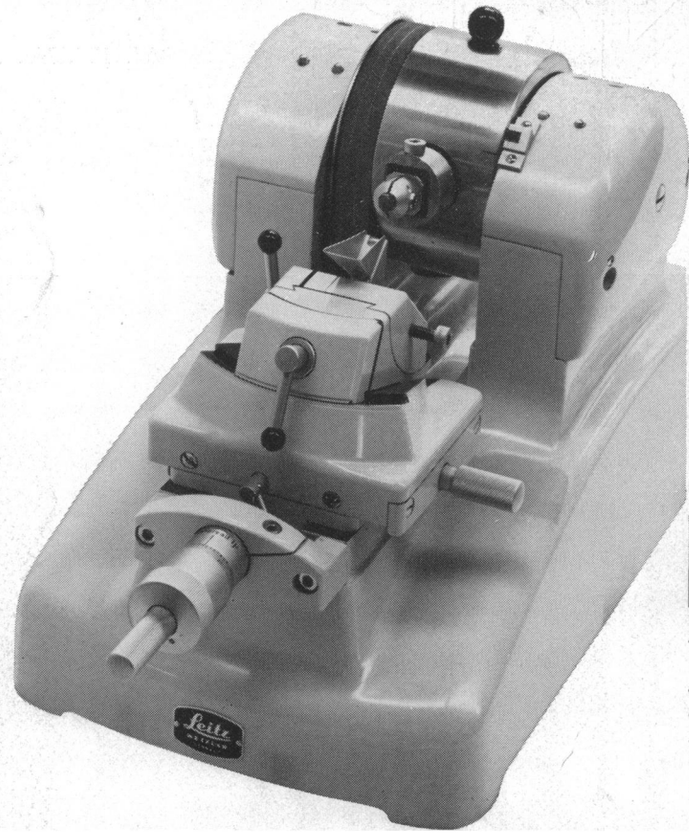
SCIENCE

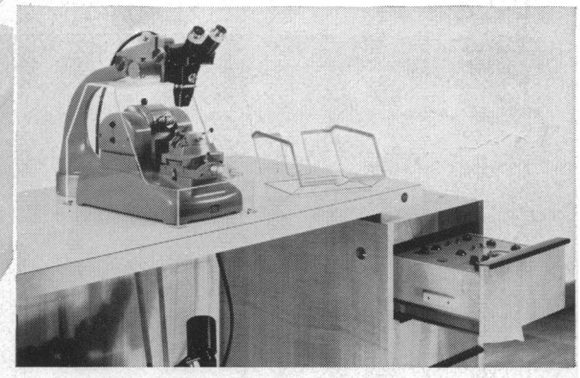
21 July 1961

Vol. 134, No. 3473

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

for the extremely thin uniform sections required by electron microscopy

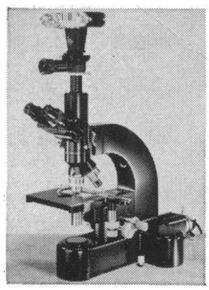




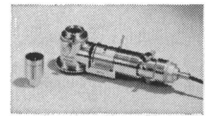
Microtome mounts on specially designed table for vibration-free rotor drive. Control panel housed in convenient safety-lock drawer. Stereoscopic microscope and lamp are mounted on a carrier arm of microtome with lateral swing-out movement. Draft-free microtome cover prevents air circulation from disturbing specimen while sections are being cut.

NEW LEITZ ULTRA-MICROTOME after Fernandez Moran cannot be matched for unvarying cutting accuracy

- *Consistently uniform series of sections* to meet the most exacting requirements, as for example in very high-power electron micrography. No other instrument compares with the uniform accuracy of the Leitz Ultra-Microtome.
- *Fully automatic specimen feed* assures uniformity in the preparation of specimens.
- *Extremely small advance feed* achieved by the thermal expansion of a nickelsteel rod.
- *Absolutely no motor vibration; backlash completely eliminated.*
- *Choice of two motor speeds.* Automatic motor switch permits slow cutting speed.
- *Both glass and diamond knives available.* Diamond knives available as follows: 45° to 46° for biological material; 50° to 60° for bones, metals and hard materials.



Phase Ortholux Research Microscope with built-in illuminating system for observations in transmitted and incident light offers a unique combination of versatility, precision and simplicity of operation.



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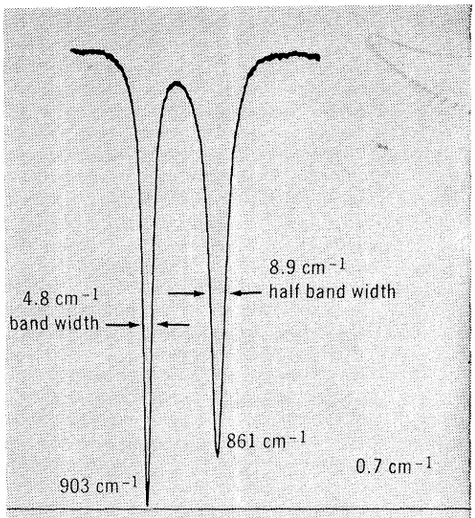
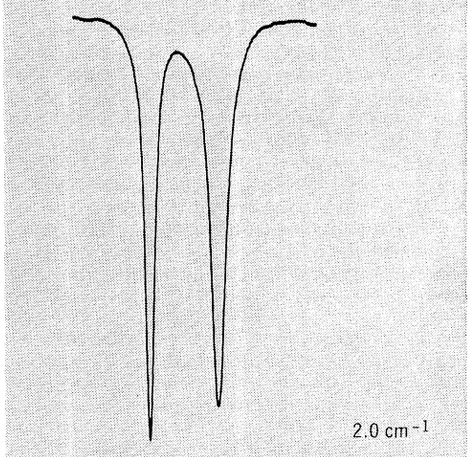
ADVANCED OPTICS AND ELECTRONICS...SERVING SCIENCE

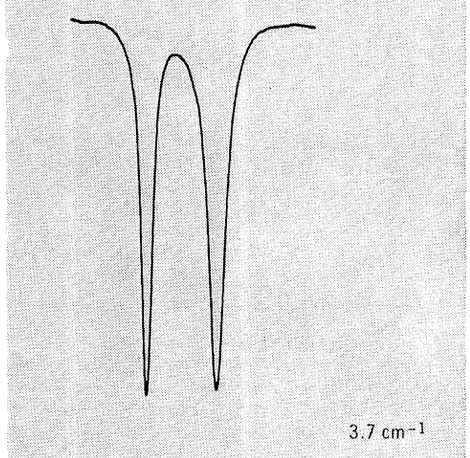
21 July 1961, Volume 134, Number 3473 **SCIENCE**

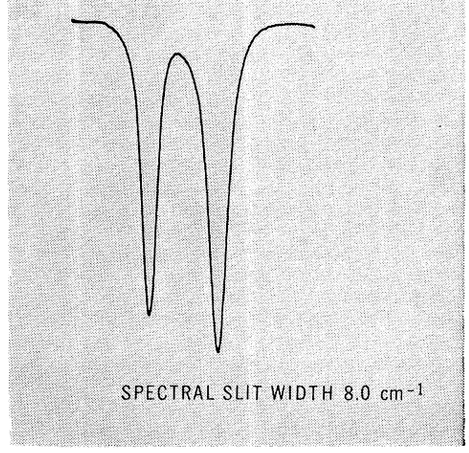
Cover

Dislocations marked by etch pits in a deformed crystal of corundum (Al_2O_3). The same phenomenon is observed in deformed ice (about × 4000). See page 164. [Peter Gibbs, University of Utah; after W. D. Kingery, *Introduction to Ceramics* (Wiley, New York, 1960)]









Left, spectrum of a 0.21 mm. thickness sample of spectro-grade cyclohexane demonstrates the importance of high resolution for routine *quantitative analysis.*

Right, the C-H stretching band of methane illustrates the increased research *data obtainable with high resolution spectroscopy.*

Beckman IR... highest resolution for routine quantitative analysis and advanced theoretical studies.

High resolution of the Beckman IR-7 does more than merely separate closely spaced neighboring bands. Note, for instance, how the apparent intensities of the two cyclohexane bands increase with higher resolution. The relatively greater increase in the intensity of the 903 cm^{-1} band at higher resolutions is the result of its narrower half-band width. These two commonly analyzed samples demonstrate the importance of high resolution in both low and high frequency regions and, for both gas and liquid samples. Comparative spectra were run with identical samples; slit width and resolutions, were varied as noted. ⊠ High resolution is essential for *all areas of spectroscopy;* for studies of molecular motion and structure, for differentiating between substances which exhibit similar spectra, and also for providing increased sensitivity and absolute accuracy for quantitative analysis. A further long-run advantage of high resolution is the increased potential for transferring data from one instrument to another. For more information about high resolution spectrophotometers, including indene spectra, write for Data File 38-29-02

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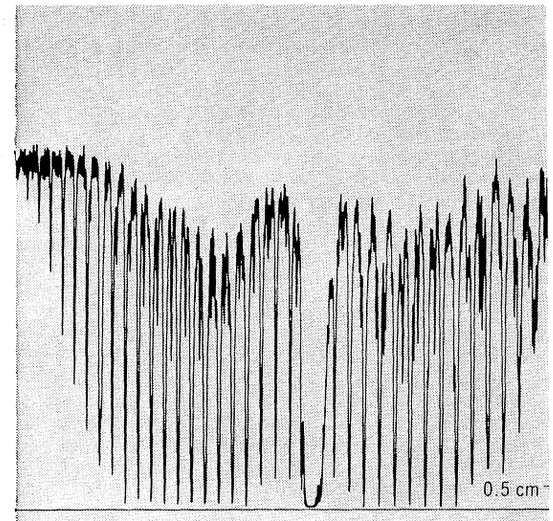
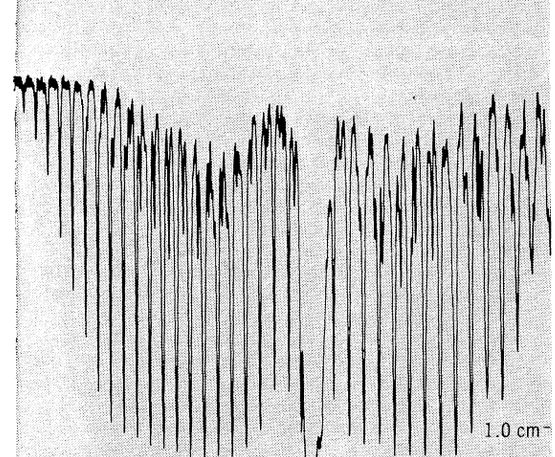
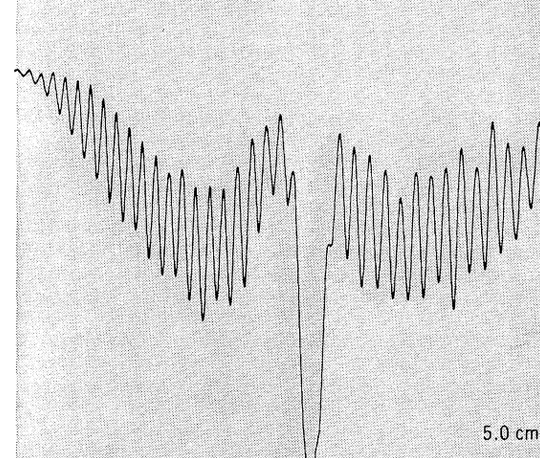
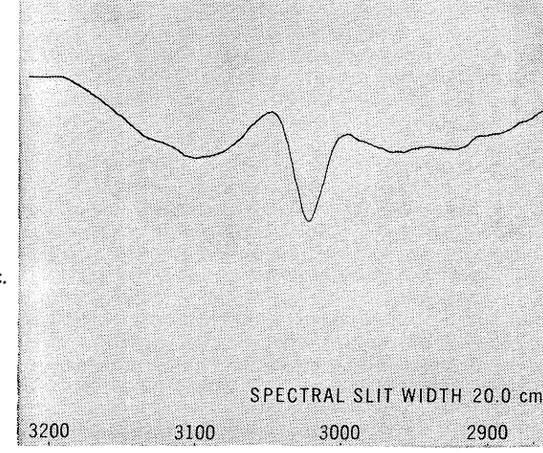
SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION
Fullerton, California









GET YOUR ADVANCE COPY

of the General Program of the AAAS Denver Meeting

by first class mail – early in December

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

Program Content

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

Advance Registration

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

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

——————————THIS IS YOUR COUPON FOR AN ADVANCE COPY OF THE GENERAL PROGRAM——————————

1a. ☐ Enclosed is $3.50 for my advance Registration Fee which brings me the *General Program,* Convention Badge, and all privileges of the Meeting (50¢ is for first-class postage and handling).

1b. ☐ Enclosed is $2.50 for only the *General Program.* (It is understood that, if I should attend the Meeting later, the Badge–necessary for the privileges of the Meeting—will be secured for $1.00 more.)
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APPLICATION FOR HOTEL RESERVATIONS
128th AAAS MEETING
Denver, 26-31 December 1961

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

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

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

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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

Rates for Rooms with Bath*

Hotel	Single for one	Double for two	Double for one	Twin Beds for one	Twin Beds for two	Studio Twins	Suites
Hilton	$8.50	$10.00	$14.00		$14.00	$15.00	$27.00 to $55.50
Brown Palace	8.00	9.00	13.00	$10.00	15.00		24.00 to 65.00
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Shirley Savoy		7.50	10.00	9.00	12.00		25.00 to 40.00

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

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AAAS Housing Bureau
225 West Colfax Avenue
Denver 2, Colorado

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Suite ..... Desired Rate ..... Maximum Rate .....

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(Attach list if this space is insufficient. The name and address of each person, including yourself, must be listed.)

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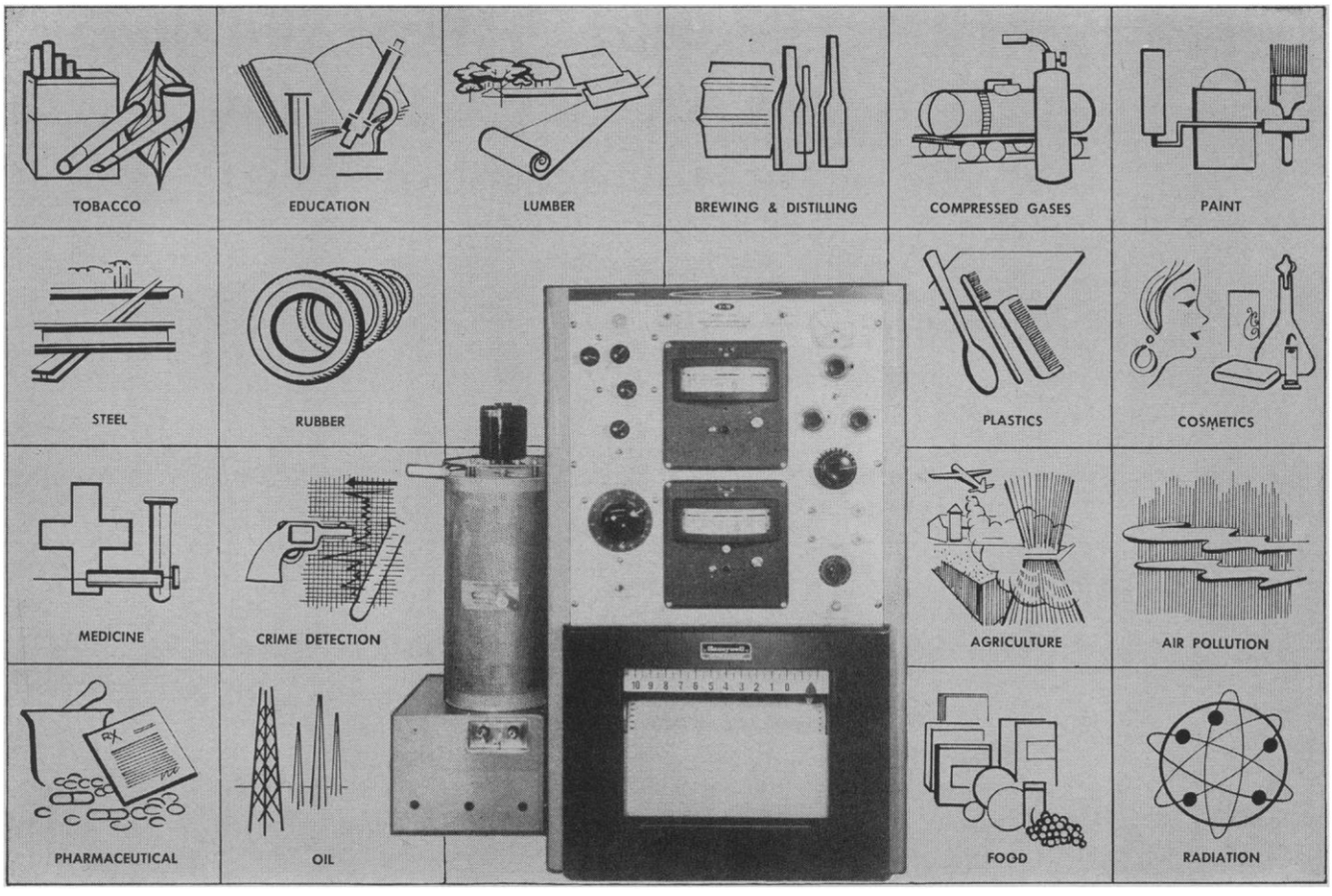
First Choice Hotel ..... **Second Choice Hotel** ..... **Third Choice Hotel** .....

DATE OF ARRIVAL ..... DEPARTURE DATE .....
(These must be indicated—add approximate hour, A.M. or P.M.)

NAME .....
(Individual requesting reservation) (Please print or type)

ADDRESS .....
(Street) (City and Zone) (State)

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



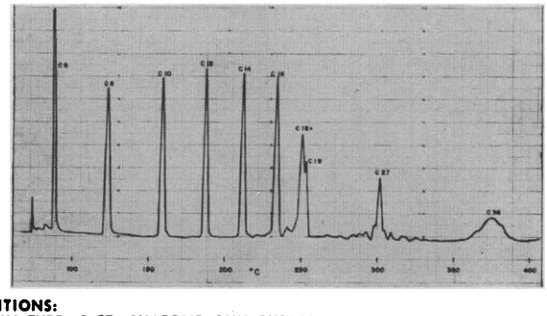
For Research and Development in all Industries

MODEL 500 LINEAR PROGRAMMED HIGH TEMPERATURE GAS CHROMATOGRAPH

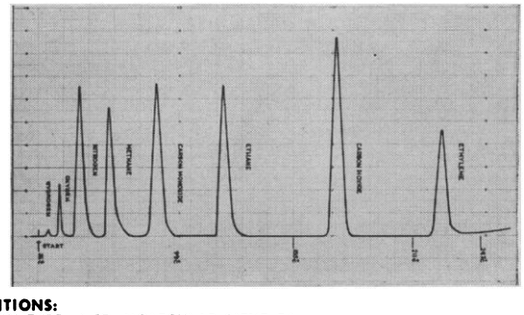
The technique of linear programmed temperature gas chromatography combined with high temperature operation makes possible these previously difficult analyses: (1) wide boiling mixtures; (2) gases (H_2, O_2, N_2, CO, CO_2 and light hydrocarbons); (3) trace quantities of high boiling residues in low boiling solvents; (4) correlation of retention times with analytical distillation data; and (5) temperature sensitive materials.

Two such analyses are shown below. Note that with programming, both separations required only one column. Without programming, the methyl ester separation would have required a fixed high column temperature with a loss in resolution of the lower boiling components. In the separation of gases at a constant column temperature, ethane, carbon dioxide and ethylene would not have eluted. To chromatograph this mixture at constant temperature, two columns and two samples are necessary.

With a Model 500, column scouting is easily performed because columns can be changed and baselines re-established in ten minutes. Heating from room temperature to 300°C takes about 10-15 minutes (27 minutes to 500°C) and cooling back to room temperature takes about the same time. Model 500 has separate and independent temperature controls, each to 500°C, for column, detector, and injection port. In addition, eighteen linear heating rates from 0.29 to 42°C/min. provide a wide selection for optimum column conditions.



CONDITIONS:
COLUMN TYPE: 2 FT. SILICONE GUM RUBBER
COLUMN TEMP. PROGRAMMED AT 5.6°C/MIN. FROM 75°C to 400°C.
This is a typical programmed temperature chromatogram demonstrating a separation of methyl esters with widely differing boiling points. Observe the sharp peaks, shaped nearly alike.



CONDITIONS:
COLUMN TYPE: 4 FT. MOLECULAR SIEVE 5A
COLUMN TEMP. PROGRAMMED AT 4.0°C/MIN. FROM 35°C TO 247°C.
By programming column temperature, H_2, N_2, O_2, CO, CO_2, ethane, and ethylene all separate on a single column in one run. Using the same column, the programmed temperature technique works equally well for the separation of nitrous and nitric oxide in the presence of these gases.

***Similar analytical advantages with Model 500** apply to the other industries illustrated above. Write for our bulletins on Model 500. These describe in detail all the specialized analyses.*

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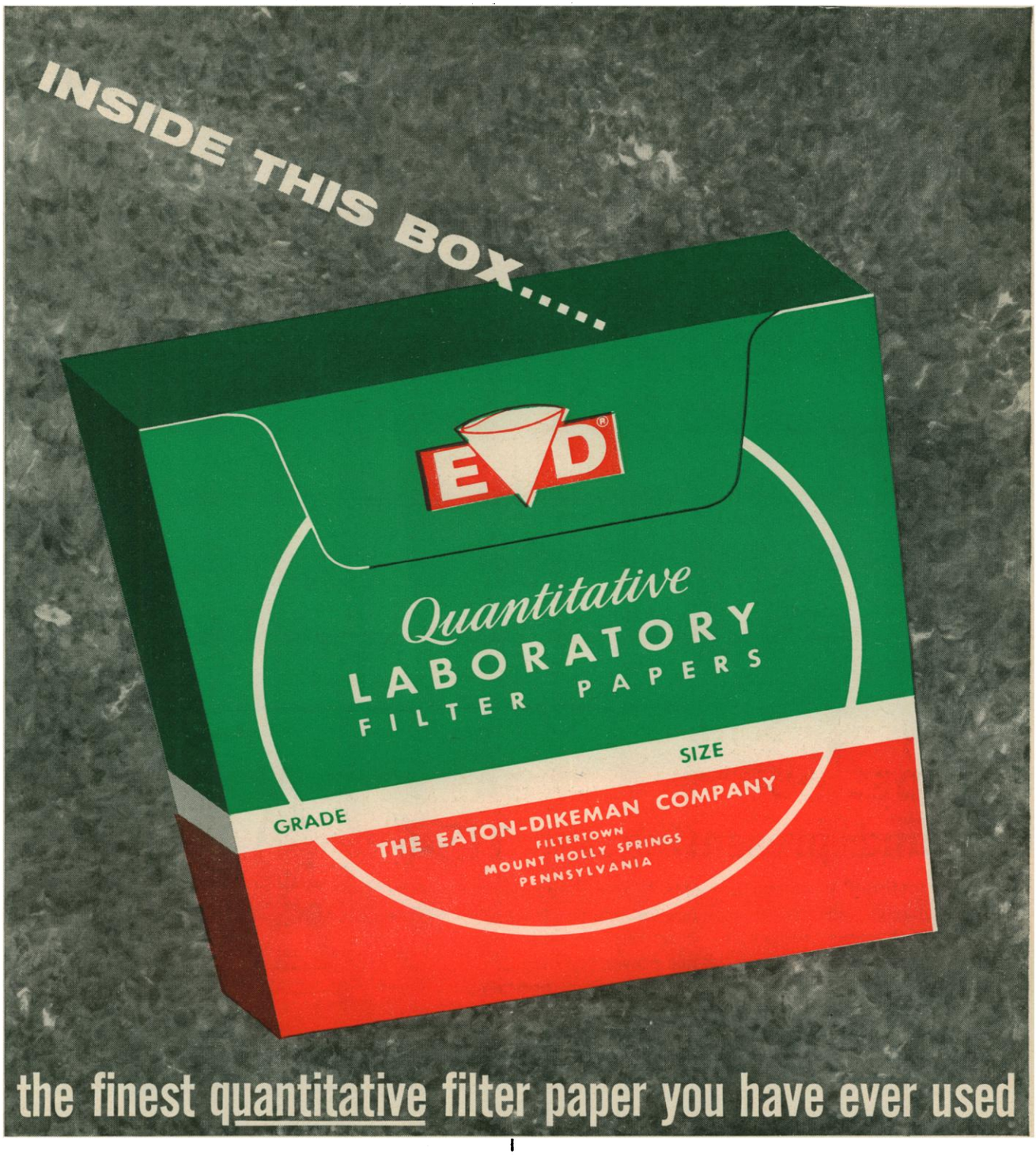

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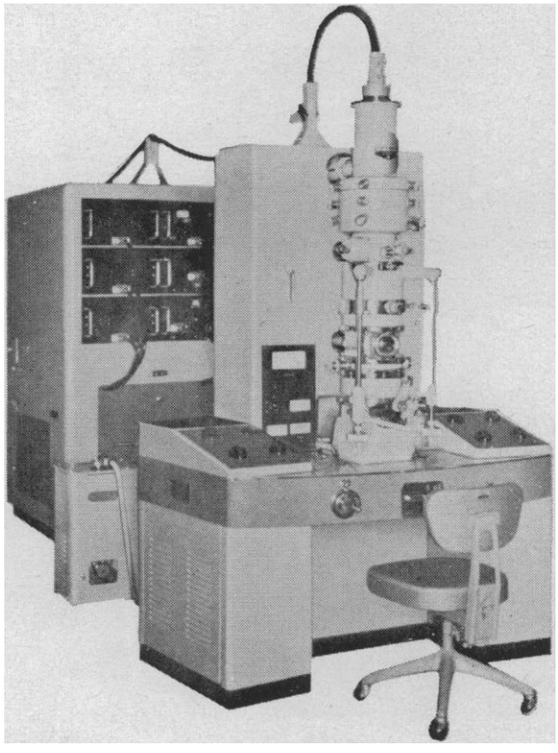

featuring the new HU-11

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

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

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

...and presenting the HS-6

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

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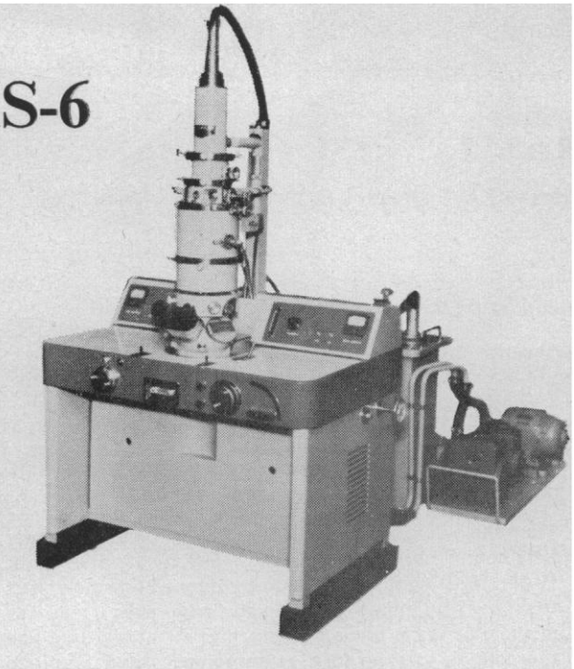
Simplicity of operation, mechanics and circuitry make the HS-6 the ideal instrument for researchers in the most sensitive medical and biological fields.



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Tokyo Japan
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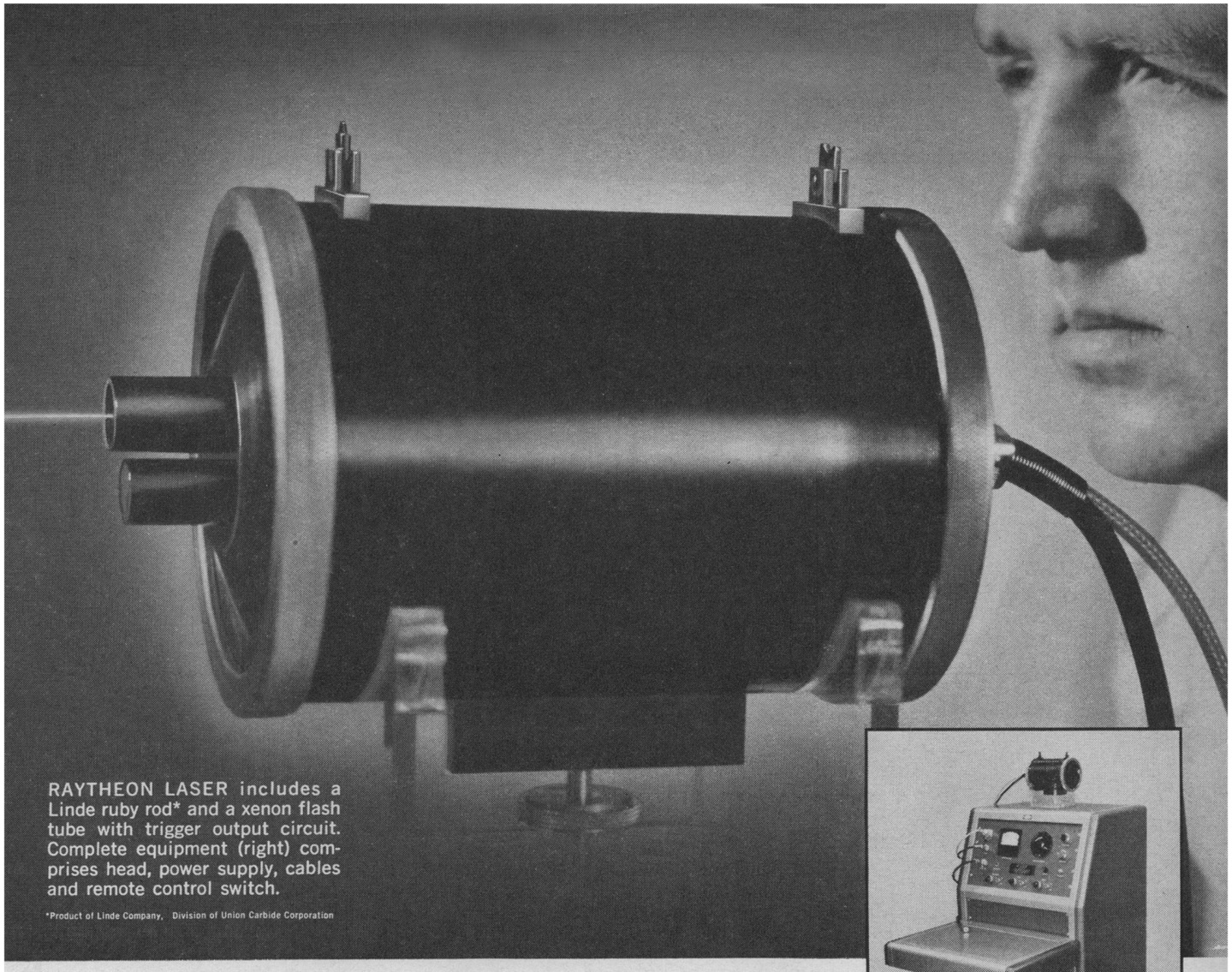

RAYTHEON LASER includes a Linde ruby rod* and a xenon flash tube with trigger output circuit. Complete equipment (right) comprises head, power supply, cables and remote control switch.

*Product of Linde Company, Division of Union Carbide Corporation

Raytheon ruby laser now available for laboratory investigations

Complete equipment as shown is ready for use and priced at $5,850.

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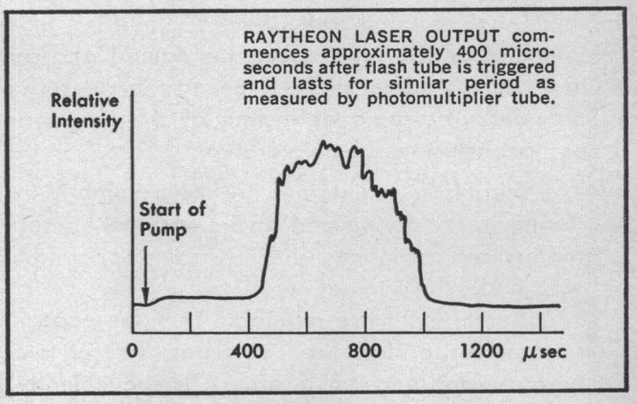
The laser head is constructed for convenient interchangeability of ruby rods and replacement of flash tube. The heavy-duty power supply is designed to permit precise adjustment of flash tube firing voltage for investigation of laser action at various power levels.

For complete technical proposal LTP-100, write to Special Microwave Devices Operation, Raytheon Company, Waltham Industrial Park, Waltham 54, Massachusetts.



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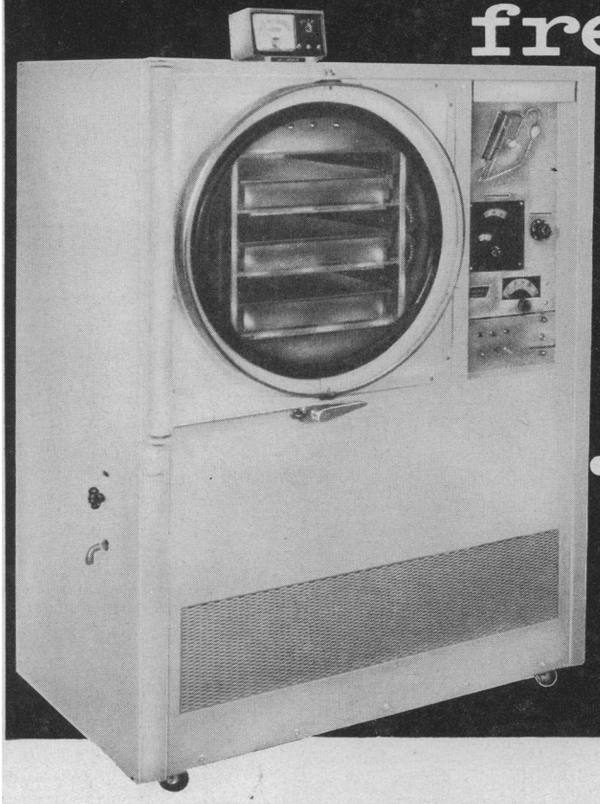

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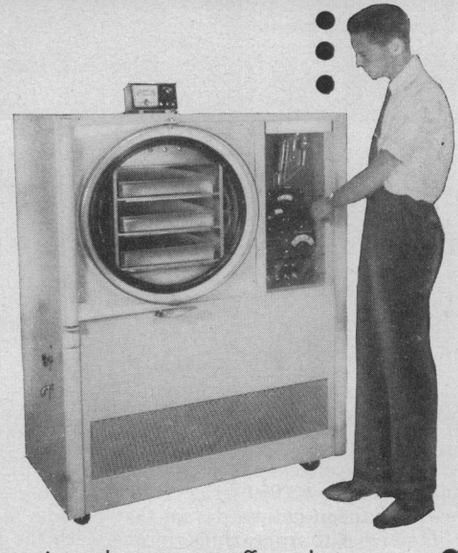

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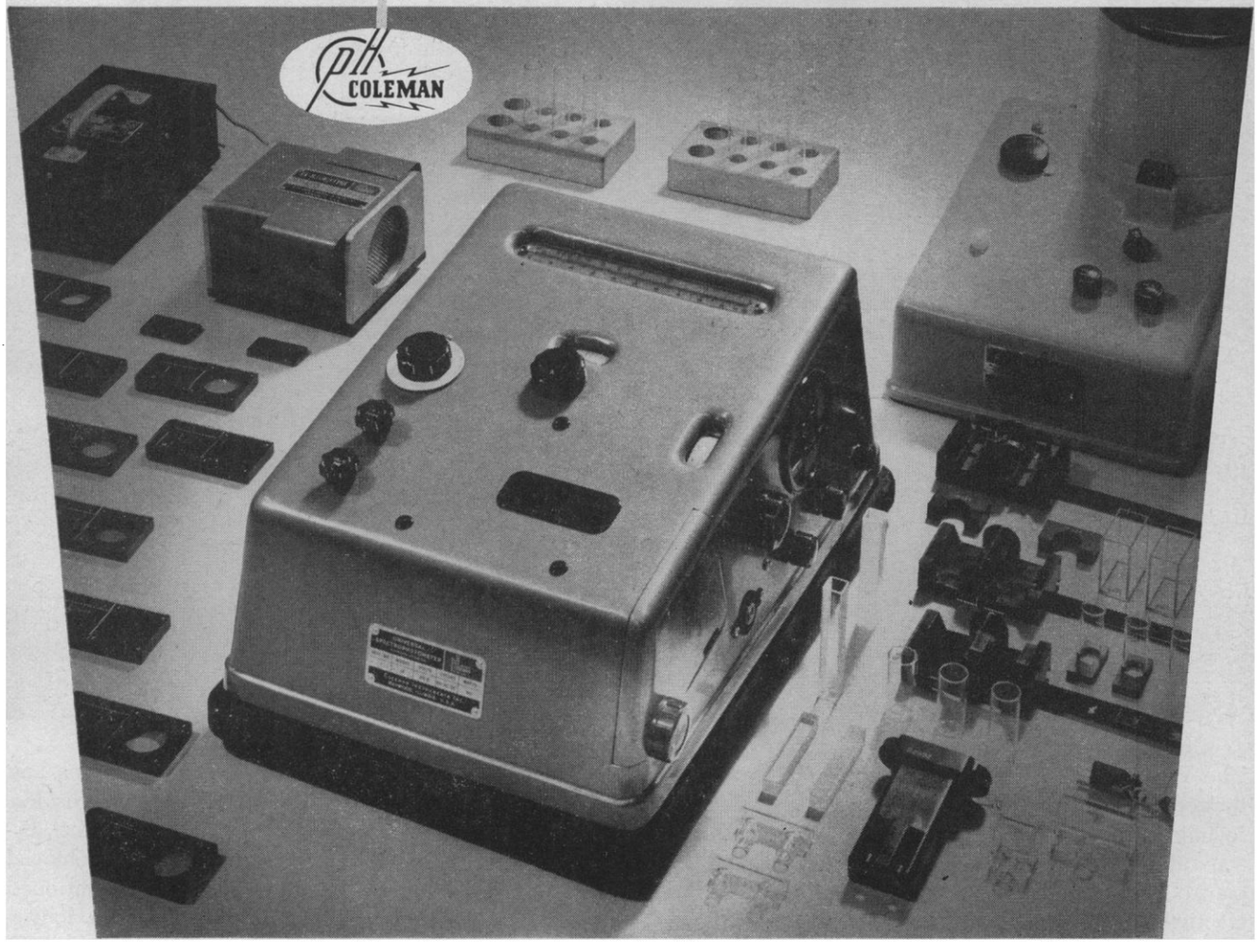

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COLEMAN INSTRUMENTS, INC., MAYWOOD, ILLINOIS

The Vanguard Model 1000 VOLUMATIC Fraction Collector

The Vanguard VOLUMATIC is a completely transistorized self-contained unit employing an advanced technique for volumetric collection of chromatographic separations. Hold-up and mixing in volumetrically controlled separations are virtually eliminated when fractionation is performed with the Vanguard VOLUMATIC. Using a unique principle of repetitive cuts for a single separation, in conjunction with a photoelectric sensing device, the VOLUMATIC will collect from one to ten times the siphon volume in each test tube. The operator merely dials the number of times he wishes the siphon to fill and discharge before advancing to the next test tube. Employing this technique for collection of 5 X siphon volume for example, only the hold-up present from the last one-fifth of the first fraction is mixed with the first one-fifth of the second fraction, *an 80% reduction in mixing.*

Transistorization of all components assures absolute reliability of operation and allows continuous cold-room operation without modification.

The cast aluminum instrument cabinet affords the strength and rigidity needed for large columns and ancillary equipment, yet the entire unit weighs less than 50 lbs. Positive indexing of the stainless steel dispensing head to succeeding inner rows is achieved through mechanical gating which assures continued reliability. Compact size (25 in. wide x 30 in. long x 6 in. high) promotes maximum utilization of valuable laboratory and cold-room space. Heavy gauge, large capacity aluminum turntable (245 samples in 13mm. or 15mm. size) is supplied with handle and base-mounted rubber feet for easy removal and use as test tube tray.

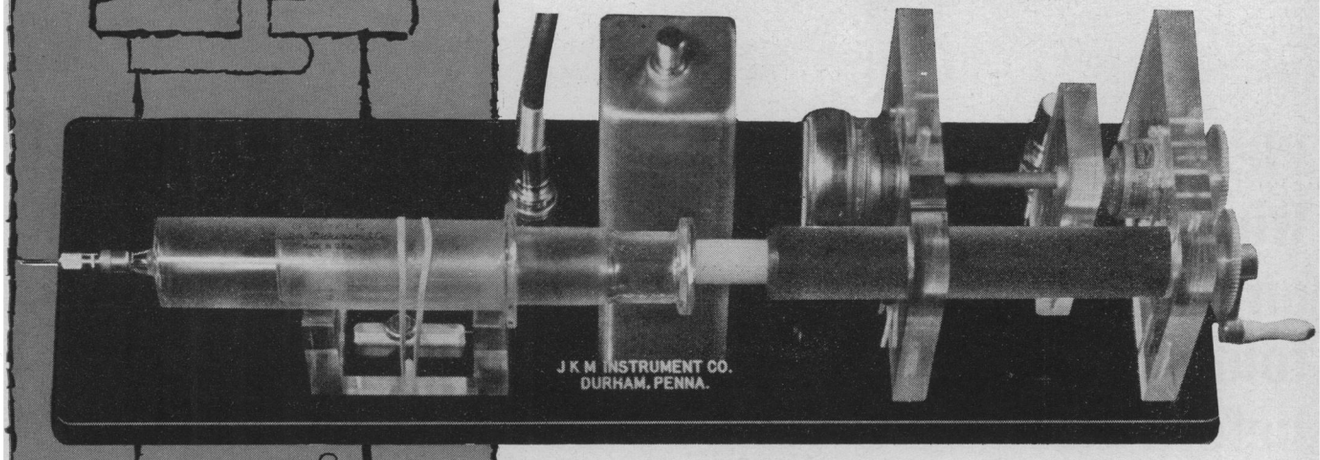
Interchangeable turntables for 13mm., 15mm. and 18mm. test tubes are offered as standard accessories. To meet varying requirements a complete selection of siphons is also available. To increase the versatility of the Vanguard VOLUMATIC, transistorized time and drop counting plug-in units are also available.

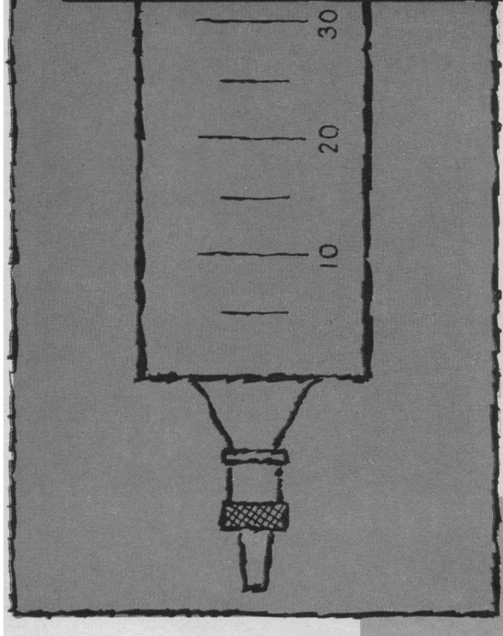
Complete unit including siphon and turntable of choice with 4 ft. column support rod priced at $695.00, F.O.B. LaGrange, Illinois.

P.O. Box 244
La Grange, Illinois
FLeetwood 4-5656

VANGUARD INSTRUMENT COMPANY

PERFORMANCE . . .
PLUS ECONOMY!





THE JKM CONSTANT RATE SYRINGE DRIVE

Originally developed for injecting samples into the Stubbings Electrophoresis Apparatus*, the syringe drive is now offered as a separate unit because of its wide area of application—wherever a long term, constant rate sample delivery is required.

The unit is characterized by extreme flexibility of operation. Drive rates may be changed by substituting different sets of gears. Liquid feed rates can be varied by changing the drive rate or syringe size. A length of flexible teflon tubing is supplied to connect the syringe to the reaction vessel.

PRICE.... .....$200.00

* Patent Pending

Check these features:

- ☐ High versatility
- ☐ Low cost
- ☐ Accepts any standard syringe
- ☐ Automatic shutoff
- ☐ No cleaning problem
- ☐ Delivers large quantities in short period of time
- ☐ Delivers small quantities over a long period of time
- ☐ Variety of gear sets available
- ☐ Saves both time and effort
- ☐ Provision for remote control
- ☐ One year warranty

jkm

JKM INSTRUMENT COMPANY INCORPORATED

OLD PHILADELPHIA PIKE DURHAM, PENNSYLVANIA

NEW TORSION DIAL BALANCES with WEIGHT LOADERS

Torsion's new line of weight-loading dial balances retains all the proved advantages of the unique Torsion principle which eliminates knife edges and guarantees long-lasting accuracy.

Since Torsion introduced the "fine weighing" dial over a year ago, users have reported substantial savings in weighing time. Now Torsion has added a "weight-loading" dial which enables the user to "dial in" additional weights as described in the specifications for each new balance.

Both dials can be used without arresting the balance.

By using two dials, one for weight loading and one for fine weighing, Torsion has cut weighing time even more.

With Torsion's new two-dial feature, the time-consuming handling of small, loose weights has been eliminated. In addition to faster weighing, Torsion's new dial balances with weight loaders minimize the possibility of weights becoming inaccurate from rough handling.

Ask your laboratory supply salesman for a demonstration or write for complete specifications.

The **Torsion Balance** *Company*

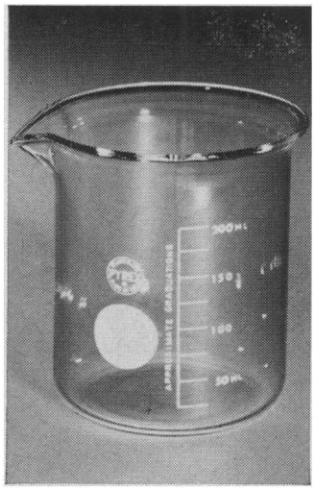
Main Office and Factory: Clifton, New Jersey
Sales Offices: Chi., Ill., San Mateo, Cal.

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

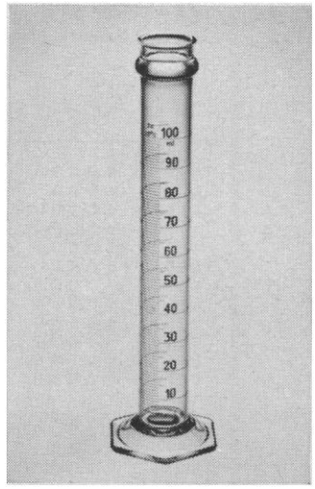
B TORSION DWL-5
Capacity: 500 grams
Weight-loading Dial: up to 90 grams by 10 gram increments
Fine Weighing Dial: 10 grams by .1 gram graduations
(Readability: .02 g)

C TORSION DWL-2
Capacity: 120 grams
Weight-loading Dial: up to 9 grams by 1 gram increments
Fine Weighing Dial: 1 gram by .01 gram graduations
(Readability: .002 g)

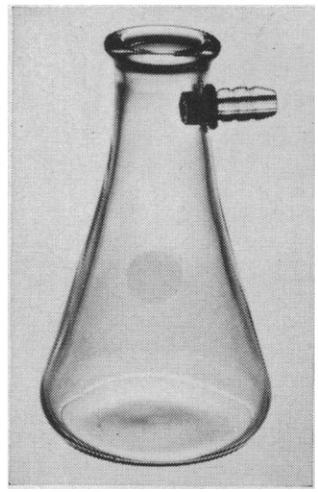
TORSION DWL2-1
Specifications are same as the DWL-2 except that this model has scoop for seeds or other bulky material.



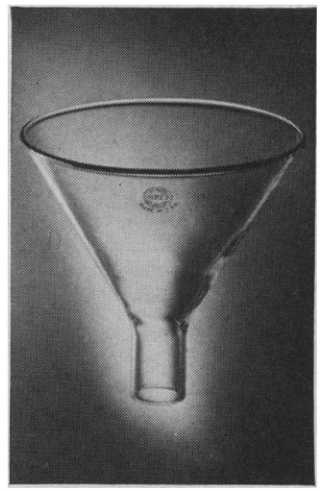
1. Graduated PYREX beaker—Now you can measure volumes quickly and with reasonable accuracy in a multi-use beaker. Graduations are white enamel. Cost is only a few pennies more than for ungraduated beaker. 250, 400, 600, 800, 1000 ml. No. 1002.



2. ACCU-RED cylinder—Graduations will never fade or wear off this PYREX cylinder. ACCU-RED process fuses them right into the glass, as in our ACCU-RED pipets and burets. Bead and hex bottom help prevent breakage. 10, 25, 50, 100, 250 ml. No. 3050.



3. Replaceable tubulation—You don't have to throw out this PYREX filter flask if the tubulation breaks. Tubulation and neoprene grommet both are easily, inexpensively replaced. 250, 500, 1000 ml. No. 5341.



4. Bigger funnels—Now you can match the PYREX filling funnel diameter to the job. New inside diameters are 75, 100, 125, and 150 mm.—added to the 65 mm. size in LG-2. No. 6220.

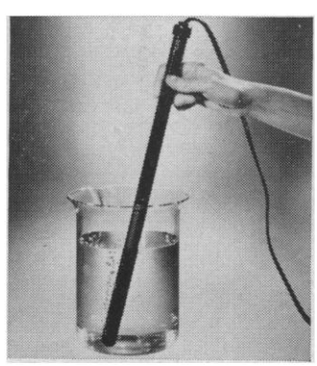
FIVE NEW LABWARE TOOLS FROM CORNING

These five products are the latest results of our continuing effort to help you do a job better, do it more quickly, and save money.

Four of them give you the time-proved chemical-thermal-mechanical balance of PYREX® brand No. 7740 glass. You can work confidently, relying on its combination of properties.

The fifth has a VYCOR® brand glass jacket to provide the extreme resistance to thermal shock and the chemical durability an immersion heater requires. You can use it for fast heating of most acids and other liquids.

For more information on any or all of these items, write for Supplement No. 3 to Catalog LG-2. Or call your laboratory supply representative. When ordering, combine your PYREX labware needs for quantity discounts as high as 23.5%.



5. VYCOR immersion heater—You can swizzle heat into a solution quickly with this radiant heater. Cord-end portion is unheated so you can hold it or rest it against the container. Cord and plug included. 250, 500, 1000 watts—all operate on 120 volts. No. 16790.

CORNING MEANS RESEARCH IN GLASS

CORNING GLASS WORKS

7507 Crystal Street, Corning, N.Y.

Please send me Supplement No. 3 to Catalog LG-2.

Name.....

Title.....

Company.....

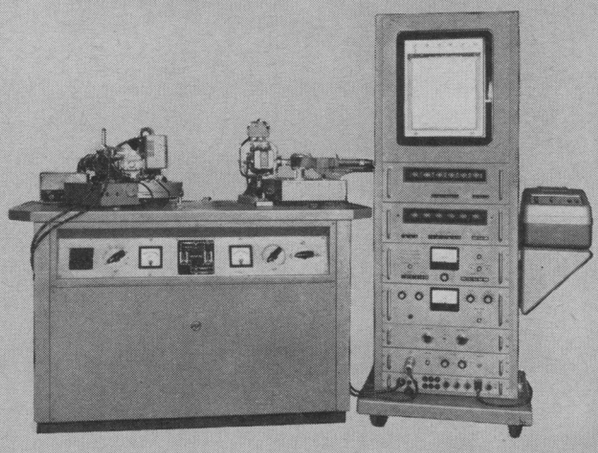
Address.....

City.....Zone.....State.....

PYREX® laboratory ware... *the tested tool of modern research*

X-RAY DIFFRACTION AND SPECTROSCOPY

NEW



No. of Events	No. of Counts	Recording Time in Minutes	
4559	10000	0.100	SEPARATE RECORDING
4560	10000	0.100	
4561	10000	0.100	
4562	10000	0.100	
4563	10000	0.100	
4564	10000	0.100	
4565	10000	0.100	
4566	10000	0.100	
4567	10000	0.100	
4568	10000	0.100	
4569	10000	0.100	
4570	10000	0.100	
4571	10000	0.100	CUMULATIVE RECORDING
4572	20000	0.200	
4573	30000	0.300	
4574	40000	0.400	
4575	50000	0.500	
4576	60000	0.600	
4577	70000	0.700	
4578	80000	0.800	
4579	90000	0.900	
4580	100000	1.000	
4581	110000	1.100	
4582	120000	1.200	

AUTOMATIC PRINTER

another time-saving device from RCA

This new RCA Printer automatically records events, counts, and time, thus freeing the researcher for other duties while this information is being accumulated. It also provides an accurate and convenient means of checking the stability of the counting, timing and recording circuits—a valuable advantage for spectroscopists in quantitative work and for diffractionists in line profile studies. The unit can be used with scintillation, proportional and Geiger-Mueller counter tubes in conjunction with the RCA Electronic Circuit Panel.

The Printer is the latest addition to the wide range of attachments and accessories available for RCA X-Ray Diffraction and Spectroscopy apparatus which contribute to its outstanding flexibility.

Others include an X-Ray Vacuum Spectrometer for analysis of both light and heavy elements, a versatile horizontal goniometer which, with RCA accessories, performs six functions, and a Table Model Generator, available complete with cameras, for as little as $4000.

Installation supervision and contract service are available through the RCA Service Company.

Leasing Plan

RCA X-ray diffraction and spectroscopy equipment, as well as electron microscopes, can be leased directly from RCA, with no down payment, low monthly rates and a favorable option to buy.

For details on RCA's complete line of X-Ray Diffraction and Spectroscopy apparatus or Electron Microscopes, write to RCA, Dept. XC-362, Bldg. 15-1, Camden, N. J.

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The Most Trusted Name in Electronics

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Why is it important to you that Whatman filter papers are used in almost every chemical laboratory in the world? It means that the Whatman grade used on the other side of the globe is identical to the sheet you have selected; that Whatman filter paper need never be considered a "variable" in reproducing work done a year ago in another place. Whatman Filter Paper—a product of carefully selected raw materials and meticulously supervised, quality-controlled production—universally acknowledged standard in its field.

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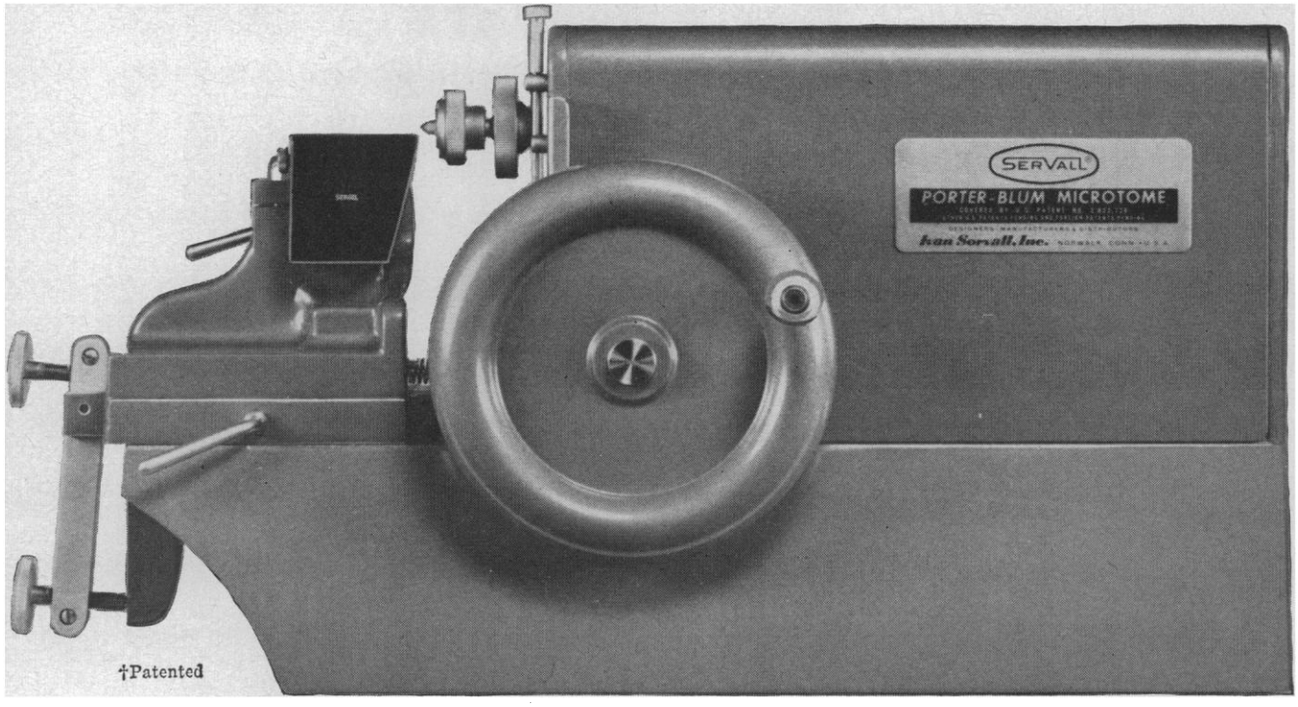
SERVALL®

"Porter-Blum" ULTRA-MICROTOME†



†Patented

ALSO CUTS COSTS!

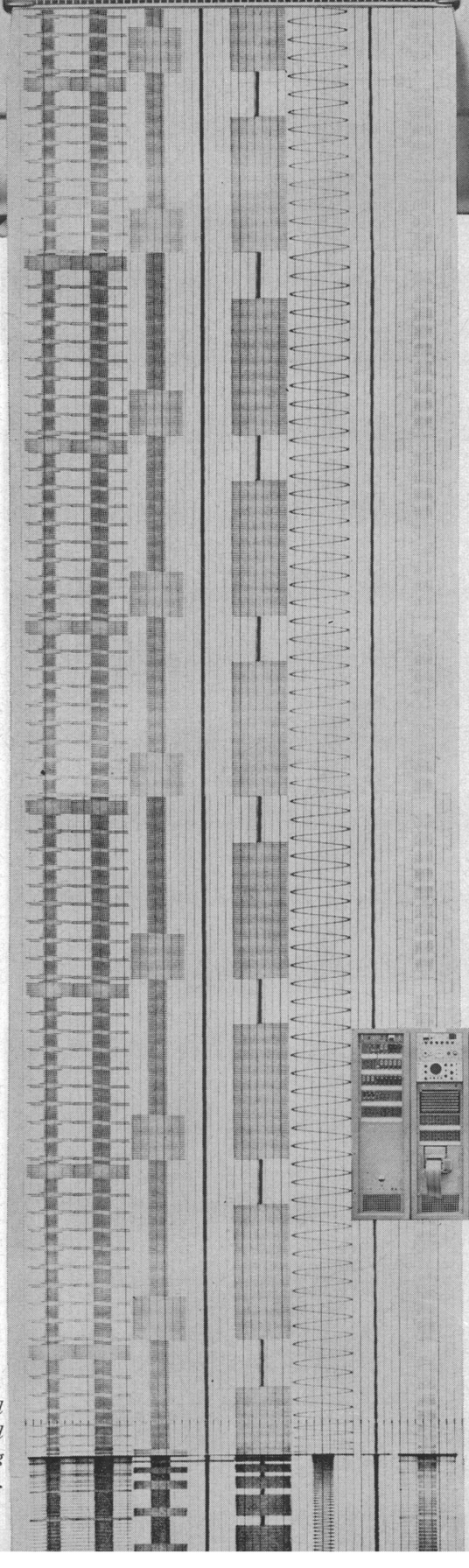
The "Porter-Blum" is the inexpensive precision instrument for electron- and light-microscope preparations. This ultra-microtome, known as "the standard in its field," will cut serial sections, or alternate thin and thick sections, of the highest uniformity and at the lowest possible cost. Its purchase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

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

Please ask us for Bulletin SC-7MT

Ivan Sorvall, Inc.
Norwalk, Connecticut

Visicorder and record shown approx. ½ actual size.



Record speed changed during recording.

"MASTER CLOCK"

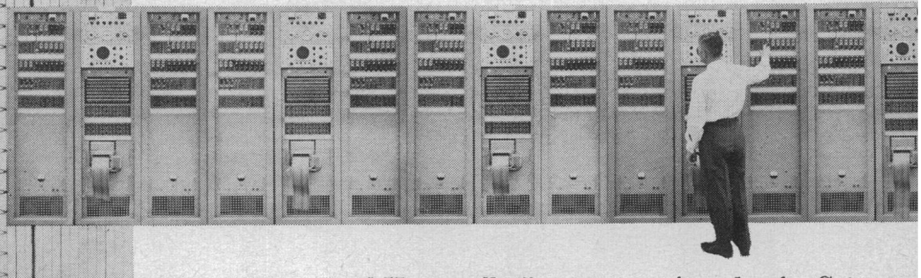
for the missile range uses 15 Honeywell Visicorder oscillographs

The Timing Operations Center designed and built by Epsco-West for the Navy's Pacific Missile Range is now in use at Point Mugu, California. It makes use of 15 Honeywell Visicorders to read out (as shown on the unretouched record at left) the modulated timing codes distributed as balanced outputs to the Center's "customers."

The solid-state Epsco-West TOC generates up to 11 separate timing signals, one or all of which may be delivered to any of 36 users.

The 906B Visicorder also performs a supplementary function as a monitor on the timing and test-patch panel, and as permanent "record-keeper" for the built-in indicators and test oscilloscopes. Visicorders were selected for their jobs with the TOC because of their versatility, reliability, low cost, and compact size ((10″ x 10″ x 15½″; weight, 37 lbs.).

Pioneer and acknowledged standard in the field of high frequency direct-recording oscillography, the Visicorder is available in several models, from 6 to 36 channels, DC to 5000 cps response, up to 50,000″/sec writing speed. Honeywell engineering is at your service through 120 field offices for help in applying one Visicorder or a full system to your data acquisition program; or a quantity of Visicorders for OEM application in your products.



Call your local Honeywell office now or write today for Catalogs HC906B, 1012, 1108, and 1406 to Minneapolis-Honeywell, Heiland Division, 5200 East Evans Avenue, Denver 22, Colorado. Our telephone is SKyline 6-3681, Area Code 303.

Honeywell

First in Control

SINCE 1885

PRECISION SCIENTIFIC CO. PS

Yearly Review

Calendar of NEWLY INTRODUCED PRODUCTS 1960-1961

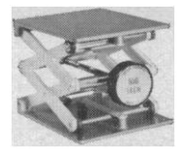
MAY 1960

New Heated Vacuum Dessicator

A versatile lab utility—dries faster, maintains samples at desired temperatures, evaporates solvent traces rapidly, does double duty as a vacuum oven—get Bulletin 608 for complete details.

AUGUST 1960

BIG JACK and LITTLE JACK



STURDY, DEPENDABLE LABORATORY JACKS

Big Jack raises or lowers heavy flasks, hot plates, baths, etc. up to 100 pounds—3 to 12 inches.
Little Jack, a smaller model of Big Jack designed to work with small objects—lifts or lowers up to 10 pounds—1½" to 5". Ideal for micro work. Write for Bulletin 611.

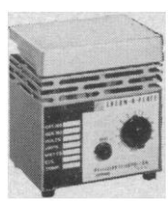
NOVEMBER 1960

Wet Test Meters

Designed to afford increased pressure range . . . from 0.3 inches water pressure to 15 PSI. Self serviced by easy removal of the back cover. Housing is of heavy cast aluminum with epoxy coated interior. Construction throughout assures longer life. Write for Bulletin No. 612.

DECEMBER 1960

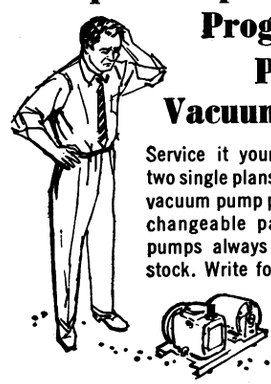
New Therm-O-Plate Hot Plates



Do you want to Heat?—Stir?—Shake? Need up to 800°F? Then depend on Therm-O-Plate line. Four types—eleven sizes—standard models, stirring, heating, shaking, heating and explosion proof models. Get full details—send for Bulletin 609.

JANUARY 1961

Unique Pump Exchange Program for Precision Vacuum Pumps



Service it yourself. Here are two single plans to reduce your vacuum pump problems. Interchangeable parts or rebuilt pumps always available from stock. Write for Bulletin 616.

FEBRUARY 1961

Micro Serological Bath

A truly versatile small bath—for micro work and exacting tests—occupies only ¼ square foot—has range up to 100°C—uniformity ±0.2°C or better. Weighs only 5 lbs. Has new universal rack for simultaneous use of various sizes and shapes of tubes, flasks and beakers—has micro tube rack for 6 to 12 mm. tubes. Write for Bulletin 613.

MARCH 1961

Constant Temperature Controlled Agitation Shaker Baths

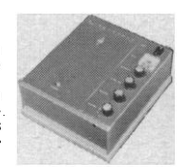
Complete new line—for Microbiological, Biochemical and Physio-Chemical studies. Variable speed control. Adjustable stroke length. Guaranteed temperature uniformity ±0.5°C. or better. Three sizes to meet all requirements. Write for Bulletin 614.

MORE COMING IN THE MONTHS AHEAD

NOW...CHRONOFRAC

A New... Fully Guaranteed... Professional Quality... GAS CHROMATOGRAPH

ONLY $250



A speedy reliable solution to routine gas and volatile liquid analysis problems... Quickly pays for itself in savings in time and material... Inexpensively makes gas chromatography available to everyone.

Ideal for quality control of any raw material or finished product with boiling point to 105°C. (and many up to 120°C.) ...Safeguards the quality of the product you sell...the products you buy. Simply installed and operated.

Since 1920 Precision Scientific Company has directed its efforts toward producing new instruments in keeping with the latest advancements in scientific technology.

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WE'RE HARD TO PLEASE

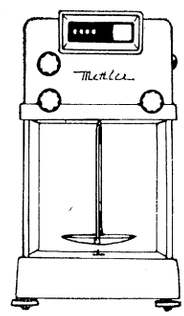
... ARE YOU?

When we speak of balances for accurate weighing we are satisfied only with instruments having the highest precision and engineered to maintain this precision forever under constant hard use.

While it is true that such an ideal is not entirely attainable, people who use Mettler balances tell us we come amazingly close. Even so, we constantly strive for still more precise readings.

If you are hard to please in this respect, let's get together and work on *your* weighing problems.

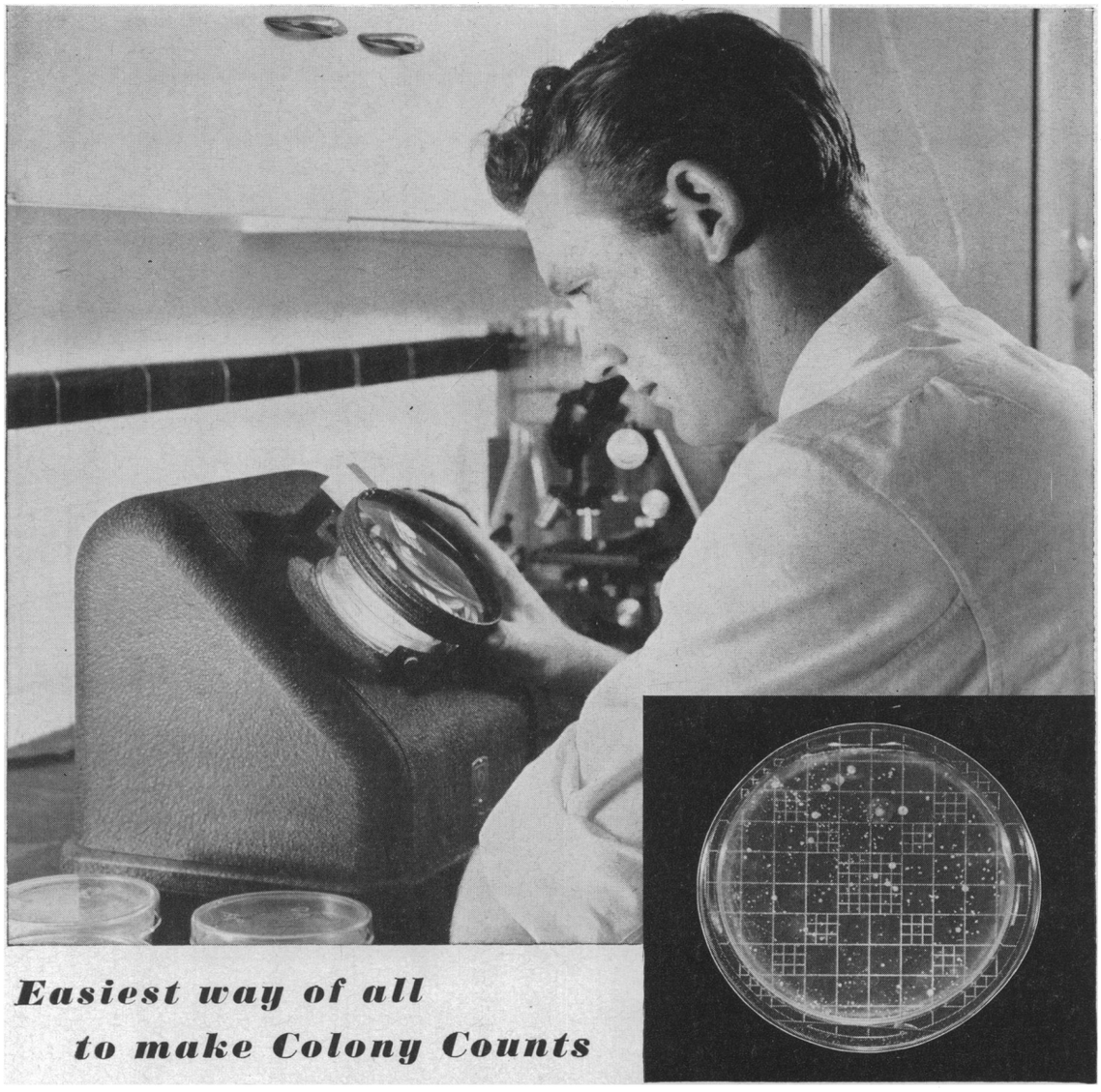
There are now more than fifty balance models in the Mettler line. They cover all the needs of the modern laboratory. Capacity ranges from 8000 grams to two milligrams, and precision from one milligram to a fraction of one microgram. In addition to the now famous Mettler "B" and "H" balances, the "M5" micro and new "UM7" ultra micro are designed to fill the needs of those requiring highest accuracy in micro ranges.



We would like to demonstrate the best instrument for your application in your laboratory or plant. If you wish to evaluate the balance at your leisure, arrangements can be made to leave certain models on trial. Write today concerning your requirements and arrange a demonstration at your convenience.

METTLER INSTRUMENT CORPORATION

P. O. BOX 100, PRINCETON, NEW JERSEY



Easiest way of all to make Colony Counts

Happily for us, many of the instruments we make fall into a special, distinguished class ... they perform their particular job so well that they have become the "standard" instrument of their type.

The AO Spencer Quebec Dark Field Colony Counter belongs to this "special" group. You'll find them as standard equipment in bacteriological and pharmaceutical labs, in research and control labs throughout the food processing, dairy and beverage industries, in Public Health departments ... wherever bacterial limits are used as a criteria in maintaining health or quality standards.

A unique illumination system floods the *entire* culture plate with soft, uniform light. The dark, contrasting background throws the colonies into bold relief... makes even pinpoint colonies easy to distinguish and count. And the sharp, controllable magnification reveals colony morphology for quick differential counts.

A Wolfthuegel Guide Plate is supplied as standard... counter also accommodates Stewart and Jeffers guide plate.

Complete information on the AO Spencer Dark Field Quebec Colony Counter is yours for the asking. Talk to your AO Representative or write us today.

American Optical COMPANY

INSTRUMENT DIVISION, BUFFALO 15, NEW YORK

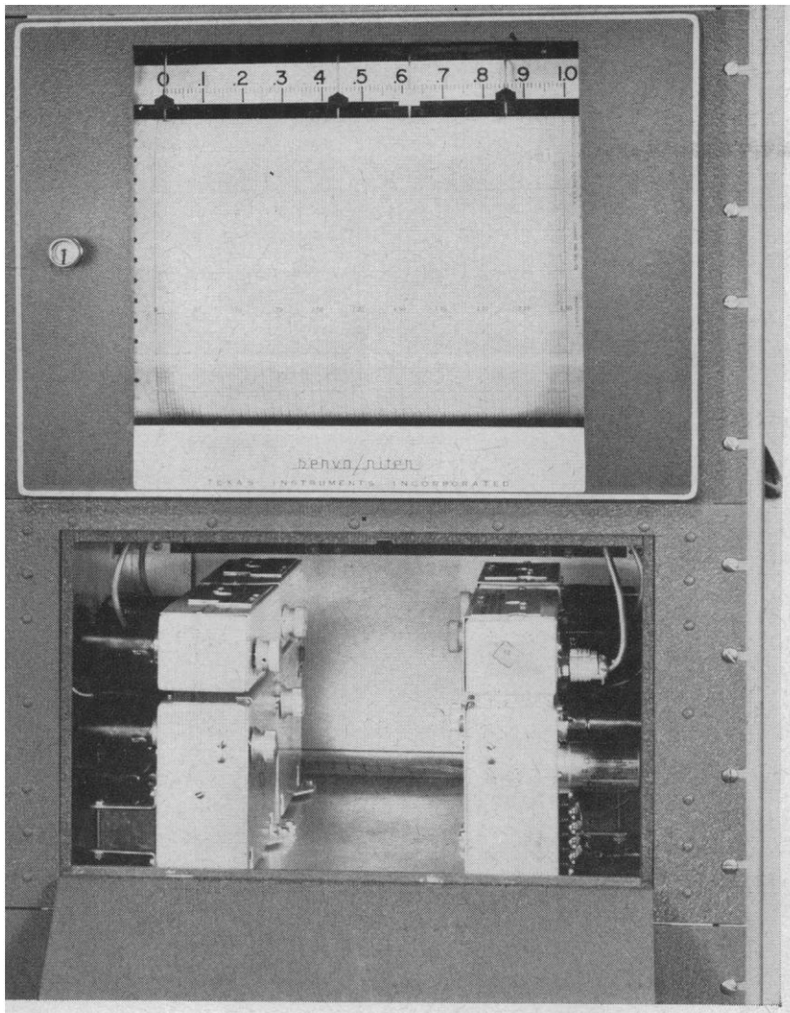
Dept. U-3

Please send me complete information on the AO Spencer Quebec Colony Counter.

Name_____

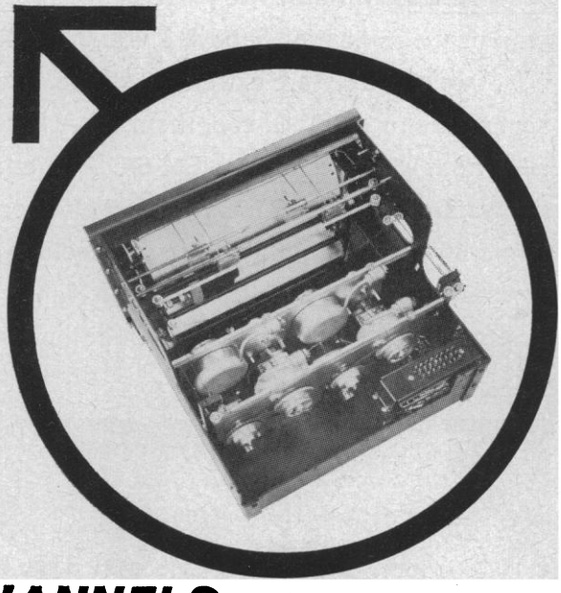
Address_____

City_____ Zone____ State____



NEW from TI

4-CHANNEL servo/riter* RECORDER



RECORDS 4 CONTINUOUS CHANNELS ON A WIDE SINGLE CHART

You can now record four continuous channels of data on a wide single chart . . . four overlapping pens continuously recording on the full width of the 9¾" chart. For the first time in a potentiometric recorder four variables can be traced with high resolution on a single sheet of chart paper! The recorder is the proved *servo/riter* in the flush-mounting configuration for use in standard 19" relay racks.

Amplifiers are separate from the recorder and may be mounted as far as 15 feet from the recorder chassis. An optional factory-assembled package places the four amplifiers in a standard rack-mounting case for location adjacent to the recorder case.

In addition, five- and six-channel *servo/riter* recorders are available, utilizing overlapping pens on dual side-by-side 4½" charts. Two- and three-channel recorders are offered in both the narrow and wide configurations, with all pens writing on only *one* sheet of chart paper.

The same industry-proved performance characteristics and wide ranges of the single and dual-channel *servo/riter* recorders are designed into the new multi-channel instruments. These include:

- HIGH SENSITIVITY—
  1.0 mv to 100 mv full-scale
- HIGH INPUT IMPEDANCE—
  4 megohms off-balance
- FAST RESPONSE—
  .5 second full-scale rise time
- HIGH REJECTION RATIOS—

"Transverse"	1,000/1
"Longitudinal"	330/1
d-c Common Mode	30,000/1
d-c & a-c Guard	30,000,000/1

- HIGH RELIABILITY—Non-lash gearing and conservatively rated electronics.

Write for complete information.

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AND DALLAS, TEXAS

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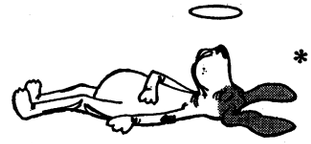
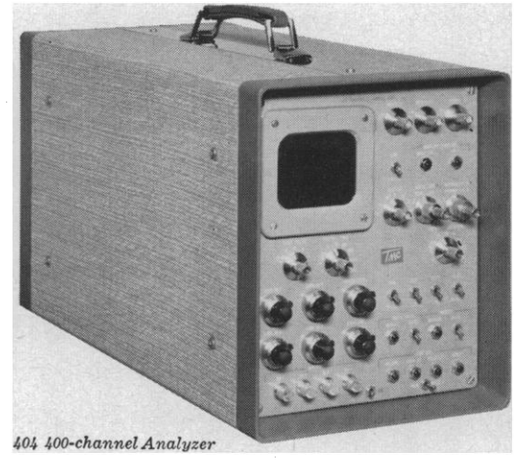


Heaven . . .
and
TMC
Pulse Analyzers

CN-110 256-channel Analyzer



404 400-channel Analyzer

"North *Heaven*, U.S.A." was the way our address came out in one of our ads translated for a foreign publication. Before the SEC and our competitors take us to task for claiming unfair competitive advantages, we'll admit we're a completely earthly operation. All over the earth, in fact.

Such international fame and fortune for TMC instruments comes, we think, from the universal appeal of wide usefulness in a single instrument — as exemplified by the CN-110 256-channel analyzer. It has 7 interchangeable plug-in logics, including pulse height, time of flight, pulsed neutron, multi-scaler, mass spectrometer, and coincidence pair. Circuitry is all-transistorized. Analog, binary, octal and decimal readout may be used. Data can be recorded on strip chart or X-Y recorders, printed paper tape, punched paper tape, or punched cards.

If you don't need an analyzer with this much versatility, but want instead a compact, portable, accurate, 400-channel instrument, the new TMC 404 may be just the thing for you. It has a magnetic core memory that can be used in sub groups of two or four; four separate inputs and associated amplifiers; internal pulse routing circuitry; push-button data transfer and display overlap; power requirements of *only 25 watts;* and provision for readout on a companion TMC Decimal Printer, high speed paper tape punch, strip chart or X-Y recorder, or an IBM electric typewriter.

**Note: The dog is dead . . . he had an unfortunate accident last week when struck by a suddenly swerving policy. (A temporary situation, we hope.)*

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21 July 1961, Volume 134, Number 3473 **SCIENCE**

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The System

Universities are faced with some hard choices in the immediate future as a consequence of rapidly mounting enrollments of both undergraduate and graduate students. One of these choices involves undergraduate education. For, in contrast to liberal-arts and other 4-year colleges, universities attempt to carry on two conflicting activities: the education of undergraduates for all kinds of occupations and the furtherance of research by both faculty and graduate students.

A peculiarity in university organization is that there is in general little differentiation in faculty function: a faculty member typically teaches undergraduates, does research, and supervises graduate students. These tasks demand quite different talents. To arouse interest, to lay bare the bones of a subject without too much qualification, in short to make an art of teaching, are the requirements for the one task; to carry on research, to teach by example, and to give general guidance to students already well immersed in a subject are the requirements of the other.

It is true that here and there some division of labor has occurred. Some professors, usually called research professors, never deal with undergraduates, and some others devote all or almost all of their efforts to undergraduate teaching. But this differentiation is exceptional, and the question remains: Why have universities in general failed to differentiate faculty functions more sharply? Part of the explanation surely is to be sought in the implicit value systems of faculties and administrators. Research and the training of graduate students are valued highly by the faculty; teaching, by contrast, is second-class. Administrators, however, according to a recent study for the American Council on Education, rate teaching as highly important and indeed regard, or at least claim to regard, teaching ability as the single most important factor in judging the worth of faculty members. Despite this kind of assurance about the value of teaching, few university faculty members believe that time devoted to teaching will receive either recognition or reward. It is a more usual, and probably a more realistic, view that time taken for teaching is time stolen from research, and that the road to academic heaven is paved with publications.

These widely prevalent beliefs of faculty members have a baneful influence on the quality of undergraduate education. Those who make the decisions about promotions in universities might well consider the balanced appraisal made by Abraham Flexner in 1930: "Original thinkers and investigators do not . . . represent the only type of university professor. They will always be the distinguished figures; theirs will usually be the most profound and far-reaching influence. But even universities, modern universities, need and use men of a different stamp—teachers whose own contributions to learning are of less importance than their influence in stimulating students or their resourcefulness in bringing together the researches of others."

Since this statement was made, the emphasis on research has tipped the balance still further away from undergraduate education. The universities have two possible courses of action: they can become "senior" colleges and graduate schools and thus leave all or part of undergraduate education to the junior colleges and the 4-year colleges, or they can find some way to change their value system by giving more than lip service to making teaching a rewarding career.—G.DuS.

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An announcement on advance registration, with a coupon, will also be found in the advertising pages of this issue and at intervals hereafter.

AAAS Headquarters

As stated in the preliminary announcement, the Denver Hilton will be hotel headquarters for the AAAS as a whole. The Hilton, with its large ballroom and other session rooms, will accommodate the evening events, the general sessions, the AAAS business sessions, and the AAAS Pressroom. It will also house the AAAS Main Registration-Information Center, the AAAS Office, the Visible Directory of Registrants, the Annual Exposition of Science and Industry, and the AAAS Science Theatre.

The Hilton will also accommodate the American Society of Zoologists, the Society of Protozoologists, the Society of Systematic Zoology, Section N–Medical Sciences, the other biological and medical groups, and some of the physical sciences as well. The Shirley Savoy will be headquarters for the American Astronomical Society and the science teaching societies. The social and economic sciences will have headquarters at the Brown Palace and its new Tower annex. Finally, the Cosmopolitan is the headquarters hotel for the sections on dentistry, pharmacy, anthropology, and education for the American Astronautical Society, and, in part, for Section Q–Education and the science teaching societies.

A detailed list of the headquarters for each section and participating organization is given below.

Hotel Headquarters in Detail

AAAS sections are listed alphabetically, and societies are listed alphabetically by discipline.

Hilton (884 rooms), 155 Court Place.

AAAS Office; AAAS Pressroom; Main Registration-Information Center; Annual Exposition of Science and Industry; AAAS Science Theatre; Visible Directory of Registrants.

AAAS (Board of Directors, Council); General Events and Special Sessions.

AAAS Southwestern and Rocky Mountain Division.

AAAS Committee on the Public Understanding of Science; AAAS Committee on Science and the Promotion of Human Welfare; Committee on Desert and Arid Zones Research of the Southwestern and Rocky Mountain Division.

AAAS Sections A–Mathematics, C–Chemistry, E–Geology and Geography, F–Zoological Sciences, G–Botanical Sciences, M–Engineering, N–Medical Sciences, and O–Agriculture.

Association for Computing Machinery, Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America, Society for Industrial and Applied Mathematics.

American Association of Clinical Chemists; American Chemical Society, Colorado Section.

Association of American Geographers, Great Plains-Rocky Mountain Division; Geological Society of America; National Geographic Society; National Speleological Society.

American Society of Zoologists, Society of Protozoologists, Society of Systematic Zoology.

American Society of Naturalists; Beta Beta Beta Biological Society; Biometric Society, Western North American Region; Ecological Society of America; Mountain Lake Biological Station; Nature Conservancy; Society of General Physiologists.

Engineering Manpower Commission, Tau Beta Pi Association.

Alpha Epsilon Delta.

American Geophysical Union, Conference on Scientific Communication, Conference on Scientific Manpower, National Academy of Sciences–National Research Council, National Association of Science Writers, National Science Foundation, Scientific Manpower Commission, Scientific Research Society of America, Sigma Delta Epsilon, Society of the Sigma Xi, United Chapters of Phi Beta Kappa.

Brown Palace and Tower (600 rooms), 17th Street and Tremont Place.

AAAS Sections I–Psychology, K–Social and Economic Sciences, L–History and Philosophy of Science, and P–Industrial Science.

American Economic Association, American Political Science Association, American Society of Criminology, American Sociological Association,

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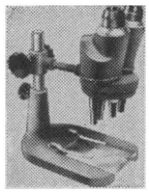

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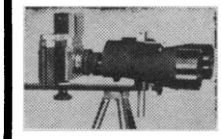

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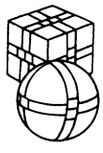

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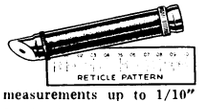

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American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section; American Society of Hospital Pharmacists; National Association of Boards of Pharmacy.

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AAAS Cooperative Committee on the Teaching of Science and Mathematics.

AAAS Sections B–Physics, D–Astronomy, and Q–Education.

American Meteorological Society, Sigma Pi Sigma.

American Astronomical Society, Astronomical League.

National Association of Biology Teachers.

Colorado Science Teachers Association, Council for Exceptional Children, National Association for Research in Science Teaching, National Science Teachers Association.

American Nature Study Society.

RAYMOND L. TAYLOR
Associate Administrative Secretary

Forthcoming Events

August

13–18. Microchemical Techniques, intern. symp., University Park, Pa. (H. J. Francis, Jr., Pennsalt Chemical Corp., P.O. Box 4388, Chestnut Hill Post Office, Philadelphia 18, Pa.)

15–24. International Astronomical Union, 11th general assembly, Berkeley, Calif. (D. H. Sadler, Royal Greenwich Observatory, Hailsham, Sussex, England)

16–18. Hypersonics Conf., intern., Cambridge, Mass. (J. J. Harford, American Rocket Soc., 500 Fifth Ave., New York, N.Y.)

18–21. Association of American Geographers, East Lansing, Mich. (M. F. Burrill, 1785 Massachusetts Ave., NW, Washington 6)

19–30. Agricultural Economists, 11th intern. conf., Cuernavaca, Mexico. (J. Ackerman, Farm Foundation, 600 S. Michigan Ave., Chicago, Ill.)

20–23. International Ergonomics Assoc., 1st congr., Stockholm, Sweden. (T. Olson, Dept. of Industrial Physiology, G.C.I. Lidingövägen 1, Stockholm)

20–24. American Veterinary Medical Assoc., Detroit, Mich. (H. E. Kingman, AVMA, 600 S. Michigan Ave., Chicago 5, Ill.)

21–23. International Hypersonics Conf., Cambridge, Mass. (F. Ridell, Avco Research Laboratory, 301 Lowell St., Wilmington, Mass.)

21–24. Biological Photographic Assoc., Chicago, Ill. (Mrs. J. W. Crouch, Box 1668, Grand Central P.O., New York 17)

21–24. International Conf. on Photoconductivity, Ithaca, N.Y. (E. Burstein, Dept. of Physics, Univ. of Pennsylvania, Philadelphia)

21–26. International Congr. of Psychotherapy, 5th, Vienna, Austria. (W. Spiel, Lazarettg. 14, Vienna 9)

21–26. World Traffic Engineering Conf., Washington, D.C. (Intern. Road Federation, 1023 Washington Bldg., Washington 5)

21–27. International Assoc. of Dental Students, congr., London, England. (D. H. Clark, Royal Dental Hospital, Leicester Sq., London, W.C.2)

21–31. United Nations Conf. on New Sources of Energy, Rome, Italy. (United Nations, New York, N.Y.)

21–2. International Congr. of Practical Medicine, Merano, Italy. (Bundesärztekammer, 1 Hädenkampfstrasse, Cologne, Germany)

21–6. Pacific Science Congr., 10th, Honolulu, Hawaii. (Secretary General, 10th Pacific Science Congr., Bishop Museum, Honolulu)

22–25. International Pharmacological Meeting, 1st, Stockholm, Sweden. (A. Wretlind, Karolinska Institutet, Stockholm 60)

22–30. International Conf. on Protozoology, Prague, Czechoslovakia. (N. D. Levine, College of Veterinary Medicine, Univ. of Illinois, Urbana)

23–25. Gas Dynamics, symp., biennial, Evanston, Ill. (J. J. Harford, American Rocket Soc., 500 Fifth Ave., New York, N.Y.)

23–26. Electron Microscope Soc. of America, Pittsburgh, Pa. (Miss M. L. Rollins, Agricultural Research Service, U.S. Department of Agriculture, P.O. Box 19,687, New Orleans 19, La.)

23–26. Institute of Management Sciences, 8th annual intern., Brussels, Belgium. (W. Smith, Inst. of Science and Technology, Univ. of Michigan, Ann Arbor)

23–1. Radioisotopes in the Biological Sciences, conf., Intern. Atomic Energy Agency, Vienna, Austria. (IAEA, 11 Kärtner Ring, Vienna 1)

24–26. Physiology of the Hippocampus, intern. colloquium, Montpellier, France. (Mme. Mineur, Centre National de la Recherche Scientifique, 13 Quai Anatole France, Paris 7)

26–1. Radiology, 10th intern. congr., Montreal, Canada. (C. B. Peirce, Suite 204, 1555 Summerhill, Montreal 25, Canada)

27–29. International Congr. of Group Psychotherapy, 3rd, Paris, France. (W. Warner, P.O. Box 819, Grand Central Station, New York 17)

27–29. Psychosomatic Aspects of Neoplastic Disease, 2nd annual conv., Paris, France. (L. L. LeShan, Intern. Psychosomatic Cancer Study Group, 144 E. 90 St., New York 28)

27–1. American Congr. of Physical Medicine and Rehabilitation, Cleveland, Ohio. (D. C. Augustin, 30 N. Michigan Ave., Chicago 2, Ill.)

27–1. American Inst. of Biological Sciences, annual, Lafayette, Ind. (J. R. Olive, AIBS, 2000 P St., NW, Washington 6)

The following 26 societies are holding meetings in conjunction with the AIBS meeting at Purdue University.

Alpha Epsilon Delta (J. E. Wiebers, Dept. of Biological Sciences, Purdue Univ.)

American Bryological Soc. (S. N. Postlethwait, Dept. of Biological Sciences, Purdue Univ.)

American Fern Soc. (C. B. Heiser, Jr., Dept. of Botany, Indiana Univ., Bloomington)

American Fisheries Soc. (Miss S. Gerking, Dept. of Zoology, Indiana Univ., Bloomington)

American Microscopical Soc. (C. J. Goodnight, Dept. of Biological Sciences, Purdue Univ.)

American Soc. for Horticultural Science (R. G. Langston, Dept. of Horticulture, Purdue Univ.)

American Soc. of Limnology and Oceanography (C. J. Goodnight, Dept. of Biological Sciences, Purdue Univ.)

American Soc. of Parasitologists (S. M. Gaafar, Dept. of Veterinary Microbiology, Pathology and Public Health, Purdue Univ.)

American Soc. of Plant Physiologists (H. Beevers, Dept. of Biological Sciences, Purdue Univ.)

American Soc. of Plant Taxonomists (G. L. Webster, Dept. of Biological Sciences, Purdue Univ.)

American Soc. of Zoologists (M. X. Zarrow, Dept. of Biological Sciences, Purdue Univ.)

Association of Midwest College Biology Teachers (J. D. Novak, Dept. of Biological Sciences, Purdue Univ.)

Biometric Society (ENAR) (H. E. McKean, Statistical and Computing Laboratory, Purdue Univ.)

Botanical Soc. of America (A. C. Leopold, Dept. of Horticulture, Purdue Univ.)

Entomological Soc. of America (Section A) (L. Chandler, Dept. of Entomology, Purdue Univ.)

Genetics Soc. of America (A. B. Burdick, Dept. of Biological Sciences, Purdue Univ.)

Mycological Soc. of America (J. S. Lovett, Dept. of Biological Sciences, Purdue Univ.)

National Assoc. of Biology Teachers (J. D. Novak, Dept. of Biological Sciences, Purdue Univ.)

Nature Conservancy (A. A. Lindsey, Dept. of Biological Sciences, Purdue Univ.)

Phycological Soc. of America (A. T. Guard, Dept. of Biological Sciences, Purdue Univ.)

Sigma Delta Epsilon (Miss V. B. White, Dept. of Foods and Nutrition, Purdue Univ.)

Society for Industrial Microbiology (W. N. Cannon, Lilly Research Laboratories, Eli Lilly and Co., Indianapolis, Ind.)

Society for the Study of Development and Growth (F. H. Wilt, Dept. of Biological Sciences, Purdue Univ.)

Society for the Study of Evolution (L. Chandler, Dept. of Entomology, Purdue Univ.)

Tomato Genetics Cooperative (A. B. Burdick, Dept. of Biological Sciences, Purdue Univ.)

Wildlife Disease Assoc. (S. M. Gaafar, Dept. of Veterinary Microbiology, Pathology and Public Health, Purdue Univ.)

27–1. Coordination Chemistry, 6th intern. conf., Detroit, Mich. (S. Kirschner, Dept. of Chemistry, Wayne State Univ., Detroit 2)

28–30. Mathematical Assoc. of America, Stillwater, Okla. (H. L. Alder, MAA, Univ. of California, Davis)

28–30. Oak Ridge Inst. of Nuclear Studies, 8th annual summer symp., Gatlin-

burg, Tenn. (Symposium Office, University Relations Division, Oak Ridge Inst. of Nuclear Studies, P.O. Box 117, Oak Ridge, Tenn.)

28–30. Scandinavian Symp. on Fat Rancidity, 3rd, Sandefjord, Norway. (E. Törnudd, Gaustadallen 30, Blindern, Norway)

28–31. American Assoc. of Clinical Chemists, natl., New York, N.Y. (B. Klein, Chemistry Dept., Kingsbridge V.A. Hospital, Bronx, N.Y.)

28–31, American Soc. for Pharmacology and Experimental Therapeutics, Rochester, N.Y. (K. H. Beyer, Merck, Sharp and Dohme Research Laboratories, West Point, Pa.)

28–31. Botanical Soc. of America, Lafayette, Ind. (B. L. Turner, Dept. of Botany, Univ. of Texas, Austin 12)

28–31. Chemical Physics of Nonmetallic Crystals, intern. conf., Evanston, Ill. (O. C. Simpson, Argonne National Laboratory, 9700 South Cass Ave., Argonne, Ill.)

28–1. Heat Transfer Conf., intern., Boulder, Colo. (S. P. Kezios, American Soc. of Mechanical Engineers, 29 W. 39 St., New York 18)

28–1. Ionization Phenomena in Gases, 5th intern. conf., Munich, Germany. (Secretariat, Oskar von Miller Ring 18, P.O. 463, Munich 1)

28–1. Radioactive Metrology, symp., Oxford, England. (B. W. Robinson, Applied Physics Division, National Physical Laboratory, Teddington, Middlesex, England)

28–1. Rockets and Astronautics, 3rd intern. symp., Tokyo, Japan. (Japanese Rocket Soc., 1-3, Ginza-Nishi, Chuo-Ku, Tokyo)

28–2. European Soc. of Haematology, 8th congr., Vienna, Austria. (H. Fleischhracker, Frankgasse 8, Billrothhaus, Vienna 9)

28–2. International Assoc. of Medical Laboratory Technologists, general assembly, Stockholm, Sweden. (Miss M. Westenins, Statens Bakteriologiska Laboratorium, Box 764, Stockholm 1)

28–2. Detonation Waves, intern. colloquium, Gif-sur-Yvette, France. (G. M. Ribaud, Centre National de la Recherche Scientifique, 13 Quai Anatole France, Paris 7, France)

28–2. Mechanics of Turbulence, intern. colloquium, Marseilles, France. (A. Favre, Faculté des Sciences, Université, Marseilles)

28–7. International Statistical Inst., 33rd session, Paris, France. (J. Berkson, Mayo Clinic, Rochester, Minn.)

29. American Soc. for Horticultural Science, Lafayette, Ind. (R. E. Marshall, Dept. of Horticulture, Michigan State Univ., East Lansing)

29–1. American Mathematical Soc., 66th summer meeting and 40th colloquium, Stillwater, Okla. (J. W. T. Youngs, AMS, 190 Hope St., Providence 6, R.I.)

29–1. Society for Industrial and Applied Mathematics, Stillwater, Okla. (G. Kaskey, Remington Rand UNIVAC, P.O. Box 500, Blue Bell, Pa.)

29–6. Planning of Experiments, intern. colloquium, Paris, France. (D. Dugue, Institut de Statistique de l'Université, 11 rue Pierre Curie, Paris 5)

29–7. International Statistical Inst.,

33rd session, Paris, France. (G. R. Chevry, 29 Quai Branly, Paris 7)

30–1. Semiconductor Conf., 3rd annual, Los Angeles, Calif. (W. V. Wright, Electro-Optical Systems, Inc., 125 N. Vinedo Ave., Pasadena, Calif.)

30–2. American Sociological Assoc., St. Louis, Mo. (T. Parsons, Dept. of Social Relations, Harvard Univ., Cambridge, Mass.)

30–2. Experimental Research on Shell Structures, colloquium, Delft, Netherlands. (A. L. Bouma, Dept. of Civil Engineering, Technological Univ., Delft)

30–5. Mental Health, 6th intern. congr., Paris, France. (Miss E. M. Thornton, World Federation for Mental Health, 19 Manchester St., London, W.1, England)

31–2. Exfoliative Cytology, intern. congr., Vienna, Austria. (Office of the Secretary of the Congress, 666 Elm St., Buffalo 3, N.Y.)

31–2. Gynaecological Cytology, 1st intern. congr., Vienna, Austria. (R. M. Graham, Roswell Park Memorial Inst., 666 Elm St., Buffalo 3, N.Y.)

31–4. Preventive and Social Medicine, meeting, Evian, France. (Societé Française de Medecine Preventive et Sociale, 1 rue de Courcelles, Paris 8, France)

31–6. American Psychological Assoc., 69th annual, New York, N.Y. (J. G. Darley, 1333 16th St., NW, Washington 6)

September

1–5. Danube Research, intern. symp., Budapest, Hungary. (Biological Sciences Group, Hungarian Acad. of Sciences, Roosevelt Tèr. 9, Budapest V)

1–9. Topology and Its Methods in Other Mathematical Disciplines, symp., Prague, Czechoslovakia. (Organizing Committee, Ke Karlovu 3, Prague 2)

1–10. International Pharmaceutical Students' Federation, 7th congr., Munich, Germany. (U. Peto, 10 Groffstr., Munich 19)

2–7. International Assoc. for Quaternary Research, Warsaw, Poland. (R. Galon, Secretary General, INQUA, Geographical Inst. Univ., Torun, Poland)

2–9. International Soc. of Surgery, 19th congr., Dublin, Ireland. (T. C. J. O'Connell, 35 Fitzwilliam Pl., Dublin)

3–7. International Assoc. for Hydraulic Research, 9th congr., Belgrade, Yugoslavia. (H. J. Schoemaker, Waterloopkundig Laboratorium, Raam 61, Delft, Netherlands)

3–8. American Chemical Soc., 140th meeting, Chicago, Ill. (A. T. Windstead, National Meetings Dept., ACS, 1155 16 St., NW, Washington 6)

3–9. International Federation of Gynaecology and Obstetrics, 3rd world congr., Vienna, Austria. (V. Grünberger, Medizinische Akademie, Alserstrasse 4, Vienna 9)

3–10. Inter-American Congr. of Radiology, 7th, São Paulo, Brazil. (W. Bomfim-Pontes, Rua Cesario Motta 112, São Paulo)

4. World Federation for Mental Health, 14th annual, Paris, France. (WFMH, 19 Manchester St., London, W.1, England)

4–6. International Assoc. for Shell Structures, colloquium, Brussels, Belgium. (Prof. Dutron, 127 Avenue Adolphe Buyl, Brussels 5)

4–6. International Symp. on the Earth Storm, Kyoto, Japan. (T. Nagata, Science Council of Japan, Ueno Park, Tokyo)

4–7. Neuropathology, 4th intern. congr., Munich, Germany. (W. Haymaker, Armed Forces Inst. of Pathology, Walter Reed Army Medical Center, Washington 25)

4–7. Rheumatology, 10th intern. congr., Rome, Italy. (C. B. Ballabio, Clinica Medica Generale, Via F. Sforza 35, Milan, Italy)

4–8. Low Energy Nuclear Physics, intern. conf., Manchester, England. (L. J. B. Goldfarb, Physics Dept., Univ. of Manchester, Manchester)

4–8. Pharmaceutical Sciences, 21st intern., congr., Pisa, Italy. (Intern. Pharmaceutical Federation, 11 Alexanderstraat, The Hague, Netherlands)

4–8. Plasma Physics and Controlled Nuclear Fusion Research, conf., Salzburg, Austria. (Intern. Atomic Energy Agency, United Nations, New York, N.Y.)

4–9. International Assoc. for Analog Computation, 3rd intern. sessions, Belgrade, Yugoslavia. (D. Strujic, Decanska 14/IV, Belgrade)

4–9. International Congr. of Angiology, 4th, Prague, Czechoslovakia. (Z. Reinis, 4th Medical Clinic, Prague 2/499)

4–9. International Symp. on Fundamental Problems in Turbulence and Their Relation to Geophysics (by invitation), Marseilles, France. (Intern. Union of Geodesy and Geophysics, 53 Avenue de Breteuil, Paris 7)

4–9. Laurentian Hormone Conf., Hoberg's Resort, Lake County, Calif. (Committee on Arrangement of the Laurentian Hormone Conference, 222 Maple Ave., Shrewsbury, Mass.)

4–13. Inter-African Conf. for Food and Nutrition, 4th, Bukavu, Congo Republic. (Commission for Technical Cooperation in Africa South of the Sahara, Pvt. Mail Bag 2359, Lagos, Nigeria)

4–14. Anglo-American Aeronautical Conf., 8th, London, England. (Inst. of Aerospace Sciences, 2 E. 64 St., New York, N.Y.)

5–8. International Congr. of Homeopathic Medicine, 25th, Amsterdam, Netherlands. (J. L. Fonteijn, Westzijde 116, Zaandam, Netherlands)

5–8. Machine Translation of Languages and Applied Language Analysis, intern. conf., Teddington, England. (L. Dostert, Director, Machine Translation Research, Georgetown Univ., 1715 Massachusetts Ave., NW, Washington 6)

5–8. National Chemical Exposition, 11th, Chicago, Ill. (Chicago Section, American Chemical Soc., 86 E. Randolph St., Chicago 1)

6–8. Effects of Ionizing Radiations on Immune Processes, intern. symp., Lawrence, Kan. (C. A. Leone, Dept. of Zoology, Univ. of Kansas, Lawrence)

6–8. Transmission and Processing of Information, intern. symp., Boston, Mass. (R. M. Fano, Research Laboratory of Electronics, Massachusetts Inst. of Technology, Cambridge 39)

6–12. Human Genetics, 2nd intern. conf., Rome, Italy. (L. Gedda, 5 Piazza Galeno, Rome)

7–8. Pacific Slope Biochemical Conf., annual, San Diego, Calif. (R. G. Wolfe, Chemistry Dept., Univ. of Oregon, Eugene)

7–9. International Cardiovascular Soc., 5th congr., Dublin, Ireland. (H. Haimovici, 715 Park Ave., New York 21)

7–9. Parapsychological Assoc., 4th annual congr., New York, N.Y. (W. A. Roll, Box 6116, College Station, Durham, N.C.)

7–11. European Orthodontic Soc., 37th congr., Bologna, Italy. (N. Gray, 16 College Rd., Eastbourne, Sussex, England)

7–12. Neurogenetics, symp., Rome, Italy. (L. Gedda, Instituto Gregorio Mendel, Viale Regina Margherita 261, Rome)

7–13. Electroencephalography and Clinical Neurophysiology, 5th intern. congr., Rome, Italy. (R. Vizioli, Viale Universita 30, Rome)

10–14. Tuberculosis Conf., 16th intern., Toronto, Canada. (C. W. L. Jeanes, 265 Elgin St., Ottawa, Ont., Canada)

10–15. Neurology, 7th intern. congr., Rome, Italy. (G. Alema, Viale Università 30, Rome)

10–17. International Union of Forest Research Organizations, 13th congr., Vienna, Austria. (Forest Research Inst., IUFRO Bureau, Vienna 89)

11–13. European Organization for Quality Control, 5th congr., Turin, Italy. (Weena 700, Rotterdam, Netherlands)

11–14. International Flax and Hemp Federation, 12th congr., Lisbon, Portugal. (IFHF, 37 rue de Courcelles, Paris 8)

11–15. Cosmic Rays, 7th intern. conf., Kyoto, Japan. (Y. Sekido, Science Council of Japan, Ueno Park, Tokyo)

11–15. Cybernetics, 3rd intern. congr., c

Namur, Belgium. (Intern. Assoc. for Cybernetics, 13 rue Basse-Marcelle, Namur)

11–15. Instrument Soc. of America, instrument-automation conf. and exhibit, 16th, Los Angeles, Calif. (W. H. Kushnick, 313 Sixth Ave., Pittsburgh 22, Pa.)

11–15. Marine Sciences Instrumentation, symp., Woods Hole, Mass. (D. D. Ketchum, Woods Hole Oceanographic Institution, Woods Hole, Mass.)

11–15. Radioecology, symp., Fort Collins, Colo. (Miss A. Barker, American Inst. of Biological Sciences, 2000 P St., NW, Washington 6)

11–16. International Union for the Scientific Study of Population, 12th congr., New York, N.Y. (C. V. Kiser, Milbank Memorial Fund, 20 Wall St., New York 5)

11–16. University of Hong Kong, intern. scientific congr., Hong Kong. (University of Hong Kong, Hong Kong)

11–19. International Congr. of Navigation, 20th, Baltimore, Md. (E. W. Adams, Jr., 22 Light St., Baltimore 2)

11–21. International Cloud Physics Conf., Canberra and Sydney, Australia. (E. G. Bowen, Commonwealth Scientific and Industrial Research Organization, University Grounds, Sydney)

12–13. International Federation of Surgical Colleges and Societies, 4th annual Oslo, Norway. (K. Cassels, IFSC Office, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2)

12–15. International Pharmaceutical Federation, 19th general assembly, Athens, Greece. (J. H. M. Winters, Alexanderstraat 11, The Hague, Netherlands)

12–15. Mass Spectrometry, conf., Oxford, England. (W. J. Brown, Instrumentation Div., A.E.I. (Manchester) Ltd., Trafford Park, Manchester 17, England)

15–20. World Medical Assoc., 15th general assembly, Rio de Janeiro, Brazil. (L. H. Bauer, 10 Columbus Circle, New York 19)

13–16. European Congr., of Gerontology, 3rd, Amsterdam, Netherlands. (A. J. S. Douma, Haanplein 8, The Hague, Netherlands)

14–17. Chemotherapy, 2nd intern. symp., Naples, Italy. (P. Preziosi, Casella postale 266, Naples)

14–20. High Energy Physics, intern., Aix-en-Provence, France. (E. W. D. Steel, European Organization for Nuclear Research, Geneva 23, Switzerland)

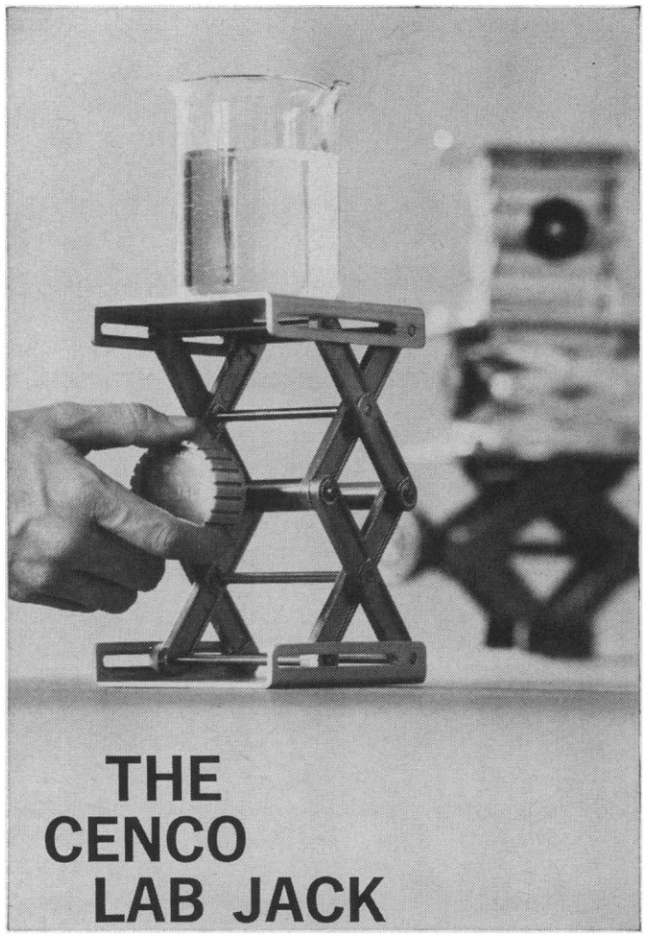
16–20. German Soc. for the History of Medicine, Physical Science and Technology, Augsberg, Germany. (G. Mann. Secretary, Wilhelmplatz 7, Bonn, Germany)

16–27. International Scientific Film Assoc., 15th congr., Rabat, Morocco. (M. Afifi, 85 Ibn Toumert, Rabat)

18–2. World Meteorological Organization, Commission for Aerology, 3rd session, Rome, Italy. (WMO, 1 Avenue de la Paix, Geneva, Switzerland)

18–20. Applied Spectroscopy, 8th symp., Ottawa, Canada. (R. Lauzon, Div. of Pure Chemistry, National Research Council, Ottawa, Ont.)

18–21. Embryological Conf., 5th intern., London. (L. Brent, Dept. of Zoology, University College, London, Grover St., London, W.C.1)



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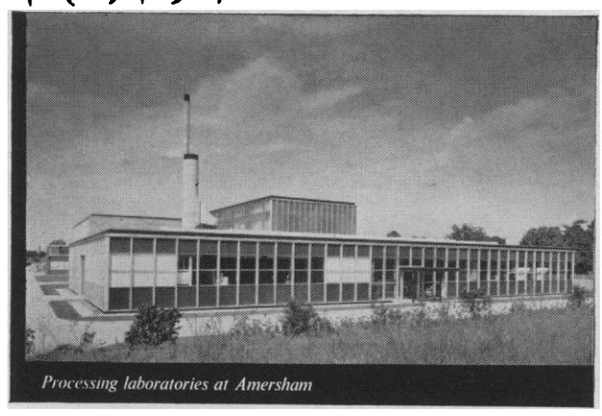

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mixed as a separate phase. In my conclusion I expressed the *"view,"* that is, the opinion, that the bulk of the data support the exclusion of carbonate as a structural constituent in apatite. I made it clear that further evidence must be collected before this viewpoint can be held to be incontrovertible.

The article by McConnell and Murdoch (*2*) does not contain crystallographic proof that the carbonate is a structural constituent of scawtite. Without a detailed x-ray diffraction structure analysis, or some equivalent quantitative method which can assign, with certainty, position parameters to the constituent atoms, any structure must remain in doubt. Even if it were proved that carbonate appears as a structural constituent of this silicate mineral (scawtite), this would not constitute proof that the same situation holds for the basic calcium phosphates, that is, the apatites.

Hendricks (*3*), Carlström (*4*), and I (*5*) have stated that the x-ray diffraction patterns of francolite and fluorapatite as shown by McConnell (*6*) are different in relative intensity values, owing to an orientation effect. McConnell kindly supplied me with some of the francolite used in his study (*6*). It was possible to produce an oriented powder diffraction pattern such as he shows, or, if proper precautions were taken to avoid orientation, it was possible to produce a pattern coincident with fluorapatite. This result was reported to McConnell in personal conversation before he submitted his paper (*6*) for publication.

It is not true that the x-ray diffraction studies on apatite discussed by McConnell were performed on materials which were not analyzed. The single-crystal, x-ray diffraction refinement of the structure of hydroxyapatite was performed on well characterized crystals prepared in our laboratory (*7*). In addition, each sample of the calcium-deficient hydroxyapatites was shown to be a single phase and was characterized by chemical and physical analyses (*8*). Reference to the original papers will corroborate this statement.

Whether or not carbonate must be present for physiological mineralization is not a subject treated in my chapter (*1*) and needs no further discussion here. It is possible, by taking special precautions, to prepare hydroxy-

apatite free of all carbonate content. Thus the presence of carbonate is not needed for the synthesis of hydroxyapatite.

The study of the exact nature of mineral tissue is fascinating work. There is room in this field for many viewpoints and dissenting theories. I think it is important to state clearly what is known and what is not known about these systems and I have attempted to do this in my chapter (*1*). I urge all workers in this field not to be satisfied with the half-answers in our possession now. We need more experiments, more facts, to define the atomic structure of hard tissue.

AARON S. POSNER
8408 Whitman Drive,
Bethesda, Maryland

References

1. A. S. Posner, chapter in *Calcification in Biological Systems*, R. F. Sognnaes, Ed. (AAAS, Washington, D.C., 1960).
2. D. McConnell and J. Murdoch, *Am. Mineralogist* **43**, 498 (1958).
3. S. B. Hendricks, *Trans. Macy Conf. on Metabolic Interrelations* **4**, 185 (1952).
4. D. Carlström, *Acta Radiol.* **Suppl. 121** (1955).
5. A. S. Posner, thesis, Univ. of Liège (1954).
6. D. McConnell, *Bull. soc. franç. mineral. et crist.* **75**, 428 (1952).
7. A. S. Posner, A. Perloff, A. F. Diorio, *Acta Cryst.* **11**, 308 (1958).
8. A. S. Posner and A. Perloff, *J. Research Natl. Bur. Standards* **58**, 279 (1957).

Grants and Applicants

The game of measuring past scientists against present grant-reviewing policies [*Science* **133**, 1040 (1961)] can be played without end. Freud was never psychoanalyzed, Mendel lacked training in genetics, Boas's degrees were not in anthropology, and Faraday's formal qualifications were belittled in his own time.

But these pioneers are not the applicants for today's research dollars. The request for a $20,000 analyzer rarely comes from an amateur in science, and the retired school teacher does not seek $50,000 (plus overhead) for studies on carcinogens. Current applicants make a point of their education, degrees, training, publications (and imagination) and expect to be judged accordingly.

It is true that a polished research plan does not automatically guarantee results. But no one has suggested that totally unplanned excursions are more productive. There are discovery-prone investigators and discovery-proof workers, and it is reasonable to bet on the former.

Years ago, in the Neolithic, an anonymous Sumerian discovered wine. Admittedly he lacked formal training in microbiology and carbohydrate chemistry. But in all probability he was versed in juice technology and combined intuition with persistence and the experimental approach. These same qualities, in modern dress, involve training, knowledge of the literature, a facility at posing problems, and demonstrated ability to see them through—qualities that may be present in one man, or shared by a team.

STANLEY M. GARN
Fels Research Institute,
Yellow Springs, Ohio

Federal Aid to Education

In the editorial "Equal but separate," on federal aid to education [*Science* **133**, 1043 (7 Apr. 1961)], there are several debatable points—for example, that of the legality under the constitution of federal aid to education and of whether the necessity for this is real (the increase in school construction since World War II has been much more rapid than the large increase in the number of students).

The point that really concerns me, however, is the argument that federal aid is needed because the communities and the property tax can no longer support schools. Does the author of the editorial feel that there are other sources, aside from all the local communities, of federal income, and does he feel that the money the federal government acquires in a community multiplies on its trip to Washington? If this type of fuzzy thinking is representative of the scientific community which *Science* represents, the situation is indeed deplorable.

RALPH S. RIFFENBURGH
595 East Colorado Boulevard,
Pasadena, California

The editorial entitled "Equal but separate" contains errors in logic and fails to use facts to justify a position. It is, therefore, little more than a regurgitation of some widely publicized views. Such a spurious effort is especially inappropriate for a scholarly publication.

For instance, it is a flagrant *non sequitur* to claim "the deficiencies in education in the United States are serious in the extreme" follows from

". . . the U.S. Office of Education puts the need at around 140,000 new classrooms, with no expectation that the property tax, the present mainstay of school financing, can even begin to meet this need."

Moreover, the author of the editorial conveniently fails to note that the Office of Education booklet No. OE-10005 also shows, in Table 6, that the "need" for new classrooms declined from something in excess of 159,800 to 132,400 during the period 1955 through 1960. Nor does he mention that the number of graduates per 100 persons 17 years of age has risen steadily to 64.9; that the percentage of the population that is illiterate has fallen steadily to 2.2; that the pupil-teacher ratio has fallen to 25.8 to 1; that the number of pupils in excess of normal capacity has declined 17.3 percent in the last five years; that the total number of degrees earned has steadily risen, to a level of 486,400 in 1960; that total expenditures per pupil for public elementary and secondary schools has steadily risen, to $446; that total expenditures for education, as a percentage of national income, now stands at 5.39 percent. These data preclude any belief that "deficiencies in education in the United States are serious in the extreme." If present "deficiencies are serious in the extreme," educational conditions heretofore would have to be described as chaotic; I think most of us, including the author of the editorial, would be reluctant to draw such a conclusion.

In addition, even the author's basic premise is faulty! The property-tax structure certainly *is* capable of being increased considerably; property taxes are on the rise and have been for many years. Furthermore, there are other state, county, city, and miscellaneous *local* sources of tax revenue untapped as yet. Is it too much to ask that editorial writers recognize that federal funds for education arise from the same sources as do local funds for education?

Consider for a moment that in 1940 the size of the U.S. economy, measured by gross national product, was $100 billion; today it is $500 billion. In 1940 the federal government was getting from taxes about $5 billion, or 5 percent of the nation's economic wealth. It is now getting $80 billion, or 16 percent of the economic wealth. I submit that the federal government, not local government, has reached the point of diminishing returns on tax

yield. What magic spell will the federal government weave to create greater support for education? And where is the evidence validating the real need for federal support on an expanded scale?

The editorial seems to imply justification for federal aid to education by saying, "One of the bitter truths about education is that opportunities are not equal for all students. Difference in level of income is a familiar source of inequality." But, here again, the editorial fails to recognize that differences in intelligence, in physical stamina, and in parents also are familiar factors intimately related to inequality of opportunity for education. The really pertinent question is whether true equality of opportunity for education can ever be attained while the noneconomic, human factors determining an individual's level of income remain unequal. Indeed, singling out income as a variable appropriation for federal subvention is specious reasoning.

Is it, in fact, a "bitter truth" that opportunities for education are not equal for all students, as is claimed by the author of the editorial? Perhaps my thinking is conditioned by the fact that I was able to earn advanced degrees from a state-supported university (Illinois) and a private university (Chicago) with absolutely no parental or scholarship financing. I do believe a good case can be made for the value of overcoming obstacles in obtaining an education. At all events, the "opportunity" to work one's way through school still exists, regardless of the merits of the procedure! Moreover, there are today far more student "opportunities" for scholarship and loan assistance than was true just a few years ago. We surely recognize, do we not, that rapidly rising personal incomes are ever more widely distributed among the population and are powerful equalizers of opportunity for higher education? Greater equality of opportunity now exists regardless of the parent's absolute level of income. Last, but by no means least, the Conant report shows clearly there is *no* difference in the quality of secondary education obtained by students attending the "better" schools—that is, those with greater financial resources. One must conclude that the advantage supposedly accruing to the more affluent parent is illusory. A valid summation of educational opportunities is that they are more widespread than ever before; the only "bitter truth" is that for certain people it is "easy" to obtain an education.

For the past 185 years we have had an expanding educational system that makes education increasingly available. Ever more students, in total and on a per capita basis, take advantage of these benefits. Our educational system has evolved with minimal federal aid (3.5 percent of the total financial support of primary and secondary education.) Rather, massive *local* aid to education has made our educational progress possible. I submit that we are quite capable of improving and extending this system without the alleged panacea of federal aid for public school construction and teachers' salaries.

May I suggest that in the future the editors of *Science* editorialize on matters of natural science, not sociology. Readers are more willing to accept your competence here, and your editorials are apt to be valid.

E. H. VAUSE
Charles F. Kettering Foundation, Hinsdale, Illinois

These communications offer many criticisms. In reply, I should like to offer two reasons why the old reliable property tax as a source of funds for schools is of limited use. (i) The distribution of children through the country is not well correlated with the dis-

tribution of valuable property. On a variety of scales, from city versus suburbs to this region of the country versus that region, the children are one place and the money is another. (ii) The property tax is very regressive. According to testimony by the National Education Association in support of federal aid to education, "this tax hits incomes under $2000 almost three times as hard, percentagewise, as it does the incomes of $15,000 and over."

I am not pretending that these arguments are original. As Vause says, the views expressed in the editorial are "widely publicized." I am merely suggesting that these views, if well known, have also been well defended.—J.T.

Satellite Orbits

I. I. Shapiro and H. M. Jones, of the Lincoln Laboratories, and R. W. Parkinson, their collaborator, now at Aeronutronics Inc., have raised the question of priority with respect to the publication of calculations on the effect of radiation pressure on satellite orbits.

I am more than pleased to put on record the fact that our interest in this subject was stimulated by reports of the work of Shapiro, Parkinson, and Jones, which they subsequently published [*Science* **131**, 920 (1960)]. These reports led me to suggest to Peter Musen of our division that he might undertake an investigation of this same problem. As a result of my suggestion Musen developed an independent theory of the effect of radiation pressure on satellite orbits, which he and his collaborators applied shortly thereafter to the orbit of the Vanguard satellite [Musen, Bryant, and Bailie, *Science* **131**, 935 (1960)], demonstrating that the discrepancy between theory and observation for the Vanguard orbit was removed by the allowance for this effect.

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Aims of a Scientists' Association

Theodore C. Kahn's letter of resignation and protest [*Science* **133**, 656 (3 Mar. 1961)] will undoubtedly bring many responses. I think that I am with the majority of members of the AAAS in believing that our association is not

designed for the economic advancement of scientists. I do agree that the economic and social position of physicians is to be envied, but I do not attribute that to the American Medical Association.

The AMA has accomplished a great deal for the science of medicine and for the standards of medical education and medical practice. But I'm amazed that Kahn should wish to have the AAAS emulate the accomplishments of the AMA for the economic and political situation of its members. I thought it was pretty generally agreed that physicians manage their personal relationships very much better than their coordinated public relations. Many of us think that the resourcefulness of AMA is inadequate to the demands of our rapidly changing culture. Understand, I'm not writing about the shortcomings of AMA—of course I wish we physicians knew better what to do. I am only trying to make clear how fatuous is Kahn's expressed desire for a scientists' association that will engineer scientists' success.

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"Xenobiology"

The nominalistic problem of a generic prefix for the sciences concerned with the study of extraterrestrial autocthons had been faced, and elegantly solved, by at least one science-fiction author long before it had become the putatively realistic concern of such august bodies as the National Academy of Sciences–National Research Council. The proper word, as any science-fiction reader should know, for the study of, say, extraterrestrial biology is "xenobiology," not "exobiology." This neoterism was used by Robert Heinlein some 7 years ago. His arguments in favor of it are set forth in the following personal letter.

You are correct in thinking that I used "xenobiology" (and several other words starting with "xeno-" in *The Star Beast* [Scribner's, New York, 1954]. But I am not certain that I coined the term; it is quite possible that I saw it used elsewhere, in fiction or non-fiction, and made use of it.

Of the several "xeno-" words I have used, I did coin "xenic," and this is a most useful adjective for designating *anything* foreign to the planet Earth—cultures, life forms, customs, history, clothing, food, you name it.

I note that Hubertus Strughold uses "astrobiology" in the way in which Lederberg [*Science* **132**, 393 (1960)] uses "exobiology" (and as you and I use "xenobiology"). Try coining a designating adjective from either of these terms: "astral" and "exic" seem to be the obvious ones. "Astral" is not only tainted with occultism, but is off in the wrong direction to start with, as "astron" is a star—and stars are about the least likely places to find life, culture, etc.

"Exobiology" does not suffer from the innate self-contradiction found in "astrobiology" but the prefix "ex-" or "exo-" has its own great shortcomings; it is tired and means too many things. The Merriam unabridged lists some 200 "ex-" words, and among them are many of the commonest words in English. . . . But "xeno-" and "xen-" have only seventy entries *not one* of which is a common word.

I submit that it is more sensible to use this almost-virgin prefix in designating non-terrestrial things, concepts, and fields of study as it will minimize conflicts in meaning, since a neologism constructed with the prefix "xeno-" is extremely unlikely to resemble or duplicate any other word already in existence (I can find only two probables; "xeno-parasite" and "xenolith"—see p. 2963 of the big Merriam).

But the situation is quite different with "ex-" and "exo-"; there are hundreds of probable conflicts with common words; *e.g.*, a major field in "exobiology" is necessarily "exogenetics"—but exogenetic already has an established meaning in biology. A scanning of pp. 887–904 of Merriam will disclose dozens to hundreds of such conflicts.

In my opinion, "xeno-" is the best choice from the standpoint of derivation. But, be that as it may, it is certainly the best of these three in the interest of clarity and exactness.

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I submit that Heinlein has set forth the arguments for "xenic," "xeno-," and "xen-"; let not xenophobia stand in the way of the prompt adoption of these useful, elegant, and unique prefixes for designating the extraterrestrial sciences.

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Exporting Universities

In response to the editorial "Diploma diplomacy" [*Science* **133**, 1557 (19 May 1961)], I wish to second the motion of Arthur F. Burns that universities be exported to those countries that ask for educational aid.

It has been my observation that education in the United States of foreign students brings much dissatisfaction to the individual himself upon his return to his native land. This is due to the fact that facilities which he has become acquainted with in the United States are not available to him in his homeland, and therefore he has little opportunity to teach others what he has learned. With the exporting of a university, the facilities would be established in his own country and would always be available to him, even after graduation.

The exchange of graduate students from foreign countries is healthy and good at the level of the individual, but for real upgrading of a country's education the educational facilities should be built on the students' own soil and the degrees given should include graduate degrees requiring research.

Having been an engineering adviser at Cheng Kung University in Taiwan for two years, I wish to put in a word of caution regarding foreign aid to education. Education does not adapt itself too well to crash programming. At least 10 years are needed, with a tapering-off period of 5 years during which both financial aid and advisory aid are gradually diminished to zero.

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