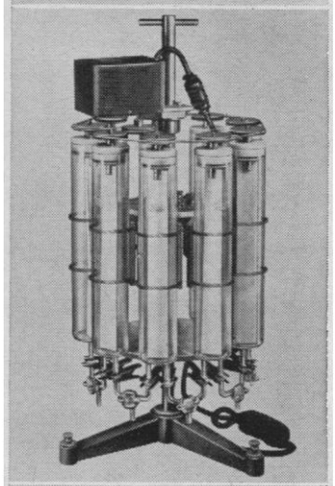

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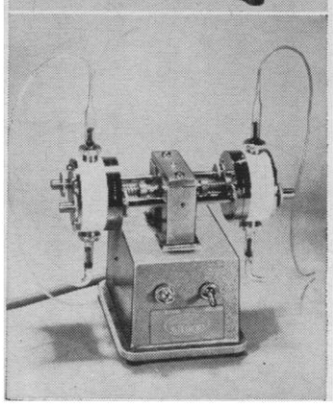

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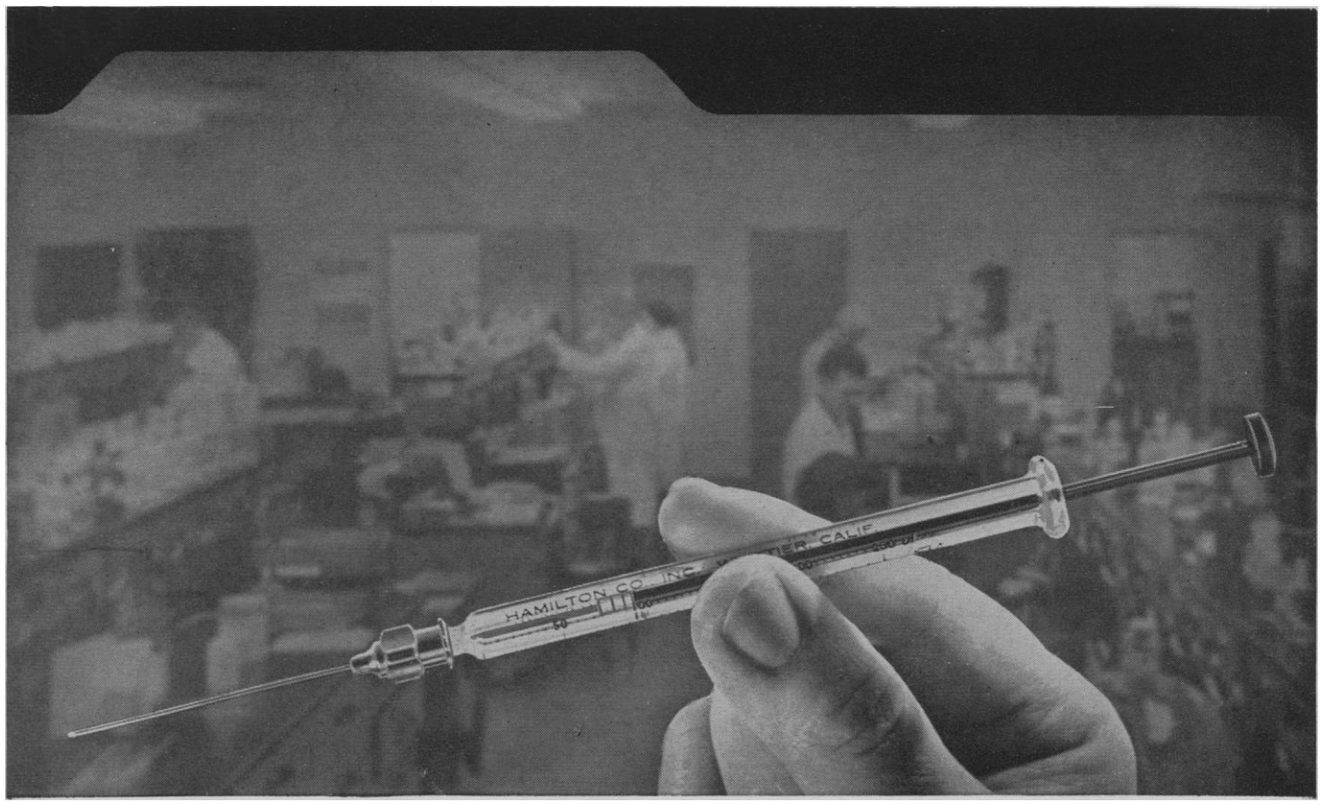

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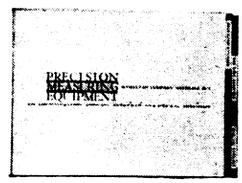

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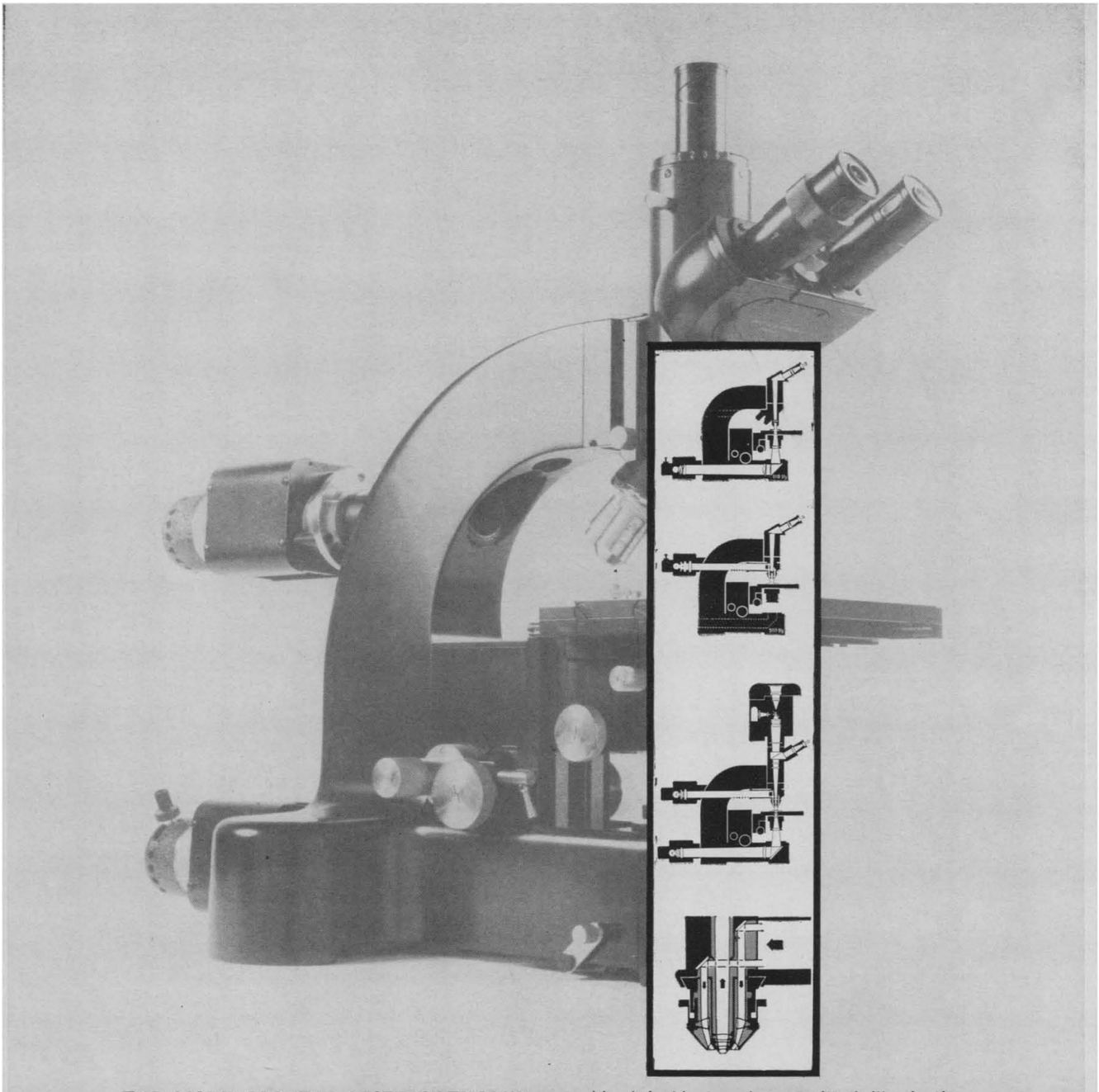

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But You Have Premises To Keep

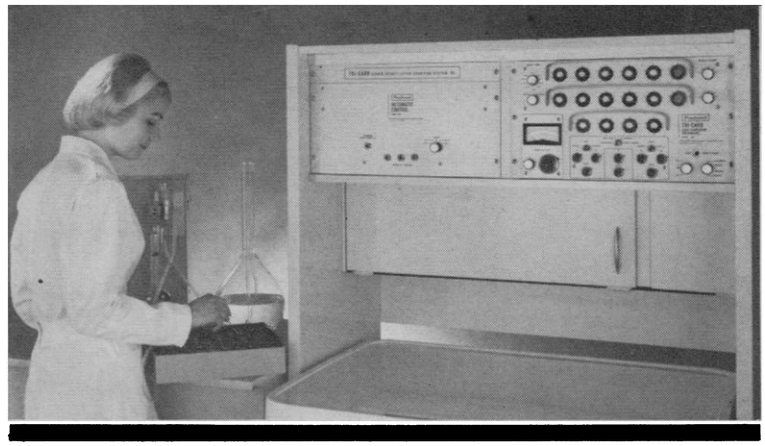
The recognition given Robert Frost these days continues to grow. He was appointed poet in residence to the Kennedy Administration: selections from his latest volume made 10 pages in *Life* magazine; and now an analysis of his early poem "Stopping by Woods on a Snowy Evening" has been programmed—that is, the analysis has been arranged in a series of items suitable for use in a teaching machine or in a special textbook. The poem and the program, together with a poem by Thomas Hardy and *its* program, are offered in a little booklet, *Poetry 230*, published in a tryout edition by Harcourt, Brace and World. Plans call for general publication of a revised and expanded version sometime next year. Enthusiasm for programming is fine and enthusiasm for poetry is equally commendable, but before combining these enthusiasms there are a few things you should bear in mind.

On the cover of the booklet it says, "Programmed instruction in reading poetry in depth." And inside there is the requisite series of items. Each item consists of a sentence or two, with a word or two missing, which the student, on the basis of a hint or two furnished by the context, is supposed to be able to supply correctly. The correct answer, as a check for the student, is then given on the following page, along with the next item. For example, one item in the booklet reads: "Even Frost would probably not have forced so much rhyme on himself if he had planned a long poem. Since he doubtless had a hunch that this was to be a _____ rather than a long poem, he decided to increase the difficulties of his rhyme game still more."

The word *short* is missing, but so is something else. What is also missing is the careful analysis that should go into preparing these items. Programmed instruction, it is true, supplies hints to enable the reader to respond correctly. But the basis for a hint is supposed to be something more than the redundancy of a sentence made redundant for no other purpose. The student should be helped, but he should be helped to do something, for example, to generalize from one situation to another. The items, moreover, are supposed to form a sequence, each item leading to the next. The present item is not part of such a sequence, and it is hard to see how it could become a part without considerable reworking. In fine, this is not a program at all.

A little programmed learning is a dangerous thing. But better understanding would not mean doing a better job; it would mean not attempting the job in the first place. Not everything ever written is suitable for programming. *The Federalist* papers are not suitable; neither are Durrell's novels, nor the Washington *Post*, nor the little essay on Frost by the poet and critic John Ciardi on which this effort is based, nor even the tables, drawings, and diagrams that adorn some of the instruction in scientific fields which has been satisfactorily programmed.

Programmed instruction has a distinctive format, but it is also based on underlying premises. The temptation, with the great pressure in education these days to be modern and technical-looking, is to imitate the format and ignore the premises. It is not necessary, however, to be an expert in programming to suspect that something is amiss with *Poetry 230*—although without such knowledge you might be inclined to denounce all programming. It is necessary only to appeal to premises of the most general sort. There should be warning enough in the contrast between the pretentiousness of this exercise and Frost's poem itself, 16 short lines of simple narrative.—J.T.



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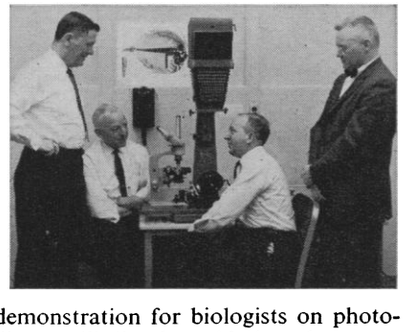
Third stand at Woods Hole



Our men H. Lou Gibson, Lynn C. Wall, William A. Sykes, and Thomas E. Callear (l. to r.) expect to be working Wednesday night, July 11, in the new auditorium of the Marine Biological Laboratory at Woods Hole, Mass. They will be putting on a three-part anti-trepidation demonstration for biologists on photographic techniques. Gibson will dispel trepidation about embarking on photomacrography and specimen photography of a useful kind. Wall will dispel trepidation about doing your own photomicrography. Sykes, ditto for autoradiography. Callear, a veteran from the Kodak Research Laboratories, will be master of ceremonies.

Back home and on their frequent travels, these gents deal with the more advanced practitioners, who surround themselves with the very latest and finest that the equipment market affords. But we ourselves are not primarily a manufacturer of research equipment. We can therefore afford to present the broad view. Our game is to give investigators confidence in their own ability to use photography wisely and well. If they are pleased with their results from minimal and improvised equipment, they will profit more from the noble efforts of the apparatus makers to trade them up.

This will be our third stand at Woods Hole. During the previous two, certain basic questions were put to us often enough to clarify differences between our spiel and what people about to undertake biological research photography really wanted to know. Before and after answering these questions to general satisfaction in the formal Wednesday night program, the team will spend its time during the week chatting informally at any desired level of photographic sophistication.

Before and after there are also the broad Cape Cod beaches that sparkle mile after glorious mile. Have fun. Take snapshots.

Such ν's!

We have just designed and constructed an *f*/3.6 lens of 21½-inch focal length for Lockheed-California Company. It is not a photographic lens, and it is certainly not for visual use.

But by infrared from 2μ to 5μ the lens is a jim dandy and makes us proud. The minimum circle of confusion "seen" in this wavelength band and measured at a diameter 85% down from peak intensity is only .003″ larger than the .002″ diameter of an impossibly perfect image of our source.

There is more to crow about. This lens is destined to move through the air at speeds great enough to make it quite hot. It can get as hot as 500 C without blinding itself by its own radiation. The monocrystalline optical materials currently used for infrared lenses cannot work that hot. These two are polycrystalline. Ours is the art of hot-pressing substances into optically workable polycrystalline form. We can pick them as we like them, and we like them to have low emission. Furthermore, a mass of tiny crystals weld together into an object more rugged, mechanically and thermally, than the same substance as a single crystal.

The polycrystalline formulation in the diverging element of our achromat, designated KODAK IRTRAN-1 Optical Material, has a refractive index of 1.3489 at 4.26μ; the one in the converging element, IRTRAN-2, has a corresponding index of 2.2490.

Redefining old Abbé's ν*-value for the infrared age as* $\frac{n_{4.26\mu}-1}{n_{3.0\mu}-n_{5.5\mu}}$

we find for the generally available infrared-transmitting materials:

	IRTRAN-1	IRTRAN-2	Ge	KRS-5	As_2S_3	Si
$n_{4.26\mu}$	1.3489	2.2490	4.0216	2.3815	2.4101	3.4242
ν	9.6	106.8	95.6	201.9	114.7	226.6

People with a little experience in lens design will vent a low whistle at such a spread of indices and dispersions that greets their tired old eyes. Immediately they will perform some rough calculations that will further excite them. Then, if interested in bringing 3.0μ and 5.5μ to a common focus, they will decide whether to proceed on their own, buying IRTRAN blanks, or whether to have us finish a design and deliver the lens ready to go. Eastman Kodak Company, Special Products Division, Rochester 4, N. Y., will assist in this decision.

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

✻ Mountainous region southeast of the crater Albategnius

Meetings

Application of Information Extraction Techniques to Human Scanning

The introduction of radioactive isotopes into human bodies as an essential tool for medical diagnosis is gaining widespread acceptance. In some cases, notably thyroid diagnosis by the uptake of radioactive iodine, precise information can be obtained from counters placed outside the body. However, in most other cases it is difficult to interpret the information which can be obtained from a study of the distribution of isotopes by detectors located outside the body—that is, by the technique of human scanning. Thus, we are in possession of a tool that appears to be powerful in concept but limited in immediate application. The conference on the application of information extraction techniques to human scanning, sponsored by the Radiation Study Section of the National Institutes of Health and held at Princeton, New Jersey, from 20 to 22 November 1961, was addressed to this specific problem: how to obtain the maximum amount of information through external scanning after administration of isotopes to man for purposes of diagnosis.

There are several possible avenues which should be explored. The first has to do with improvements in signal. One example is the use of positron emitters, which provide more accurate information about the position of the isotope in the body through the registration of coincidences from the diametrically opposed gamma rays which are emitted after positron annihilation. The use of short-lived isotopes makes it possible to increase the amount of isotope administered to the patient and thus yields a larger number of quanta in a given time of observation. The amplitude of the signal may also be increased by means of various chemical or physical tricks, such as incorporating isotopes in specific chemical compounds or attaching them to physical carriers such as microspheres. Either of these procedures might increase localization in specific parts of the body.

The second avenue of exploration is that of effecting improvements in data recording, as by increasing the efficiency of the counters themselves or developing techniques for collimating the signal and thus sharpening the directional response. Methods for decreasing noise which yield an increase in the signal-to-noise ratio also belong in this category. The third area of investigation which may lead to important advances is that of data processing and display. A great deal of attention has already been paid to the first two avenues; the third has received by far the least attention. This last problem was the primary concern of the meeting.

A limited group of 14 participants gathered at Princeton for 2½ days. The participants were chosen to include individuals with experience in the problem of human scanning; others with experience in the extraction of data from minimal information; and finally, others with experience in data processing and display. The meeting was designed to be informal and was kept small to encourage discussion. There were, however, a number of formal presentations. In the first of these, C. A. Tobias (University of California, Berkeley), G. L. Brownell (Massachusetts General Hospital), and E. C. Gregg (Western Reserve University, Cleveland) discussed isotope distribution in the human body as determined by scanning. In a series of papers on the extraction of information under difficult conditions, W. V. Mayneord (Institute of Cancer Research, London, England) discussed x-ray diagnosis in man; J. C. Lilly (Communications Research Institute of St. Thomas, Miami) spoke on recognition of patterns of electrical activity in animal brain: F. D. Drake (National Radio Astronomy Observatory, Greenbank, W. Va.) discussed the search for communication originating from extraterrestrial human beings; P. E. Green (Lincoln Laboratory, Lexington, Mass.) reported on extraterrestrial radar reflections; and W. A. Rosenblith (Massachusetts Institute of Technology, Cambridge) spoke on recognition of patterns of electrical activity in the human brain. Finally there was a round-table discussion on information theory, led by R. M. Fano and W. F. Schreiber (Massachusetts Institute of Technology).

Other participants were the members of the arrangements committee (A. K. Solomon, chairman; H. L. Friedell; and Henry Quastler); an additional member of the study section, H. E. Johns; and two rapporteurs, D. A. Goldstein and T. F. Weiss.

The discussion was vigorous and lively throughout the meeting. During the first day, effective channels of communication were established between the various participants. There appeared to

be reasonable agreement about the nature of the problem and the contributions that might come from the diverse fields represented. Part of the first day and most of the second were devoted to a presentation of specific methods by which the signal-to-noise ratio might be increased in a variety of systems. The latter part of the second day was devoted to contributions that might arise from the use of advanced information-extraction techniques. The third day was spent in the round-table discussion. When the meeting ended, there was a general feeling among the participants that it had been successful and useful.

Three particularly important suggestions were made. The first concerned the application of techniques for signal modulation in order to provide noise-free amplification and more efficient detection. Though this technique has long been known, and is widely used in radar, Drake's discussion of it in connection with 21-centimeter radio astronomy (the Dicke radiometer) led to the suggestion that it might be particularly applicable to human scanning. The pinhole camera appeared, on first view, to be relatively adaptable to mechanical modulation by a lead shutter.

Very interesting suggestions also emerged from the detailed discussion of data processing and display. It was generally agreed that this was a two-step process, and that data recording and storage should be entirely separated from data processing. In the first instance, all possible data should be recorded and stored, with no clipping or suppression of any sort. After this, the stored data should be examined without haste in order to determine the best method of display. It appeared that much might be gained from recording the data in such a way that they would be adaptable for treatment by computers. It also appeared important, in designing the display, to make optimal use of those characteristics of the human eye which have been shown to be of aid in discriminating signal from noise. One example is the unique ability of the human eye to enhance contrast.

It was clear that it is desirable to arrange for further close collaboration between scientists engaged in obtaining and recording data through human scanning and others whose major field is data processing and display. To this end it was suggested that a special course in computer techniques be arranged for scientists who are now engaged in human scanning. This course

would be designed to show how data may be recorded so that the record is readily adaptable to the more sophisticated computer treatments. It might also provide some knowledge of digital-computer characteristics and some practical experience in the use of computers, enabling those who took the course to collaborate more closely with scientists in the field of information extraction.

Further information on the course and the meeting may be obtained from Dr. Hymer L. Friedell, Department of Radiology, Western Reserve University, Cleveland, Ohio. A more detailed report, prepared by the two rapporteurs, may also be obtained from Dr. Friedell.

A. K. SOLOMON
Harvard Medical School, Boston, Massachusetts

H. L. FRIEDELL
Western Reserve University Cleveland, Ohio

H. QUASTLER
Brookhaven National Laboratory, Upton, New York

Forthcoming Events

July

1–4. European Chest Surgery Congr., annual, Stockholm, Sweden. (C. Crafoord, Karolinska Institute, Stockholm 60)

1–4. European Soc. of Cardiovascular Surgery, Stockholm, Sweden. (G. Arnuff, 1, pl. Gailleton, Lyons, France)

1–4. Oral Surgery, intern. conf., London, England. (D. C. Trexler, American Soc. of Oral Surgeons, 840 N. Lake Shore Dr., Chicago 11, Ill.)

1–5. Operational Research, intern. conf., Oslo, Norway. (Sir A. Goodeve, International Federation of Operational Research Societies, 11 Park Lane, London, W.1, England)

1–7. Rehabilitation, European natl. conf. and course, Cambridge, England. (I. R. Henderson, British Council for Rehabilitation, Tavistock House, Tavistock Sq., London, W.C.1)

1–7. Science in General Education, conf., Basutoland, S. Africa. (Institute of Education, Univ. College of Pius XII, Basutoland)

2–4. High-Resolution Nuclear Magnetic Resonance Spectroscopy, symp., Boulder, Colo. (M. T. Rogers, Dept. of Chemistry, Michigan State Univ., East Lansing)

2–4. Structure of Solid Metallic Solutions, intern. colloquium, Orsay, France. (Prof. Guinier, National Scientific Research Center, 16 rue Pierre Curie, Paris 5°, France)

2–5. International Federation of Societies of Cosmetic Chemists, London, England. (A. Herzka, Pressurized Packaging Consultants, Ltd., Ashbourne House, Alberon Gdns., London, N.W.11)

2–6. Biological Effects of Ionizing Radiation at the Molecular Level, symp., Brno, Czechoslovakia. (International Atomic Energy Agency, 11 Kaerntnerring, Vienna 1, Austria)

2–6. Ionosphere, conf., London, England. (Administrative Assistant, Institute of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

2–6. Northern Forest Congr., Oslo, Norway. (T. Austin, Nordiske Skogkongress, Akersgaten 42, Oslo)

2–7. Magnetic and Electric Resonance and Relaxation, intern. conf., Eindhoven, Netherlands. (D. J. Kroon, Philips Research Laboratories, Eindhoven)

2–7. National Education Assoc. of the United States, Denver, Colo. (W. G. Carr, 1201 Sixteenth St., NW, Washington 6, D.C.)

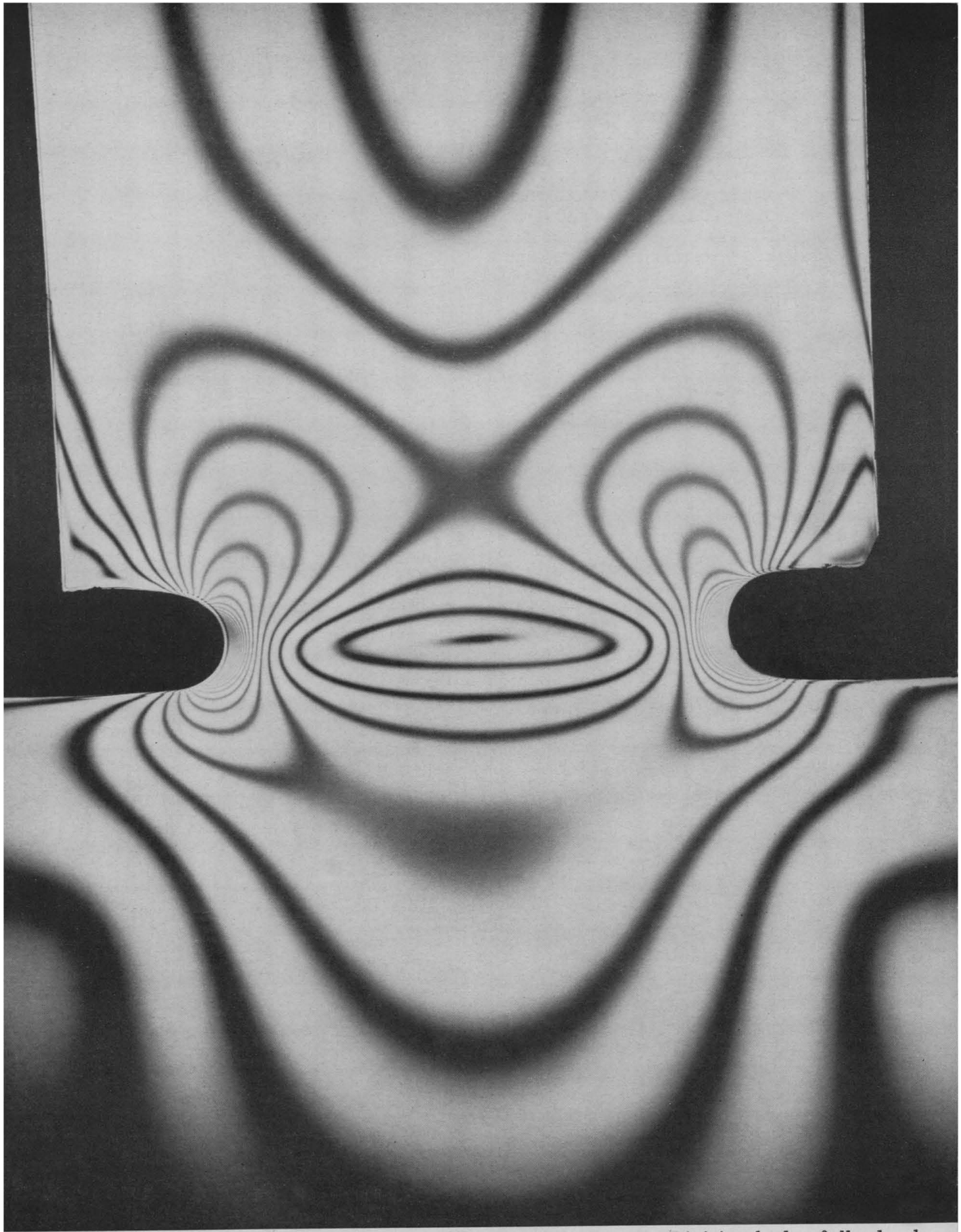
2–11. South African Chemical Institute, Johannesburg, S. Africa. (Secretary, SACI, P.O. Box 3361, Johannesburg)

2–14. Biology of Tuna and Related Species, intern. mtg., U.N. Food and Agriculture Organization, La Jolla, Calif. (J. L. McHugh, Bureau of Commercial Fisheries, Washington 25, D.C.)

3–7. Acta Endocrinologica Congr., Geneva, Switzerland. (R. Borth, Laboratoire de la Materinité, Hôpital de Genève, Geneva)

3–13. Malariology, inter-African conf., Yaounde, Cameroun, Africa. (World Health Organization, Palais des Nations, Geneva, Switzerland)

4–11. High-Energy Physics, intern. conf., Geneva, Switzerland. (E. W. D.



Charles Norton of Avco's Research and Advanced Development Division had a fully developed negative and a positive of this stress analysis picture of a missile component just 20 seconds after he took it. He used a rigid-bed 4x5 view camera loaded with **Polaroid P/N 4x5 film.**

Steel, CERN, Geneva 23, Switzerland)

5–12. Health and Nutrition Education, inter-African semin., Point Noire, Congo Republic. (Commission for Technical Cooperation in Africa South of the Sahara, Pvt. Mail Bag 2359, Lagos, Nigeria)

7–14. International Dental Congr., Cologne, Germany. (R. Braun, Universitätsstr. 73, Köln-Lindenthal, Germany)

8–12. Pan American Tuberculosis Congr., Guatemala City, Guatemala. (Horacio Estrada G., Asociación Guatemalteca de Tisiología, 10a av. 14–65, Guatemala City 1)

8–12. Psychosomatic Medicine and Childbirth, 1st intern. congr., Paris, France. (L. Chertok, Société Française de Médecine Psychosomatique, 54, av. de la République, Villejuif [Seine], France)

8–15. International Assoc. of Dental Students, congr., Düsseldorf, Germany. (D. H. Clark, Royal Dental Hospital, Leicester Sq., London, W.C.2, England)

8–15. International Council of Scientific Unions, Abstracting Board, Moscow, Russia. (G. A. Boutry, 292 rue Saint-Martin, Paris 3e, France)

9–10. Sonar Systems, symp., Birmingham, England. (British Institution of Radio Engineers, 9 Bedford Square, London, W.C.1)

9–11. Astrophysics, intern. symp., Liège, Belgium. (P. Swings, Institute of Astrophysics, Cointe-Sclessin, Belgium)

9–11. NATO Advisory Group for Aeronautical Research and Development, Paris, France. (NATO, 64 rue de Varenne, Paris 17e)

9–13. European Forestry Commission, session on torrent control, avalanche protection, and watershed management, Italy. (International Agency Liaison Branch, Office of Director General, Food and Agriculture Organization, Viale delle Terme di Caracalla, Rome, Italy)

9–13. International Academy of Pathology, congr., Zurich, Switzerland. (F. K. Mostofi, Armed Forces Institute of Pathology, Washington 25, D.C.)

9–13. Reticulo-Endothelial System and Immunity, intern. colloquium, Gif-sur-Yvette, France. (Prof. Halpern, National Scientific Research Center, 16 rue Pierre Curie, Paris 5e, Fr.)

9–14. Glass, intern. congr., Washington, D.C. (C. H. Hahner, Glass Section, National Bureau of Standards, Washington 25)

9–15. Clinical Aviation and Aerospace Medicine, mtg., NATO Advisory Group for Aeronautical Research and Development, Paris, France. (NATO, 64 rue de Varenne, Paris 17e)

9–27. Commission for Agricultural Meteorology, World Meteorological Organization, Toronto, Canada. (WMO, Geneva, Switzerland)

11–12. Bird Control, natl. seminar, Bowling Green, Ohio. (W. B. Jackson, Dept. of Biology, Bowling Green State Univ., Bowling Green)

11–21. South Pacific Conf., Utulei, American Samoa. (Secretary General, South Pacific Commission, P.O. Box 9, Nouméa, New Caledonia)

12–15. French Congr. of Anesthesiology, Montpellier, France. (J. du Cailar, Clinique Saint-Elio, Centre Hospitalier Universitaire, Montpellier)

15. International Soc. of Psychophathology of Expression, congr., Antwerp, Belgium. (ISPE, Cept. d'Art Psychopathologique, Centre Psychiatrique Sainte-Anne, 1 rue Cabanis, Paris 14e, France)

15. Psychosomatic Aspects of Odontostomatology, intern, symp., Milan, Italy. (B. Acht, Piazzetta Umberto Giordano 2, Milan)

16–18. Instrumentation, intern. conf., Hamburg, Germany. (Conference Secretariat, CERN, Geneva 23, Switzerland)

16–18. Instrumentation for High-Energy Physics, intern. conf., Geneva, Switzerland. (E. W. D. Steel, CERN, Geneva 23)

16–19. Novae, Novoids, and Supernovae, intern. colloquium, Lyons, France. (J. Dufay, Faculté des Sciences, Université de Lyons, 30 rue de Cavenne, Lyons)

16–20. Carbohydrate Chemistry, intern. symp., Birmingham, England. (General Secretary, Chemical Soc., Burlington House, London W.1)

16–20. Paramagnetic Resonance, 1st. intern. conf., Jerusalem, Israel. (W. Low, Hebrew Univ. of Jerusalem)

16–20. Physics of Semiconductors, intern. conf., Exeter, England. (Administrative Assistant, Institute of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

16–25 Aug. Theoretical Physics, semin., Trieste, Italy. (International Atomic Energy Agency, 11 Kaerntnerring, Vienna 1, Austria)

17–18. Data Acquisition and Processing in Medicine and Biology, conf., Rochester, N.Y. (K. Enslein, Brooks Research, Inc., P.O. Box 271, E. Rochester)

17–19. Lunar Missions, mtg., American Rocket Soc., Cleveland, Ohio. (J. J. Harford, ARS, 500 Fifth Ave., New York 36, N.Y.)

17–20. Fluorine Chemistry, intern. symp., Estes Park, Colo. (D. N. Gray, Denver Research Institute, Denver 10, Colo.)

17–21. American Nuclear Soc., natl. mtg., Boston, Mass. (O. J. Du Temple, ANS, 86 E. Randolph St., Chicago 1, Ill.)

17–24. Prophylactic Medicine and Social Hygiene, intern., Grado, Italy. (E. Berghoff, Piaristengasse 41, Vienna, Austria)

18–10. Water and Soil Utilization, intern. semin., Brookings, S.D. (I. B. Johnson, Dept. of Animal Husbandry, South Dakota State College, Brookings)

21–28. Institute on Religion in an Age of Science, annual summer conf., Star Island, N.H. (IRAS, 280 Newton St., Brookline 46, Mass.)

22–28. Cancer, intern. congr., Moscow, U.S.S.R. (L. Shabad, Academy of Medical Sciences of the U.S.S.R., 14 Solyanka, Moscow)

22–28. Latin American Congr. of Gynecology and Obstetrics, Bogotá, Colombia. (R. Camero, Apartado No. 2463, Bogotá)

27–31. Psychoanalysis, intern. forum, Amsterdam, Netherlands. (L. Salzman, 1610 New Hampshire Ave., Washington 9, D.C.)

27–31. Recent Advances in Experimental and Theoretical Methods of Crystal Structure Research, symp., Munich, Germany. (F. Bopp, Institut für Theo-

retische Physik, Universität München, Schellingstrasse 4–8, Munich)

28–4. International Geographical Association (Esperantist), Odense, Denmark. (P. Thorsen, Dyblandsvangen 7, Copenhagen, Denmark)

30–10. Recent Advances in Clay Mineralogy, semin., University Park, Pa. (College of Mineral Industries and Continuing Education, Pennsylvania State Univ., University Park)

August

2–7. Long-Range Goals for Ethical Humanism, intern. congr. Blindern, Norway. (Secretariat, Intern. Humanist and Ethical Union, 152 Oudegracht, Utrecht, Netherlands)

5–8. Heat Transfer, conf. & exhibit, Houston, Tex. (A. B. Conlin, Jr., Amer. Soc. of Mechanical Engineers, 29 W. 39 St., New York 18, N.Y.)

5–11. Industrial Research, annual conf., New York, N.Y. (M. F. Garvey, 301A Seeley W. Mudd Bldg., Columbia Univ., New York 27)

5–11. Radiation Research, intern. congr., Yorkshire, England. (A. Howard, Mount Vermon Hosp., Northwood, Middlesex, England)

6–10. World Federation for Mental Health, annual, Lima, Peru. (Secretary General, 19 Manchester St., London, W.1, England)

6–17. International Commission for Prevention of Alcoholism, annual, Seattle, Wash. (ICPA, 6830 Laurel St., NW, Washington 12, D.C.)

7. World Medical Esperanto Assoc., annual, Copenhagen, Denmark. (M. Jarnuszkiewicz, Majowieska 69, Krakow, Poland)

7–8. Forest Products Utilization, annual conf., Blacksburg, Va. (C. J. Holcomb, Virginia Polytechnic Inst., Blacksburg)

8–10. Standards Laboratories, natl. conf., Boulder, Colo. (A. E. Hess, Circuit Standards Div., Natl. Bureau of Standards, Boulder)

8–10. X-ray Analysis Applications, annual conf., Denver, Colo. (W. M. Mueller, Metallurgy Div., Denver Research Inst., Univ. of Denver, Denver 10)

8–14. Trace Gases and Natural and Artificial Radioactivity in the Atmosphere, symp., Utrecht, Netherlands. (E. C. Junge, Intern. Assoc. of Meteorology and Atmospheric Physics, 26 Bluebery Lane, Lexington, Mass.)

8–15. Fertility and Sterility, intern. congr., Rio de Janeiro, Brazil. (J. A. Cabello, Parque Melitón Porras 161, Mirafores, Lima, Peru)

10–11. Man-Machine Competition, mtg., Seattle, Wash. (Inst. of the Aerospace Sciences, 2 E. 64 St., New York 21, N.Y.)

10–18. Poultry, intern. congr., Sydney, Australia. (World's Poultry Science Assoc., 674 W. Lane Ave., Columbus 10, Ohio)

11–13. International Mathematical Union, genl. congr., Saltsjöbaden, Sweden. (R. Thorn, Intern. Congr. of Mathematicians, c/o Kungl. Järnvägsstyrelsen, Stockholm C, Sweden)

12–16. American Veterinary Medical Assoc., Miami Beach, Fla. (H. E. Kingman, Jr., AVMA, 600 S. Michigan Ave., Chicago, Ill.)

13–16. Biological Problems in Water Pollution, seminar—Effects of Radioac-

tivity on Aquatic Environment, Concentration of Radioactive Materials and Suggested Safe Limits, symp., Cincinnati, Ohio. (C. M. Tarzwell, Taft Sanitary Engineering Center, 4676 Columbia Pkwy., Cincinnati 26)

13–16. Pacific Energy Conversion Conf., San Francisco, Calif. (R. S. Gardner, Amer. Inst. of Electrical Engineers, 33 W. 39 St., New York 18, N.Y.)

13–17. Antarctic Logistics, symp., Boulder, Colo. (By invitation only). (National Acad. of Sciences, 2101 Constitution Ave., NW, Washington 25, D.C.)

13–17. Clay Minerals, annual conf., Ottawa, Ont., Canada. (D. Hunka, Natl. Research Council, Ottawa)

13–17. Lunar Exploration, intern. conf., Blacksburg, Va. (J. B. Eades, Jr., Dept. of Aerospace Engineering, Virginia Polytechnic Inst., Blacksburg)

14–16. Cryogenic Engineering, annual conf., Los Angeles, Calif. (K. D. Timmerhaus, Chemical Engineering Dept., Univ. of Colorado, Boulder)

14–16. Precision Electromagnetic Measurements, intern. conf., Boulder, Colo. (J. F. Brockman, Natl. Bureau of Standards, Boulder)

15–17. Electronic Packaging, annual symp., Boulder, Colo. (A. Brown, 352 Chemistry Bldg., Univ. of Colorado, Boulder)

15–22. Mathematics, intern. congr., Stockholm, Sweden. (B. Eckman, Intern. Mathematical Union c/o Ecole Polytechnique Fédérale, Zurich, Switzerland)

16–18. Communications Technology, seminar, San Diego, Calif. (R. C. Cannon, Calif. Western Univ., 3902 Lomaland Dr., San Diego 6)

16–20. American Soc. for Pharmacology and Experimental Therapeutics, Atlantic City, N.J. (H. G. Mandel, George Washington Univ. School of Medicine, 1337 H St., NW, Washington 5, D.C.)

16–25. Theoretical Physics, seminar, Trieste, Italy. (Intern. Atomic Energy Agency, 11 Kärntnerring, Vienna 1, Austria)

17–24. International Soc. for Human and Animal Mycology, congr., Montreal, Canada. (R. Vanbreuseghem, Institut de Médecine Tropicale, 155 rue Nationale, Antwerp, Belgium)

19–22. American Soc. of Animal Science, Corvallis, Ore. (C. E. Terrill, Animal Husbandry Research Div., Agricultural Research Center, Beltsville, Md.)

19–23. Conservation Education Assoc., annual, Stevens Point, Wis. (O. C. Sand, 17715 Westview Dr., New Berlin, Wis.)

19–23. Health, annual conf. and exhibit, University Park, Pa. (M. Cashman, Pennsylvania Dept. of Health, P.O. Box 90, Harrisburg)

19–25. Microbiology, intern. congr., Montreal, Canada. (N. E. Gibbons, Natl. Research Council, Ottawa 2, Ont., Canada)

19–26. Image Formation and Vision, intern. conf., Munich, Germany. (H. Schober, Intern. Commission for Optics, München 19, Arnulfstr. 205, AEC-Haus, Germany)

19–31. International Union of Geodesy and Geophysics, general assembly, Berkeley, Calif. (Amer. Geophysical Union, 1515 Mass. Ave. NW, Washington 5, D.C.)

20–22. Progress in Nuclear Science and Engineering Education, conf., Gatlinburg, Tenn. (Univ. Relations Div., Oak Ridge Inst. of Nuclear Studies, P.O. Box 117, Oak Ridge, Tenn.)

20–23. American Soc. of Agronomy, annual, Ithaca, N.Y. (ASA, 2702 Monroe St., Madison 5, Wisc.)

20–23. Problems of Gyroscopy, symp., Celerina, Upper Engadine, Switzerland. (H Ziegler, Comité Scientifique, UITAM, École Polytechnique Fédérale, Zurich, Switzerland)

20–24. American Soc. of Agronomy, Denver, Colo. (M. Stelly, 2702 Monroe St., Madison 5, Wisc.)

20–24. Chemistry, congr., Abo, Finland. (E Wänninen, Turun Yliopiston Kemian Laitos Vattenborgsvägen 5, Abo 2)

20–24. Soil Science Soc. of America, annual, Ithaca, N.Y. (M. Stelly, Amer. Soc. of Agronomy, 2702 Monroe St., Madison 5, Wis.)

20–24. Structural Design of Asphalt Pavements, intern. conf., Ann Arbor, Mich. (W. K. Parr, Box 619, Univ. of Michigan, Ann Arbor)

20–25. American Soc. of Limnology and Oceanography, Madison, Wis. (G. H. Lauff, Dept. of Zoology, Univ. of Michigan, Ann Arbor)

20–25. Limnology, intern, congr., Madison, Wis. (J. C. Wright, Birge Hall, Univ. of Wisconsin, Madison 6)

21–24. Electronics, exhibit and convention, Los Angeles, Calif. (Technical Program Chairman, WESCON Business Office, 1435 S. La Cienega Blvd., Los Angeles 35)

21–24. Far Infrared Spectroscopy, intern. symp., Cincinnati, Ohio. (Office of Information, Wright Air Development Div., Wright-Patterson Air Force Base, Ohio)

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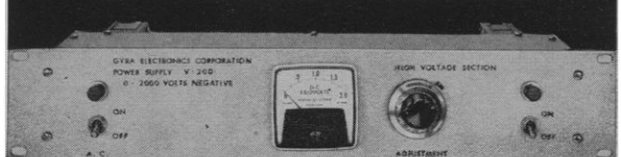

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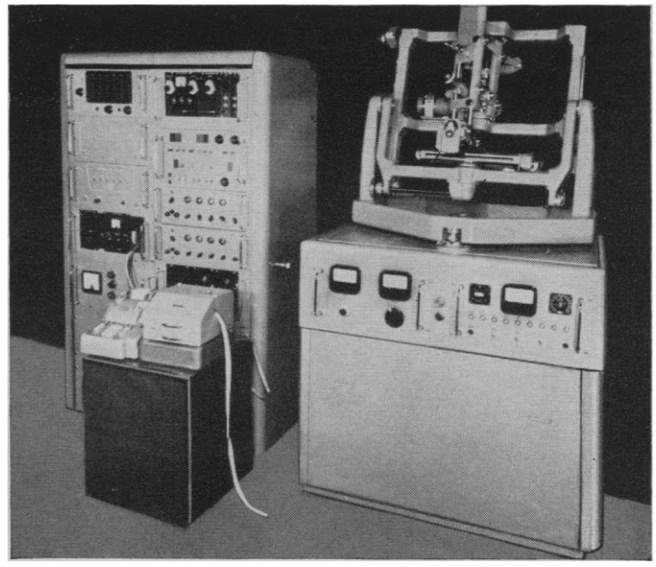

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21–24. Fracture in Crystalline Solids, intern. conf., Maple Valley, Wash. (Amer. Inst. of Mining, Metallurgical and Petroleum Engineers, 345 E. 47 St., New York 17, N.Y.)

21–25. International Inst. of Refrigeration, commissions mtg., Washington, D.C. (W. Pentzer, National Research Council, 2101 Constitution Ave., Washington 25)

21–25. International Scientific Committee for Trypanosomiasis Research, mtg., Dalaba, Guinea, Africa. (Commission for Technical Cooperation in Africa South of the Sahara, Private Mail Bag 2359, Lagos, Nigeria, Africa)

21–28. Acoustics, intern. congr., Copenhagen, Denmark. (F. H. B. Interslav, Tekniske Højskole, Østervoldgade 10, Copenhagen)

22–23. International Commission on Radiological Units and Measurements, mtg., Montreal, Canada. (Members only.) (H. O. Wyckoff, X-ray Section, Natl. Bureau of Standards, Washington 25, D.C.)

22–24. Calorimetry, annual conf., Berkeley, Calif. (J. A. Morrison, Div. of Pure Chemistry, Natl. Research Council, Ottawa, Ont., Canada)

22–24. X-ray Optics and Microanalysis, intern. conf., Stanford, Calif. (L. Zeitz, Biophysics Laboratory, Stanford Univ., Stanford)

22–25. Neurology, congr., Oslo, Norway. (S. Rufsum, Rikshospitalet, Oslo)

22–26. American Assoc. for the Advancement of Science, Alaska Div., Juneau, Alaska. (A. Sosnkowski, Alaska State Museum, Box 2051, Juneau)

23–24. Thin Films, conf., Denver, Colo. (R. B. Feagin, Univ. of Denver Research Inst., Denver 10)

23–25. Obstetrics and Gynecology, congr., Copenhagen, Denmark. (P. Lange, Eivindsvej 36 Chl., Copenhagen)

23–26. International Union of the History and Philosophy of Science, Philosophy Div., genl. assembly, Helsinki, Finland. (R. Taton, 64 rue Gay-Lussac, Paris 5e, France)

24–31. Child Psychiatry, intern. congr., Scheveningen, Netherlands. (Secretary, c/o Holland Organizing Center, Lange Voorhout 16, The Hague, Netherlands)

24–25. Plant Phenolics Group of North America, annual, Corvallis, Ore. (V. C. Runeckles, Imperial Tobacco Co. of Canada, P.O. Box 6500, Montreal, Quebec, Canada)

24–1. Surveying, intern. congr., Vienna, Austria. (A. Barvir, Intern. Federation of Surveyors, Krotenthallergasse 3, Vienna 8)

24–2. International Pharmaceutical Students' Federation, congr., Barcelona, Spain. (A. Damen, IPSF, Spaargarenstraat 26, Oegstegeest-Leiden, Netherlands)

25–26. International Chiropractors Assoc., annual, Davenport, Iowa. (G. R. Price, 741 Brady St., Davenport)

25–31. Environmental Control of Plant Growth, intern. symp., Canberra, Australia. (L. T. Evans, C.S.I.R.O., Div. of Plant Industry, P.O. Box 109, Canberra City, A.C.T., Australia)

26–29. American Inst. of Chemical Engineers, natl. mtg., Denver, Colo. (F. H. Poettmann, Ohio Oil Co., P.O. Box 269, Littleton, Colo.)

26–29. Soil Conservation Soc. of America, Washington, D.C. (H. W. Pritchard, 838 Fifth Ave., Des Moines 14, Iowa)

26–31. American Inst. of Biological Sciences—American Assoc. for the Advancement of Science, Pacific Div., Corvallis, Ore. (AIBS, 2000 P St., NW, Washington 6, D.C.)

The following 27 meetings are being held under AIBS auspices during the annual meeting in Corvallis:

American Bryological Soc. (R. O. Belkengren, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Fern Soc. (L. Dennis, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Fisheries Soc. (J. H. Wales, Fish & Game Management, Oregon State Univ., Corvallis)

American Microscopical Soc. (H. K. Phinney, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Phytopathological Soc. (E. K. Vaughan, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Soc. for Horticultural Science. (S. B. Apple, Jr., Dept. of Horticulture, Oregon State Univ., Corvallis)

American Soc. of Human Genetics. (J. D. Mohler, Dept. of Zoology, Oregon State Univ., Corvallis)

American Soc. of Limnology & Oceanography. (J. Pattullo, Dept. of Oceanography, Oregon State Univ., Corvallis)

American Soc. of Plant Physiologists. (H. J. Evans, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Soc. of Plant Taxonomists. (K. L. Chambers, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

American Soc. of Zoologists. (A. W. Pritchard, Dept. of Zoology, Oregon State Univ., Corvallis)

Biometric Soc. (L. D. Calvin, Statistical Laboratory, Oregon State Univ., Corvallis)

Botanical Soc. of America. (L. E. Jones, Dept. of Botany and Plant Pathology, Oregon State Univ., Corvallis)

Ecological Soc. of America. (W. W. Chilcote, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

Genetics Soc. of America. (R. Bogart, Dept. of Dairy & Animal Husbandry, Oregon State Univ., Corvallis)

Mycological Soc. of America. (C. M. Leach, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

National Assoc. of Biology Teachers. (S. E. Williamson, Dept. of Science Education, Oregon State Univ., Corvallis)

Nature Conservancy. (R. M. Storm, Dept. of Zoology, Oregon State Univ., Corvallis)

Phi Sigma Soc. (W. H. Brandt, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

Phycological Soc. of America. (H. K. Phinney, Dept. of Botany & Plant Pathology, Oregon State Univ., Corvallis)

Plant Phenolics Group of America. (H. Aft, Forest Products Laboratory, Oregon State Univ., Corvallis)

Society for Industrial Microbiology. (R. Bogart, Dept. of Dairy and Animal Husbandry, Oregon State Univ., Corvallis)

Society for the Study of Evolution, (W. F. Stephen, Dept. of Entomology, Oregon State Univ., Corvallis)

Society for the Study of Development and Growth. (A. W. Pritchard, Dept. of Zoology, Oregon State Univ., Corvallis)

Society of General Physiologists. (E. J. Dornfeld, Dept. of Zoology, Oregon State Univ., Corvallis)

Society of Protozoologists. (S. E. Knapp, Dept. of Veterinary Medicine, Oregon State Univ., Corvallis)

Tomato Genetics Cooperative. (W. A. Frazier, Dept. of Horticulture, Oregon State Univ., Corvallis)

The following 9 meetings are being held under AAAS auspices during the annual meeting of the Pacific Division:

American Meteorological Soc. (L. D. Calvin, Statistical Laboratory, Oregon State Univ., Corvallis)

American Nature Study Soc. (R. E. Storm, Dept. of Zoology, Oregon State Univ., Corvallis)

American Soc. of Ichthyologists & Herpetologists, Western Div. (R. E. Storm, Dept. of Zoology, Oregon State Univ., Corvallis)

American Soc. of Limnology & Oceanography, Pacific Div. (J. Pattullo, Dept. of Oceanography, Oregon State Univ., Corvallis)

Institute of Food Technologists. (C. E. Samuels, Dept. of Food & Dairy Technology, Oregon State Univ., Corvallis)

Oregon Acad. of Science. (F. A. Gilfillan, Dean of Sciences, Oregon State Univ., Corvallis)

Oregon Marine Biological Soc. (J. H. Wilson, Public Health Service, Portland, Ore.)

Society of Systematic Zoology. (J. D. Lattin, Dept. of Entomology, Oregon State Univ., Corvallis)

Western Soc. of Soil Science. (T. L. Jackson, Dept. of Soils, Oregon State Univ., Corvallis)

26–1. International Commission for Uniform Methods of Sugar Analysis, session, Berlin, Germany. (F. Schneider, Langer Kamp 5, Braunschweig, Germany)

26–1. Radiology, intern. congr., Montreal, Canada. (C. B. Peirce, Suite 204, 1555 Summerhill Ave., Montreal 25)

26–2. History of Science, intern. congr., Ithaca, N.Y. (26–31 Aug.) and Philadelphia, Pa. (31 Aug.-2 Sept.). (Secretary, Intern. Congr. of the History of Science, Cornell Univ., Ithaca)

27–28. Culture Collections, specialists' conf., Ottawa, Ont., Canada. (By invitation.) (S. M. Martin, Div. of Applied Biology, National Research Council, Ottawa 2)

27–28. Scandinavian Neurosurgical Soc., annual, Odense, Denmark. (B. Broager, Neurokirurgisk Afdeling, Bispebjerg Hosp., Copenhagen, Denmark)

27–29. American Physical Soc., Seattle, Wash. (H. A. Shugart, Univ. of California, Berkeley 4)

27–29. Ballistic Missile and Space Technology, symp., Los Angeles, Calif. (C. T. Morrow, Aerospace Corp., P.O. Box 95085, Los Angeles 45)

27–29. Mathematical Assoc. of America, summer mtg., Vancouver, B.C. (H. L. Alder, MAA, Dept. of Mathematics, Univ. of California, Davis)

27–29. Metallurgy of Semiconductor Materials, conf., Philadelphia, Pa. (Amer. Inst. of Mining, Metallurgical, and Petroleum Engineers, 345 E. 47 St., New York 17, N.Y.)

27–30. American Assoc. of Clinical Chemists, Santa Monica, Calif. (G. F. Lanchantin, Cedars of Lebanon Hosp., Los Angeles, Calif.)

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

27–30. American Soc. for Pharmacology and Experimental Therapeutics, Nashville, Tenn. (H. G. Mandel, George Washington Univ. School of Medicine, 1337 H St., NW, Washington 5, D.C.)

27–31. American Congr. of Physical Medicine and Rehabilitation, annual, New York, N.Y. (G. Gullickson, Jr., N. Michigan Ave., Chicago 2, Ill.)

27–31. Space Technology and Science, intern. symp., Tokyo, Japan. (F. Tamaki, Inst. of Industrial Science, Univ. of Tokyo, Shin-Ryudo-cho 10, Minato-ku, Toyko)

27–1. Combustion, intern. symp., Ithaca, N.Y. (Combustion Symp. Office, Upson Hall, Sibley School of Mechanical Engineering, Cornell Univ., Ithaca)

27–1. Environmental Physiology and Psychology in Arid Conditions, Naini Tal, India. (M. Batisse, UNESCO Dept. of Natural Sciences, Place de Fontenoy, Paris 7e, France)

27–1. International Assoc. of Logopadics and Phoniatrics, annual, Padua, Italy. (C. Croatto-Martinolli, Via Bergamo 10, Padua)

27–1. International Council of the Aeronautical Sciences, congr., Stockholm, Sweden. (Mr. Bergquist, Flugtechniska Föreningen, Bromma 11, Stockholm)

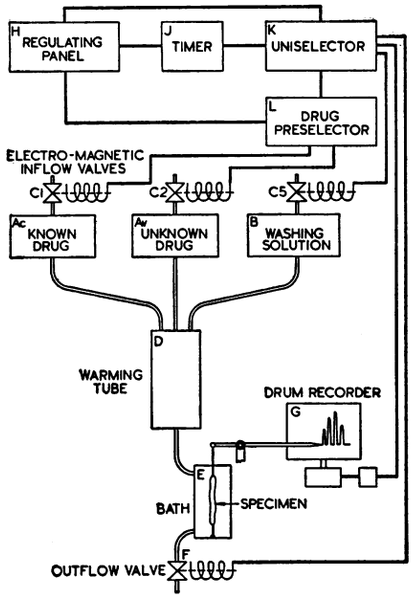
COOKE BRIEFS

Instruments and Applications

Automated quantitative measurement of drug activity

In such applications as testing of anti-spasmodic drugs, histamine assays, potentiation and antagonist experiments, etc., the speed, accuracy and convenience of set-up and measurement procedures can be improved by use of the Casella Automatic Biological Assay Apparatus.

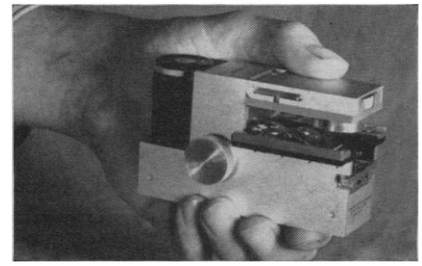
The apparatus controls the flow of drug and washing solutions into and out of the isolated organ bath, using electro-magnetic valves.



The drug and washing solutions are contained in reservoirs Av, Ac and B respectively. When one of the air-inlets is opened by its valve C, the solution flows via the warming tube D into the jacketed isolated organ bath E — which is emptied by another electro-magnetic valve F. The contractions of the specimen are traced on the drum of a standard type of variable speed recorder G.

The cycle has been divided into several stages. The time required for each of these operations is independently variable over a very wide range. This is done by adjusting those controls on panel H which regulate the intervals between the pulses sent out by timer J to the uniselector switching device K. The order in which the drugs are added is decided by the position in which plugs are placed in the preselector L.

The McArthur Microscope



The McArthur Microscope shown was originally designed for malaria diagnosis and control work in the field in Southeast Asia. It can be quite easily carried in a coat pocket, but retains all the performance advantages of a full size instrument. A full range of achromatic and fluorite objectives is available as well as dark ground accessories. Illumination can be by mirror or by a battery or transformer operated built-in light source.

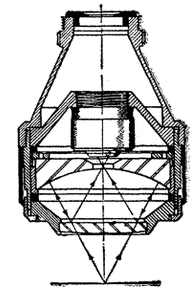
Phase contrast examination of tissue cultures in test tubes

Adequate optical examination of the living cell sheet while in the test tube (in which tissue cultures for routine virology are often and most conveniently grown) has not previously been possible — chiefly because it has not been possible to apply the phase contrast method. However, this is now feasible with the McCarthy Phase Apparatus, supplied as an accessory with the Cooke M15 microscopes, designed to give a phase contrast image (up to 150X-200X) of tissue cultures in a round 6" x ⅝" (150mm x 16mm) test tube.

In the McCarthy system provision is made for correction of astigmatism caused by the test tube and a special condenser system, compensated for the tube's cylinder effect, projects the substage phase annulus in the plane of the object.

High power microscope objectives with long working distances

Under unusual observation conditions and for some work involving the techniques of micro-manipulation, it would be advantageous to use "high dry" objectives but with working distances many times those normally obtained. Cooke-A.E.I. special objectives with working distances more



than 15 times conventional values are sometimes used. Drawing shows the general construction, involving a mirror system which projects object image to a conventional microscope objective mounted behind. Working distance of both 20X and 40X objectives is 12.8mm, as contrasted with the normal working distance of approximately 0.71mm.

Numerical apertures are slightly reduced (to N.A. 0.57 in the case of a 40X achromat) and there is some loss of light inherent in the design. Excellent image quality is achieved, however, if cover glasses are close to the 0.18mm thickness for which the system is adjusted. Because of the mirror system, the objectives cannot be used on metallurgical specimens.

Gardens, but this is a technicality which it should be possible to circumvent, or the law should be modified to take care of this particular case.

In any event, it seems clear that the relict Florida torreya, known to professional botanists throughout the world, and locally of significant general interest, is even now all but extinct in its natural habitat. Its preservation, in cultivation, can perhaps be accomplished if prompt and bold measures are immediately instigated.

R. K. GODFREY
HERMAN KURZ
Department of Biological Sciences, Florida State University, Tallahassee

Interpreting Science

Joseph Turner's editorial reviewing the recent Bell System television program "About Time" [*Science* **135**, 635 (23 Feb. 1962)] was superb. His urbane appraisal of this latest attempt to make science palatable to the general public was very much to the point.

Many of us who are actively engaged in the interpretation of science realize that the fault lies not so much in the content as in the approach. The latest offering of the Telephone Company is a good example. The material treated was well selected, as one would expect from a practiced hand such as that of Feynman. It would appear, however, that once the material was in their hands, the "entertainment" people took over and injected the type of corn that they invariably insist is necessary in order to gain and hold the attention of the public.

In their search for a suitable "format" the production staff seemed to overlook the fact that a straightforward presentation may be worth trying, even if its adoption entails the possible loss of some of the fringe public. Of the shows currently on the air, the forthright, informative, and highly absorbing "David Brinkley's Journal" proves the point splendidly. By telling his story simply and telling it well, Brinkley proves, week after week, that an audience can be held without resort to special gimmicks of any kind. There is no reason why this approach would not work just as effectively for science material.

On the subject of science interpretation via radio and television, I would like to say one thing more. In recent

days the collective imagination of the American public has been dominated by John Glenn's orbital flight. Television did a remarkably competent job of presenting the actual flight and the festivities that followed its successful completion. But during this whole period not so much as a single half-hour segment of television time on any station or network was devoted to an explanation of the scientific background of this exploit. Presentation of a few basic principles—such as the concept of an orbit, weightlessness, physical conditions in space, and the physiology of space flight—could have lent meaning and substance to this great technological achievement.

Is it not the duty of the AAAS, as the spokesman for American science, to see that another such opportunity does not pass unheeded?

IRA M. FREEMAN
College of Arts and Sciences,
Rutgers University,
New Brunswick, New Jersey

Cell Growth

A preoccupation with Mendelsohn's concluding remarks in his report on chronic infusion of tritiated thymidine into mice with tumors [*Science* **135**, 213 (1962)] to the effect that a tumor "literally doubles before one's eyes" should not deflect attention from the real significance of the finding that an appreciable number of tumor cells do not give evidence of DNA accretion during a 3- to 7-day period and are therefore not proliferating. If this conclusion can be stretched to embrace a corollary hypothesis—that cancer is not necessarily a wildly proliferative, exuberantly growing, racing reduplication of cells, that it may, in fact be just the reverse—it will then be found to fit in with a welter of ancillary evidence, emerging from all medical subdisciplines, that calls for a reassessment and readjudication of common (descriptively borne) notions of the nature of cancer.

If the question had arisen in connection with the usual experimental tumor —a transplant—I would not have bothered to comment. Arising as it does from studies of tritiated thymidine uptake (studies whose validity I feel to be established) by an autochthonous tumor which is as close as anyone can get to spontaneous human carcinoma, the factual data from Mendelsohn's Fig. 2,

showing that in an infusion period of up to 4 days three out of seven tumors show about 50 percent labeling, must be taken seriously. Compared with normal acinar cells, the rate of proliferation must be considered markedly *diminished* in the neoplasm.

Why, then, tumor formation? The answer in this instance applies to carcinoma in any situation. Normal epithelial cells are always contiguous to a lumen, where their proliferation products are discharged. Allow clones of these normal epithelial cells to be displaced beneath muscularis mucosae where such desquamation is impossible, and intumescence is inevitable if proliferation occurs at all, even if it occurs at only 1/100 the rate of proliferation of the homologous cells of origin (Barnard and Oppenheim, *Brit. Med. J.*, **1**, 943 (1962). The "doubling" in tumor size in a period of 1 week can be put into proper perspective when one considers the quadrupling in size, in a 6-hour period, of the normal lactating breast: although the volume may be fluid, all of it represents a prior accretion of acinar cells.

The growing realization that some experienced pathologists have been right for years in calling malignant neoplasm a frozen senescence rather than an exemplification of youthful proliferative overactivity arises now from a diversity of promptings. One of these that deserves mention, in light of Mendelsohn's doubts about the rationale of administering the halogenated pyrimidines as cancer chemotherapeutic agents, is the notorious failure of any of the antimetabolite therapies to do anything for the patient other than retard the function of the bone marrow and the intestinal mucosa where a high proliferation rate *is* extant.

From our present knowledge that all popular cancer chemotherapeutic agents (with the exception of steroids and certain antibiotics)—whether of the ureide-base analog, folic acid antagonist, alkylating agent, or radiomimetic class—have in common the characteristics of (i) curbing ureide-bases synthesis, (ii) preventing nucleoside and nucleotide formation, and (iii) curtailing nucleotide polymerization and incorporation into the polynucleotide chain, we can say that Mendelsohn's argument applies to all these as well as to definitive irradiation. And well it might, if, as we are beginning to suspect, the nature of cancer is the opposite of what we always thought it to be—if a cancerous cell is a cell finding difficulty in organizing its information through adequate DNA synthesis.

To further increase this informational digestive disability by exhibiting noxious potions is a therapeutic fallacy which I believe is pointed up by Mendelsohn's results.

ROBERT D. BARNARD
Division of Cancer Research,
New York City Department of Health,
New York

There are three ways in which the growth of a cell population can increase: (i) through prolongation of the survival time of nonproliferating cells, (ii) through shortening of the generation time of proliferating cells, and (iii) through increase in the fraction of proliferating cells in the population. Methods for measuring these parameters in cell populations are only just becoming available. Until we have the appropriate information about the growth properties of normal and tumorous breast tissue, I cannot support the statement that breast tumor cells are proliferating at a diminished rate. Actually, there are few if any cases where enough data are available for an adequate comparison between comparable normal and tumorous tissues, but this situation should soon be rectified. For

example, A. B. Reiskin and I are studying normal basal cells and carcinogenically induced epidermoid tumors in the hamster pouch. As is often the case, these tumors have a higher mitotic index than their normal counterparts. In addition, the tumors have a shorter duration of DNA synthesis, and labeling is more intensive (there are more grains per labeled cell) than in normal cells. Since the fraction of cells that become labeled after a single injection of tritiated thymidine is higher in the tumor than in the normal cell, it is clear that in this case the tumor cells have the shorter generation time, or the larger fraction of proliferating cells, or both.

In any case, these arguments and the infusion experiment are significant only for those therapeutic situations where effectiveness hinges on mitotic activity of the target cells during exposure to the agent. Barnard may be justified in his skepticism about most cancer chemotherapy, but I tend to be more optimistic in view of our lack of complete understanding of the mechanism of action of current therapeutic agents (including ionizing radiation).

MORTIMER L. MENDELSOHN
Department of Radiology,
University of Pennsylvania,
Philadelphia

Desert Vegetation in Nevada

"Succession in desert vegetation on streets of a Nevada ghost town" [*Science* **134**, 670 (1961)] is a commanding and iconoclastic title, and an article on this subject deserves very careful reading. Upon such reading, I feel sure the paper deserves commendation—and comment. In this study, Philip V. Wells (New Mexico Highlands University, Las Vegas) compared the density and frequency of the most abundant species on the 33-year-abandoned streets of an ephemeral ghost town in Nye County, Nevada, with conditions on "undisturbed" adjacent bajada. He shows that "several shrubs of dry washes can become established in abundance on . . . an alluvial fan," and states, "Obviously, these pioneer plants of the desert play a role similar to that of successional plants of more humid regions."

As a statement of what Wells is trying to topple, I quote Wells: "Shreve . . . concluded: 'Each habitat in each subdivision of a desert area has its

own climax, which must *not be given* an elastic definition and *must be interpreted* as having a genetic relation to any other climax" (italics mine). May I quote again, this time directly from Shreve: "It is not possible to use the term 'climax' with reference to desert vegetation. Each habitat in each subdivision of a desert area has its own climax, which *must be given* an elastic definition and *must not be interpreted* as having a genetic relation to any other climax." I by no means imply that Wells purposedly misquoted Shreve. As an unintentional misquotation however, . . . this is the most interesting psychologic twist of its kind in the ecologic literature, to my knowledge, completely in accord with the thinking and reasoning Wells has expressed throughout his paper. The case of the ghost town supports and substantiates Shreve's generalizations, not the contrary.

FRANK E. EGLER
Aton Forest, Norfolk, Connecticut

The misquotation caused by the misplacement of the word *not* was lacking in the manuscript, appeared first in the proof, was corrected by me in the proof, but slipped through into the final printing. Hence, the "psychological twist" deduced by Egler as the reason for the error must be traced to the editorial office or the printer. Even after undergoing surgery by Egler, my article provides no basis for his sole conclusion, given ex cathedra in the last sentence of his letter.

As a statement of what Egler is trying to topple, I quote his quotation from my article: "several shrubs of dry washes can become established in abundance on . . . an alluvial fan. . . . Obviously, these pioneer plants of the desert play a role similar to that of successional plants of more humid regions." I would like to quote from the original, in context: "Since the word climax, as applied to vegetation, conveys an idea of relative stability, it seems scarcely applicable in the case of desert washes, which are periodically scoured by floods carrying great quantities of coarse detritus. The average wash presents an extensive open surface favorable for invasion by pioneer plants possessing the requisite adaptations for efficient seed dispersal, celerity of growth, and early maturation. One might suppose that all plants of this habitat have a greater water requirement than plants of upland

sites and for this reason are restricted to naturally irrigated areas of the desert. However, the present study shows that several shrubs of dry washes can become established in abundance on *the more xeric upland portions of* an alluvial fan *when the competition of the dominant upland shrubs is largely removed.* Obviously, these pioneer plants of the desert play a role similar to that of successional plants of more humid regions." This does not necessarily imply that Egler has edited to alter meaning, but as a "psychological twist," it appears to have been overlooked by perennial critic Egler in his survey of the ecological literature.

The evidence presented in my report is at variance with the "auto-successional" views of Shreve, as well as with his related views on climax vegetation. The latter were distorted by the typographical error, but, thanks to Egler, now stand corrected.

PHILIP V. WELLS
New Mexico Highlands University, Las Vegas

The Cunningham Amendment

Your recent editorial [*Science* **135**, 877 (1962)] commented on the terms of the "Cunningham amendment" to the postal rate bill, an amendment to end free or subsidized delivery of Communist propaganda by the Post Office. As the author of the amendment, I would appreciate the opportunity to add several facts for the benefit of your readers, many of whom may have a desire and need for certain Russian or other Communist bloc publications. These might include outright propaganda, daily papers, magazines of general interest, and scientific journals or papers.

There is no intention on my part, as I have often said, to deny to any American any material he needs or wants to receive. I do not believe it would be possible or practical to bar Communist propaganda from the country, but I do believe that the vast majority of Americans are in favor of ending the subsidy given Communist propaganda, especially at this time when American postal rates are almost certain to be increased.

Accordingly, the House of Representatives felt it was time to take cognizance of the fact that the Russians and other Communist governments have long violated the reciprocal

terms of the Universal Postal Union, an international mail-forwarding agreement which dates to 1874. There is ample evidence that U.S. mail sent behind the Iron Curtain is censored, stopped, destroyed, or "lost," depending on the content. These procedures are all in violation of UPU agreements, yet this country has not seen fit to retaliate by stopping mail delivery from these countries, as we have every right to do under the UPU. The amendment adopted by the House would be merely a first step in this process.

Because some of your readers may wish to receive outright Communist propaganda or material which contains Communist propaganda, I would point out that under my amendment such material may be received into this country by freight or air freight, then sent to its destination (whether individual, library, government office, or newsstand) via parcel post, freight or air freight, messenger service, delivery route, or any other means that does not involve the use of first-class, second-class, or third-class mail.

It may also be possible for material to bear both foreign stamps and U. S. stamps for parcel post rates and be carried via postal systems from the point of foreign origin to the destination in the United States. A similar UPU arrangement has been put into effect in regard to certain international mail which is considered third-class advertising in this country.

Although some persons (apparently through a lack of knowledge of present procedures) have said that the Cunningham amendment would require vast new inspection programs, the truth is that suspect foreign and domestic mail is already inspected to weed out pornography, matter advocating the violent overthrow of the government, material which contains fraudulent claims, and so on.

GLENN CUNNINGHAM
United States House of Representatives, Washington, D.C.

Lemurs Born in Captivity

The picture of the baby lemur on the cover of *Science* [**135** (13 Apr. 1962)] was very interesting. The news that baby animals are being born and successfully reared in captivity is always very exciting.

The caption for the cover picture states that the baby lemur was born at

Yale University—and is thought to be the first one born in captivity. Perhaps it is meant that it is the first baby lemur of this particular species born in captivity, although the wording of the statement does not indicate this. Here at the Bronx Zoo baby lemurs (black lemurs) have been born and reared since about 1902. There have not been a great many born, however, and the last was reared here in the late 1950's. Perhaps other zoos in the country have also reared baby lemurs from birth.

DORIS S. CELLARIUS
New York Zoological Society, New York

Shelter Program

Howard Margolis's comments [*Science* **135**, 776 (9 Mar. 1962)] on the Peace Research Institute report, "The Shelter-Centered Society," fail to make clear that the report was based on the deliberations of *several* qualified social scientists (the undersigned), and that although the report was written by Arthur Waskow for the institute, there was essential agreement among us on its substance.

Margolis also fails to make clear that the report is concerned with the consequences of a large shelter program—that is, of a "shelter-centered society." We believe, on the basis of evidence and arguments set out in the report, that the evolution of such a society is highly likely once a civil defense program is begun, even if it is the initial intention to keep the program small. And on the one point in the report which Margolis does emphasize (and repudiate)—the probable adverse effects of civil defense on disarmament—direct evidence is presented in the report that the effects have already been disadvantageous where hope for disarmament is concerned. For the future, the report warns of possible regimentation developing from a large shelter program.

The report also emphasizes that careful study is needed to determine whether control of civil defense or juxtaposition of other public programs can mitigate or eliminate the undesirable effects foreseen to follow from a large program.

As social scientists we know that no one is completely unbiased in his interpretation of reality and assignment of priorities; but as social scientists we also believe that understanding of the implications of a shelter system for a so-

ciety's political processes can be greatly increased by carefully applying systematically derived knowledge about men and their institutions. This we assiduously attempted to do during our deliberations and in reviewing drafts of the report, by recognizing the limits of humans as "objective" evaluators, the limits on the present armamentarium of social science, and above all, the limits on foreseeing the future.

To this end the report states: "Applying the established knowledge of social scientists to the situation which might be created by the existence of a civil defense system cannot, of course, produce iron-clad predictions of what will happen. But it can point to the kinds of problems that are likely to develop—problems whose avoidance or solution will tax all the ingenuity of people and government, problems which therefore demand serious thought before action is taken that could make them and their consequences impossible to cope with."

RAYMOND BAUER
URIE BRONFENBRENNER
MORTON DEUTSCH
HERBERT HYMAN
ERIC LINDEMANN
DONALD MICHAEL
DAVID RIESMAN
ARTHUR WASKOW
STEPHEN WITHEY

In "News and comment" [*Science* **135**, 776 (9 Mar. 1962)] Howard Margolis discusses the civil defense debate. In commenting on the papers published by a group of eight scientists, he does not realize that these papers purposely do not speak for or against shelters. Yet, he does understand that they prove the utter foolishness of the government program.

In his presentation, Margolis does not bring out the following salient points.

1) A pure fallout-shelter program will protect at best only a small portion of the American population in the event of a nuclear war. To deny this would be to assume that the adversary would, out of sheer kindness, not aim at the large population centers.

2) If a substantial part of the population is to have any chance of survival, thermal effects in shelters cannot be disregarded.

3) Because of the heat generated by the human body the temperature within the shelters will rise within a few days to unacceptable levels unless cooling equipment is provided or cold air can be drawn in. Such ingestion of cold air would bring with it the danger of drawing in air contaminated by fallout particles.

4) In order to reduce the unacceptable rise in temperature in the shelters, it would be necessary to make the shelters much larger than the government proposes.

5) Concerning the cost of shelters, much more than the mere construction costs have to be considered. When all costs are taken into account we find that a program which may make it possible for 120 million Americans to survive would cost in the neighborhood of $300 billion.

6) Such a program would require a construction effort five times the present total national effort and, therefore, would require that all civilian and military construction, including construction of all armaments, be ended, unless the program should be stretched out over many years.

7) Even if we were to go in for such a program, the survivors coming out

of shelters would find their surroundings nonviable.

8) Since the building of shelters may increase international tensions, it is possible that such a shelter program would endanger rather than save lives.

If Margolis had tried to disprove any of the contentions in the papers one could argue with him, but unfortunately he did not discuss the contents of the papers.

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I am not sure what our correspondents mean by a "large" program. The term is defined only as it is related to a shelter-centered society, and *this* term is not defined at all, either in the letter or in the report. If they consider the currently proposed program "large," then I can hardly have misled anyone by not specifically saying the Peace Research Institute was talking about the proposed "large" program, since that was what my entire article was about. If they mean large as compared to the proposed program, then they are surely guilty of seriously misleading their readers. The report clearly and unambiguously says it is talking about the "impact of the newly proposed shelter program." Equally clearly, the argument that the program might grow is stated in the report neither as emphatically nor as prominently as the reply to my comment may suggest, and it is, in any case, given as a possible additional hazard of going into civil defense, not (as the reply may seem to suggest) as the basis for the analysis. In sum, then, if the writers of the PRI report were talking about the proposed program, their complaint is trivial; if, on the contrary, they were talking about some undefined "large" program, then they have drastically misled their readers.

Our correspondents quite properly point out that "no one is completely unbiased" but that this does not rule out useful analysis by social scientists. But there is a reasonable limit to the degree of bias that can be excused in this way. On the disarmament question, for example: In its description of a spectrum of possible policies to deal with the threat of war, the report presents effective pursuit of disarmament as flatly incompatible with a civil defense program. Do our correspondents really believe the report presented

enough, or any, "direct evidence" to justify giving readers the clear impression that a choice *must* be made between having a civil defense program and seeking disarmament?

As for Paschkis's letter, in my comments I said that the papers were largely irrelevant to a discussion of the proposed program. The report is directed, or misdirected, mainly toward demonstrating the "utter foolishness" of a deep-shelter program, which no one in a responsible position has advocated. This misdirection comes from the fact that the preface to the report assumes, without any argument more detailed than what is given in Paschkis's point 1, that the only kind of nuclear attack worth considering is a massive attack on our cities. From this, the report assumes that any shelter program "must" include blast as well as fallout shelters. The point is not that these are necessarily unsound assumptions but that once you have accepted them you do not have to read the report. If a shelter program, to be even worth considering, must include blast shelters, then the Administration program, which does not include blast shelters, is not worth considering.

It is possible to dig out some arguments that could be used specifically against the Administration program, but the report, because of its underlying assumptions, is not organized to present a coherent case against the program. Consider, for example, the paper summarized in Paschkis's point 3: Shelters of the kind the government is recommending have 100-percent air intakes. Therefore the fairly detailed discussion in the report of overheating where there is whole or substantial reliance on self-contained air systems is irrelevant. A discussion of how seriously, if at all seriously, the air intake would reduce a fallout shelter's value would have been very relevant. But there is no discussion of this point beyond mention of it as something to consider.—HOWARD MARGOLIS

Space Messengers

Although Leslie C. Edie, of Bellmore, N.Y. [see *Science* **136**, 184 (13 Apr. 1962)] and I are separated by less than a mile in distance, we are many miles apart in speculating on the possibility of "intercivilizational" communication via coded messages on "meteorites, comets, and other space travelers."

Wouldn't a civilization anxious to proclaim its existence employ missiles more obviously recognizable as messengers than an inconspicuous chunk of rock? Furthermore, wouldn't any launched "letter-carrier" forever remain confined to its parent solar system unless it was sufficiently powered for space travel?

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Heredity, Environment, and Culture

The storm of comment in the "Letters" column [*Science* **135**, 961 (16 Mar. 1962)] on Howard Margolis's eminently reasonable remarks on "Science and segregation" [*ibid.* **134**, 1868 (1961)] makes one wonder if the anthropologists perhaps do not "protest too much." It seems appropriate to redirect attention to Margolis's paragraph 2 in column 2 of page 1869, which describes a real problem. As a biologist I have been for many years distressed by the almost hysterical denial by many anthropologists of any possibility of a hereditary basis for any cultural traits or even for any difference in mentality or emotional makeup. If such a position had a factual basis, to provide an explanation of such facts would certainly be a real problem.

What a great pity it is that the anthropologists, the human geneticists, and perhaps the human ecologists cannot seem to get together and investigate the relations between human heredity, environment, and culture without the undefinable concept of inferiority entering into the matter at all.

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Information-Gathering by the CIA

In a recent issue of *Science* [**136**, 173 (13 Apr. 1962)] Patrick D. Wall reported that he declined to disclose to a representative of the Central Intelligence Agency information as to the direction being taken by certain foreign scientists in the field of neurophysiology, because (i) one should reasonably ask the questioner to share the same ethics and tell you specifically for what purpose he intends to use the information, a professor being required to remain in a position to assess the consequences of his profession, and (ii) a consequence of a relationship with the CIA would be to limit the freedom of discussion between American and foreign colleagues by increasing the danger that American scientists will be regarded as government agents. Wall says that if a colleague had asked him for this information he would have replied without hesitation.

Wall could deal with the situation, although perhaps somewhat deviously, by disclosing the requested information without reporting the fact to his foreign colleagues, some of whom he characterizes as certainly part-time intelligence agents. This would minimize the hazard of impairing the usually free exchange and argument of a scientific discussion, which he properly prizes. But this does not meet his first objection.

Not all of us can share Wall's conviction that undisclosed purposes of the United States Government are evil. Even he probably does not, in order to

preclude disclosure to the government, require a specific statement of purpose on the part of every colleague and student and every reader of any periodical in which his work may be published. We thus come to a practical difficulty in the application of his principles. Can he really be sure that no colleague, student, or reader will disclose information to the United States Government? Is it not even possible that one of them may be an American agent in disguise? The only effective way to preserve security would be to refrain from talking about his work to anyone or, on the assumption that the Central Intelligence Agency and other government agencies are as subtle as he believes, to refrain from doing any scientific work at all.

But this is not the end of the problem. I was once consulted by a gentleman who was oppressed by the consciousness that the Federal Bureau of Investigation was telepathically prying into his thoughts. This raises the question of whether, in addition to refraining from talking about scientific work or engaging in it, we ought not avoid thinking about it. As a fellow who sometimes puts himself to sleep at night by working out simple topological problems in his head, I would hesitate to adopt a policy which would condemn me to wakefulness during my nonworking hours.

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The good will and good intentions of the government are not in question. What is in question is the price we are paying for the CIA's questioning of scientists. It is generally agreed that secret classification of projects and wiretapping should be limited, since they increase mistrust and suspicion and diminish freedom of communication. It is to be hoped that the good sense of the government and the scientists will limit CIA information gathering, because we are paying a price for it, too. The government has tremendous in-house capabilities for collecting information from the many very able government scientists. Only when this source is exhausted should university scientists be consulted, and then only after careful consideration of the price paid for the information in terms of loss of freedom of communication between scientists.

Kingsley offers the secrecy of relations with the CIA as a "devious" way

to avoid the issue. But secrecy provides little practical protection. The widespread questioning of scientists by the CIA is now so well known that it is no longer possible to hide its general existence. The specific information handed over may, indeed, remain secret, but the needs of society change, and we have all seen yesterday's secret files become today's subpoenaed public evidence. Kingsley's second answer to the issue suggests that the problem of personal responsibility no longer exists. I am relieved to learn that, because others are willing to hand on information, it is therefore all right for me to do so. It is ironical that Kingsley should write his letter on Patriots' Day, since now, as in that celebrated time, a man must examine his conscience when asked to become an informer.

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Standards of Conduct

A recent issue of *Science* [**135** (16 Mar. 1962)] came to my notice during the week that the United States, in collaboration with Great Britain, resumed the testing of atomic weapons in the atmosphere. The letters from Wittenberg and Kaplan [*Science* **135**, 997 (1962)] therefore seemed particularly relevant and worthy of further comment.

Wittenberg appealed for scientists as a body to make ethical judgments regarding whom they will accept into their company, and to make a clear distinction between the "scientist who cures cancer and the one who willfully induces it through nuclear fall-out." Kaplan, in order to give weight to such a judgment, refused to attend the International Cancer Congress in Moscow. I am in sympathy with much of the content of these two letters, which were inspired by the last Russian series of bomb tests, but I now find myself wondering whether Wittenberg and Kaplan will follow out the logic of the position they have adopted and apply their ethical strictures to the American and British scientists working on atomic weapons. I am sure they do not think that only Russian tests "cause the premature and unnecessary death of at least a few individuals in the world. . . ."

It does not require a great stretch of the imagination to realize that the

motives prompting Russian scientists who work on Defense contracts are similar to those of their opposite numbers in the West, and that Soviet and Western scientists would try to justify their actions in almost identical terms. An International Conference of Atomic Weapon Scientists would, I am sure, be a great success if freed from the restraints of national security, and Kaplan would find himself far less at home in such a gathering than he would at the Moscow Cancer Congress.

All this only goes to show that the problem of introducing ethical judgments into the practice of science is by no means simple. Nevertheless, the problem cannot be ignored unless we are content to have scientists cast permanently in the role of back-room boys whose services will always be available to the highest bidder. Bronowski [*Science and Human Values* (Hutchinson, London, 1961)] has tried to show that certain human values follow inevitably from the practice of science. Even if we agree with him that this is so, the impressive list of values he deduces—namely, truth to fact, freedom of thought and speech, tolerance, dissent, justice, honor, human dignity and self-respect—can only give limited guidance in the field of action. Scientists on both sides of the iron curtain might assent to these values but interpret them in different ways and differ completely as to the form of society that best promotes their growth. Amongst ourselves in the West we may also be in profound disagreement as to the means by which these values are to be preserved, and it is, I submit, on this crucial question of means that science can have little to offer in the way of ethical guidance. Science is helpless because its most powerful tool, the series of experiments under controlled conditions, is no longer usable. If, for example, the present experiment of mutual deterrence by ever more efficient weapon systems fails to keep the peace, then we shall not subsequently be in a position to try out an alternative policy, such as, for instance, unilateral disarmament.

To acknowledge thus the limitations of science does not, however, absolve the individual scientist from the necessity of making ethical judgments regarding the way his talents should be employed. We do not, for example, consider a doctor free to obtain scientific information, however important it might be for the general welfare, by experiments that subject patients to un-