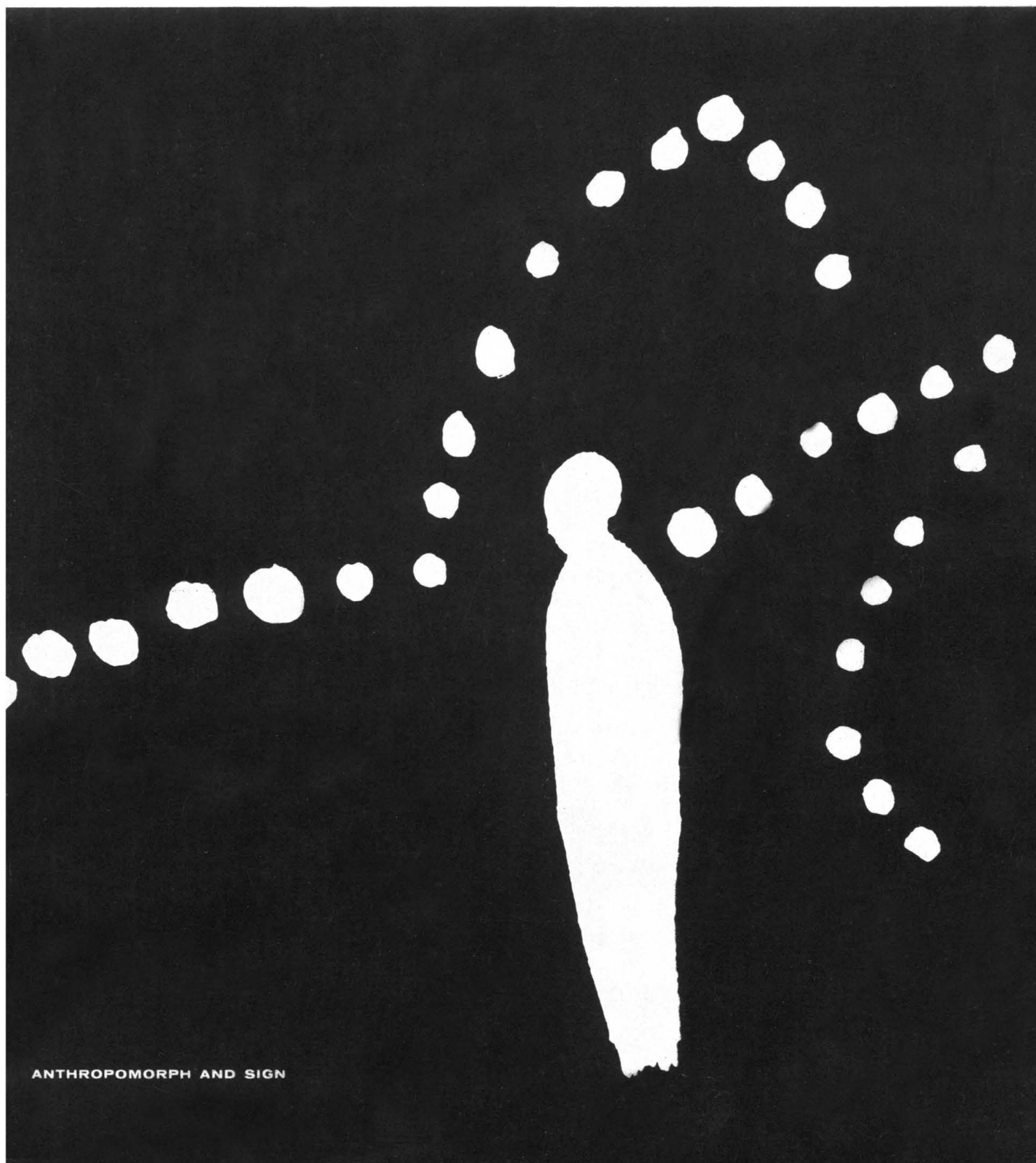


SCIENCE

6 November 1964

Vol. 146, No. 3645

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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Linde Cryobiology NEWS

REPORT NO. 5 FROM UNION CARBIDE CORPORATION, LINDE DIVISION

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

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

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

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

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

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

New Products from LINDE

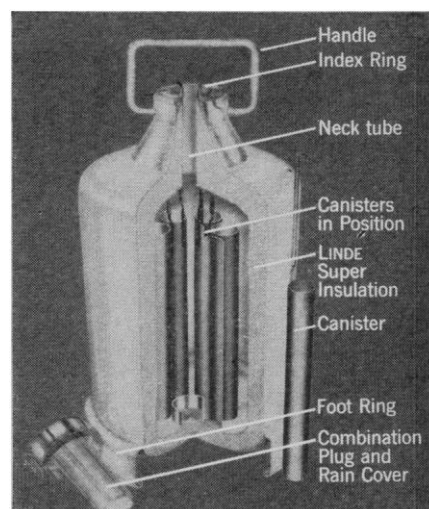
Our new LR-10A-6 portable refrigerator is designed both for economical shipping and small quantity storage of biological specimens. It will hold six canisters with a capacity of 115 cu. in. and has a minimum holding time of 3 weeks at -196°C between refills of liquid nitrogen. Lightweight, rugged, vibration-and-shock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

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

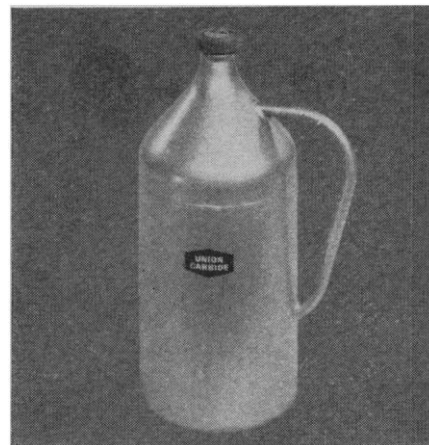
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(1) Sokolski, W. T., Stapert, E. M., Ferrer, E. B., and Hanka, L. J., *Bact. Proc.*, RT4, 1964. (2) Stapert, E. M., Sokolski, W. T., Kaneshiro, W. M., and Cole, R. J., *Bact. Proc.* RT5, 1964. (3) Djerassi, I. and Roy, A., *Blood XXII*, 703-717, 1963.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

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CRYOGENIC PRODUCTS

6 November 1964

Vol. 146, No. 3645

SCIENCE

LETTERS	Prescient: <i>G. P. Rèdei</i> ; The Physician and the Drug Disputes: <i>C. Harris</i> ; Science in Less-Developed Countries: <i>J. B. Calhoun</i> ; Crackpot Scale Applied: <i>H. Schenck, Jr.</i> ; Training in Microbiology: <i>S. G. Bradley</i> ; On Quoting: <i>V. E. Bixenstine</i>	717
EDITORIAL	Conventional versus Nuclear Power	721
ARTICLES	The Pleistocene Epoch in Deep-Sea Sediments: <i>D. B. Ericson, M. Ewing, G. Wollin</i>	723
	Infrared Surveys of Hawaiian Volcanoes: <i>W. A. Fischer et al.</i>	733
	Lunar Notation on Upper Paleolithic Remains: <i>A. Marshack</i>	743
	The Compleat Botanist: <i>A. J. Sharp</i>	745
NEWS AND COMMENT	Nobel Award: British Chemist Honored—The Midwest: Peace and a New Organization for Argonne—Communications Satellite Corporation II: Domestic Entanglements	748
	<i>Report from Europe</i> : Large New Telescopes for the Southern Hemisphere: <i>V. K. McElheny</i>	755
BOOK REVIEWS	<i>Isotopic and Cosmic Chemistry</i> , reviewed by <i>H. Faul</i> ; other reviews by <i>J. Weber</i> , <i>E. N. Kozloff</i> , <i>R. Johnsen</i> , <i>G. M. Brown</i> , <i>M. A. Paul</i> , <i>M. D. Kamen</i>	758
REPORTS	Air Concentrations of Twelve Radionuclides from 1962 through Mid-1964: <i>R. W. Perkins, J. M. Nielsen, C. W. Thomas</i>	762
	Component Shapes in Double Radio Sources: <i>A. T. Moffet</i>	764
	Tremorine: Its Peripheral Action on Striated Muscle: <i>B. Csillik</i>	765
	Protein Synthesis Enhanced in the Liver of Rats Force-Fed a Threonine-Devoid Diet: <i>H. Sidransky, T. Staehelin, E. Verney</i>	766
	Fully Deuterated <i>Euglena gracilis</i> : <i>S. E. Mandeville, H. L. Crespi, J. J. Katz</i>	769
	Autonomic Mediation of the Effect of Raised Arterial Glucose upon Free Fatty Acids: <i>C. J. Goodner and W. A. Tustison</i>	770
	Streptomycinoid Antibiotics: Synergism by Puromycin: <i>J. R. White and H. L. White</i>	772
	Transferrin: Variations in Blood Serum of Red Howler Monkeys: <i>M. A. Schön and T. Arends</i>	774

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Fructose-1,6-diphosphate Requirement of Streptococcal Lactic Dehydrogenases: <i>M. J. Wolin</i>	775
<i>Neurospora</i> β -Galactosidase: Evidence for a Second Enzyme: <i>W. K. Bates and D. O. Woodward</i>	777
Polyoma Virus: Production in <i>Bacillus subtilis</i> : <i>K. E. Bayreuther and W. R. Romig</i> ..	778
Delayed Appearance of Labeled Protein in Isolated Nerve Endings and Axoplasmic Flow: <i>S. H. Barondes</i>	779
Staphylytic Enzyme from <i>Chalaropsis</i> : Mechanism of Action: <i>D. J. Tipper, J. L. Strominger, J.-M. Ghuysen</i>	781
Uric Acid in the Reproductive System of Males of the Cockroach <i>Blattella germanica</i> : <i>L. M. Roth and G. P. Dateo, Jr.</i>	782
Reptilian Thermoregulation: Evaluation of Field Studies: <i>J. E. Heath</i>	784
Homocystinuria due to Cystathionine Synthetase Deficiency: The Mode of Inheritance: <i>J. D. Finkelstein et al.</i>	785
Physical Interaction of a Murine Leukemia Virus with Influenza Virus in vitro: <i>T. E. O'Connor and F. J. Rauscher</i>	787
Spalled, Aerodynamically Modified Moldavite from Slavice, Moravia, Czechoslovakia: <i>E. C. T. Chao</i>	790
β -Galactosidase: Inactivation of Its Messenger RNA by Ultraviolet Irradiation: <i>P. A. Swenson and R. B. Setlow</i>	791
Actinomycin and Puromycin: Effects on Sequential Gene Activation by Ecdysone: <i>U. Clever</i>	794
Dialysis of Sleep and Waking Factors in Blood of the Rabbit: <i>M. Monnier and L. Hösli</i>	796
Attitude Statements as Positive and Negative Reinforcements: <i>C. Golightly and D. Byrne</i>	798
Visual Function of the Forebrain Commissures in the Chimpanzee: <i>P. Black and R. E. Myers</i>	799
<i>Comments on Reports: Stereopsis Suppression: Addendum: J. Hochberg</i>	800
ASSOCIATION AFFAIRS The Social Nature of Man	801
MEETINGS Evolution of Galaxies: <i>T. Page</i> ; High-Energy Physics: <i>G. Snow</i> ; Forthcoming Events	804
DEPARTMENTS New Products	833

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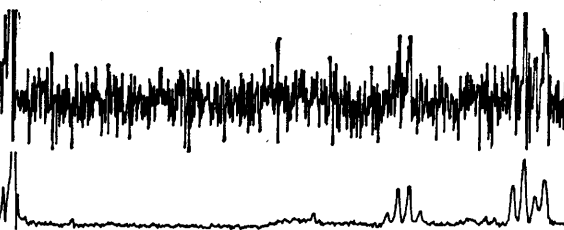
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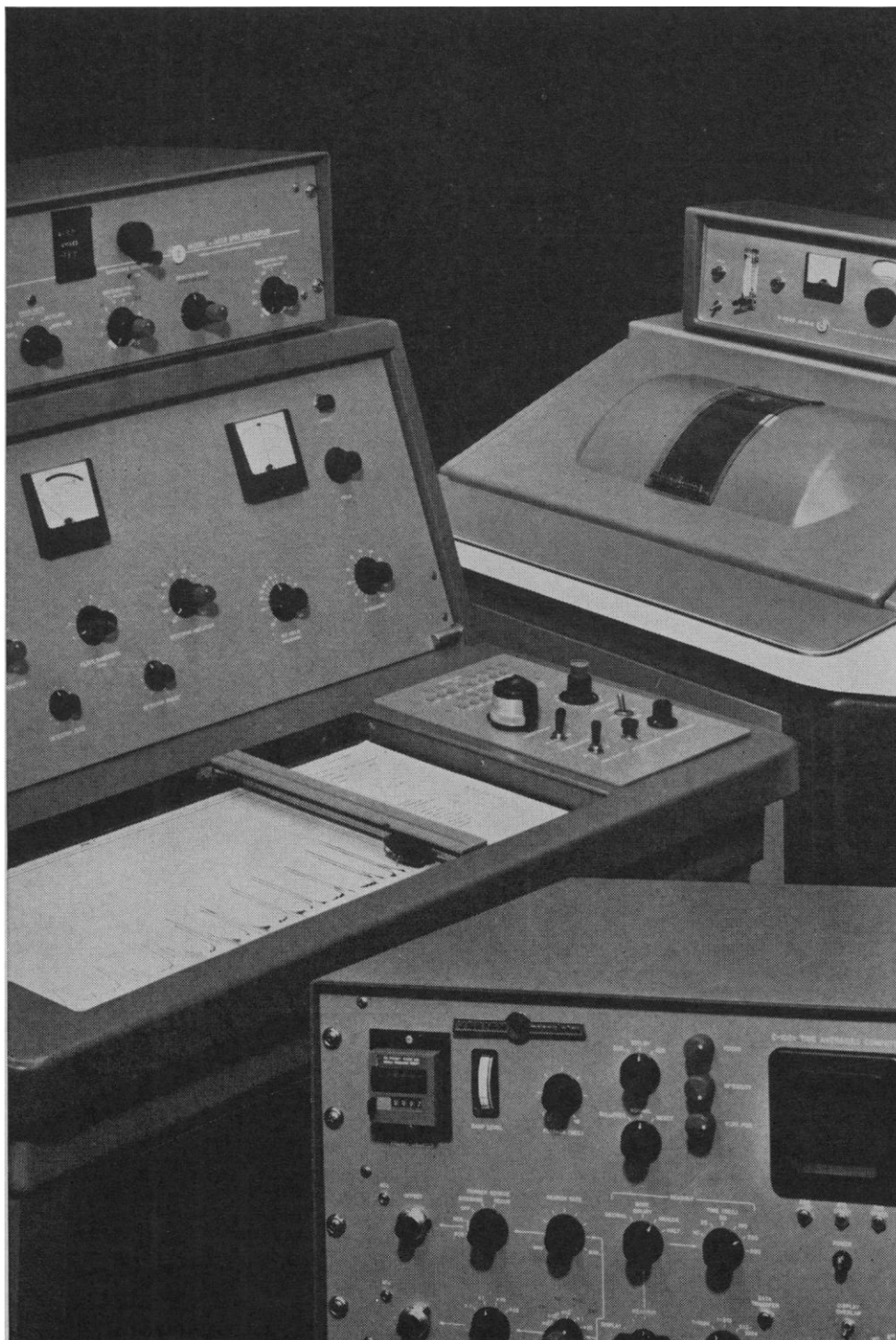
Red-painted figure on rock wall at Abri de las Veñas in southwestern Spain (Badajoz). The date of the composition is uncertain but it is thought to be post-Ice Age Mesolithic and related to the art and "signs" of the Ice Age Magdalenian. Spanish rock art varies widely in complexity, style, meaning, and chronology. This composition has been analyzed as lunar. See page 743. [From Henri Breuil, courtesy Trianon Press, Paris, France]

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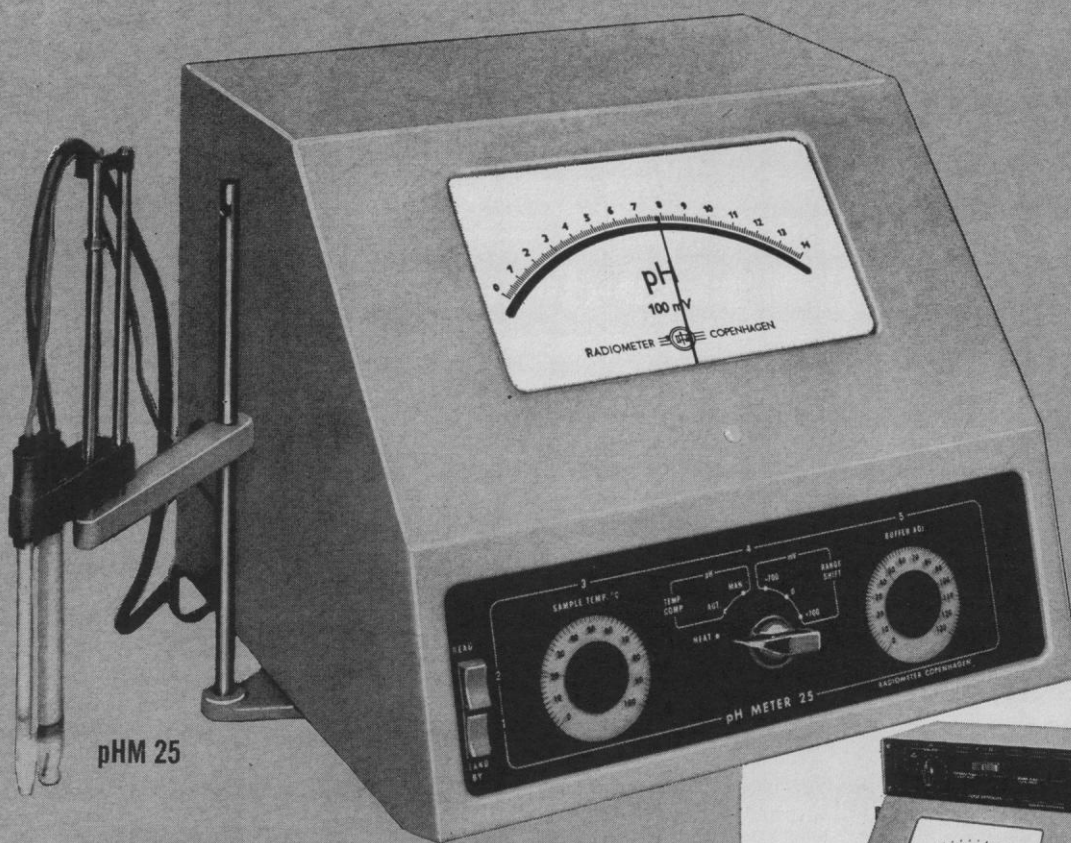


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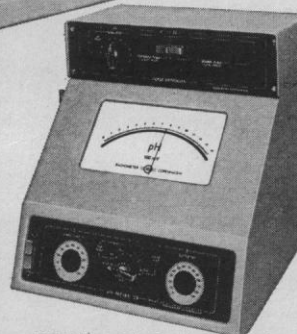
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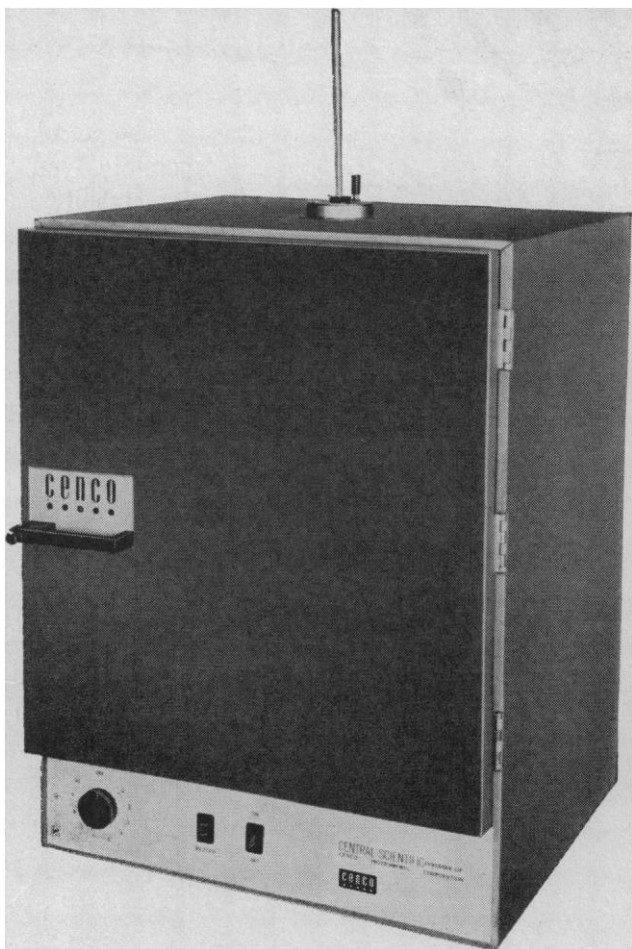


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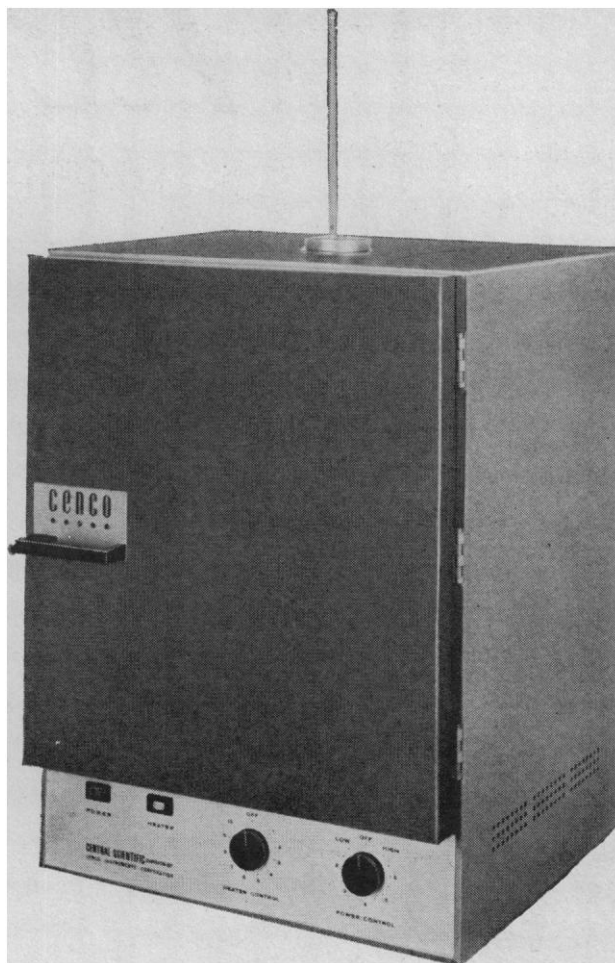
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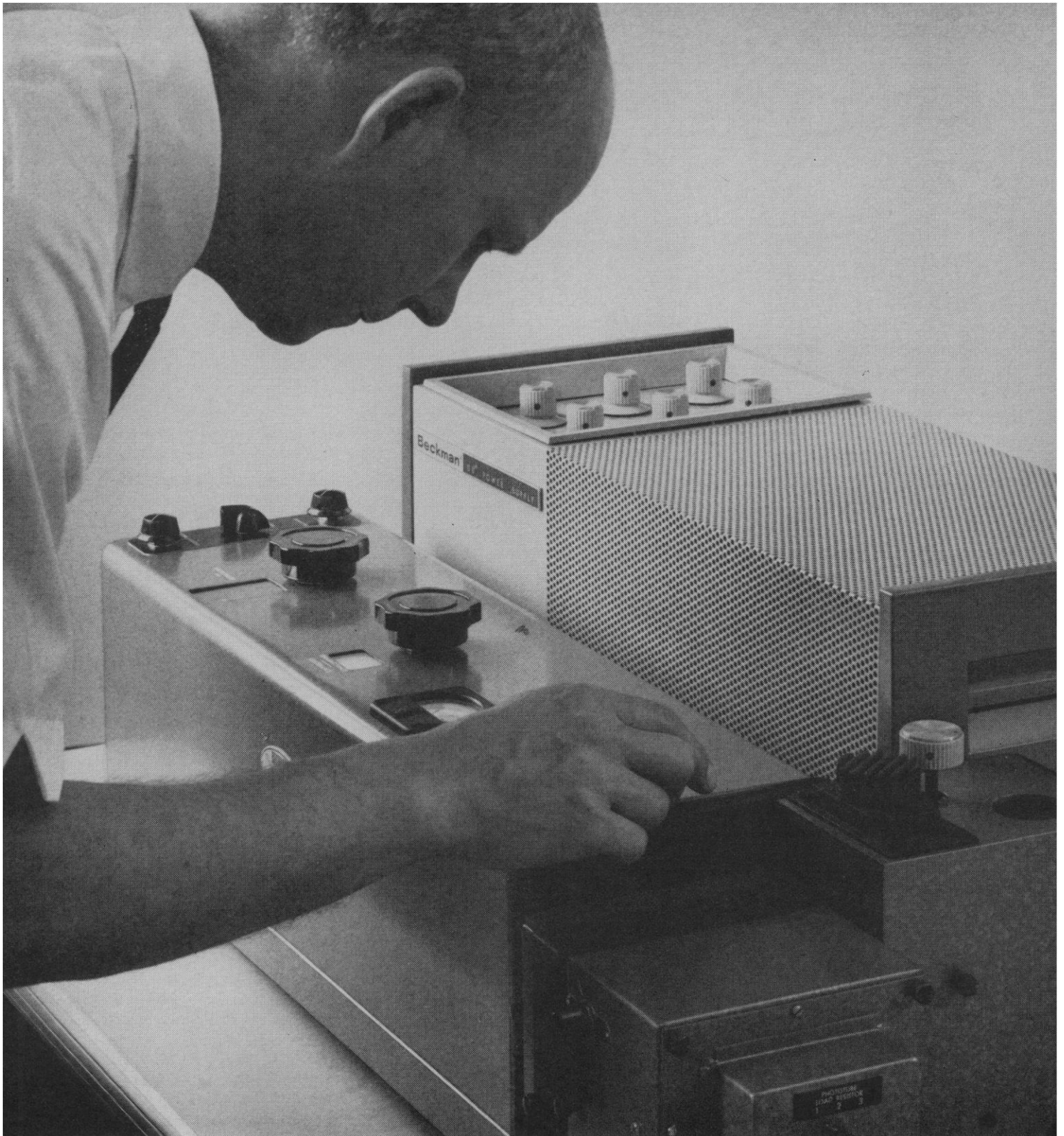
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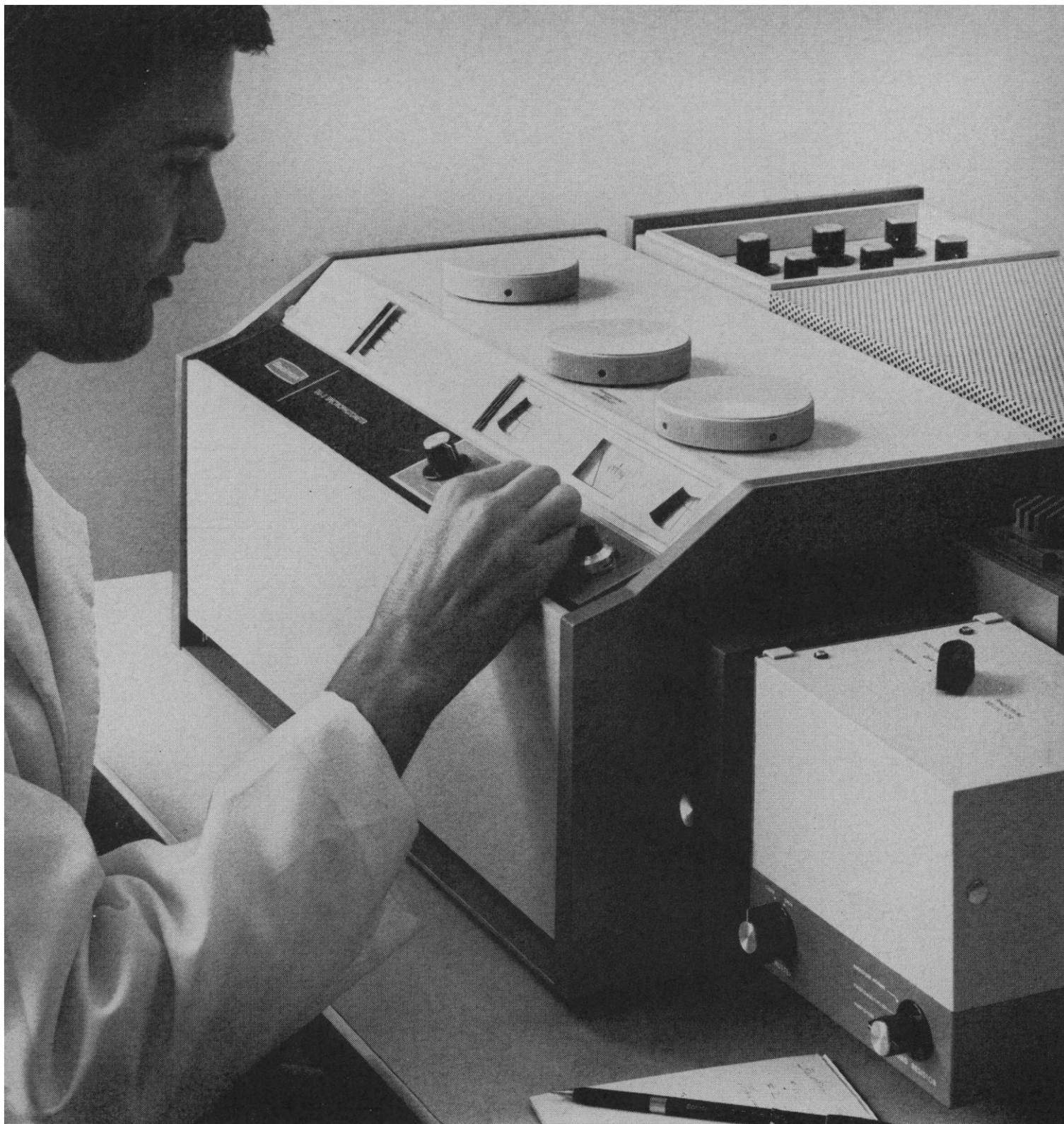
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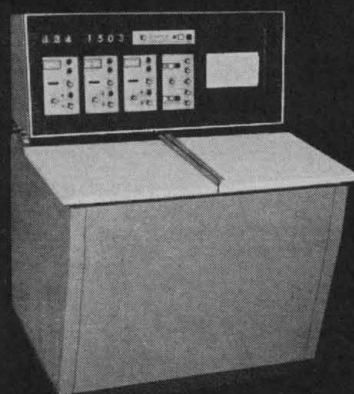
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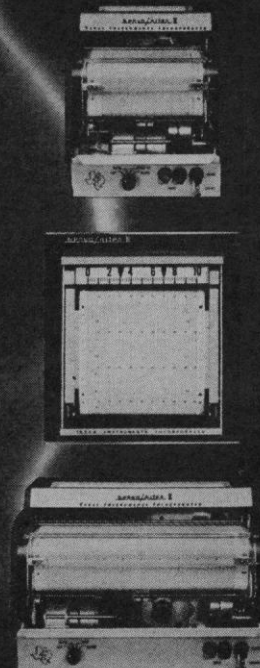
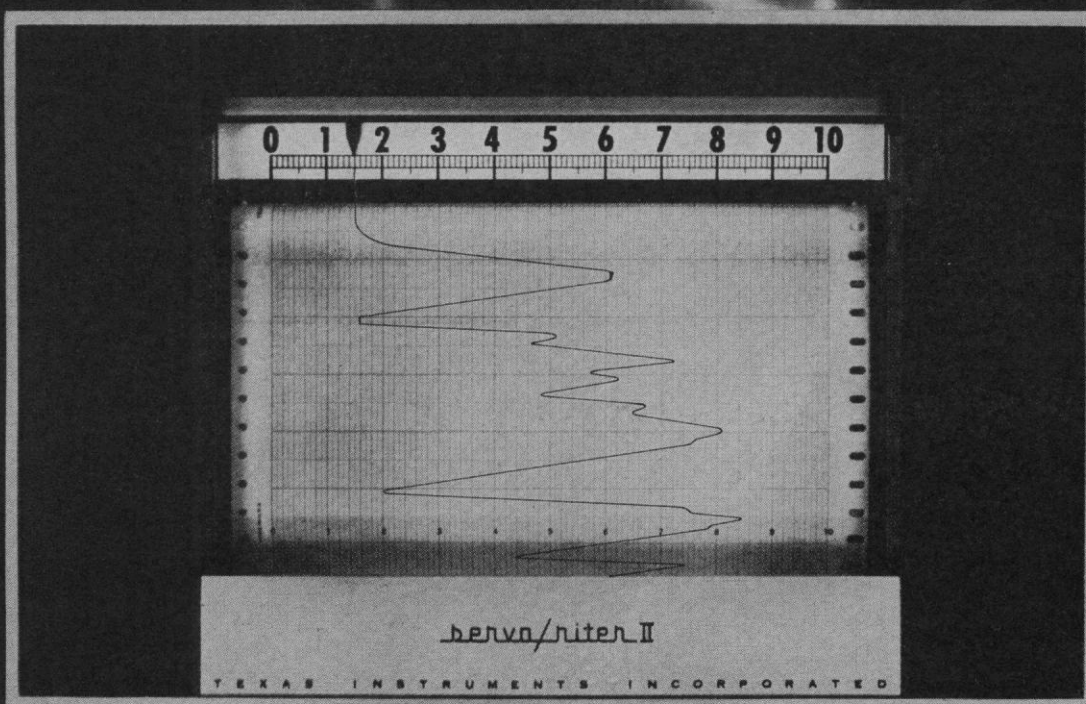
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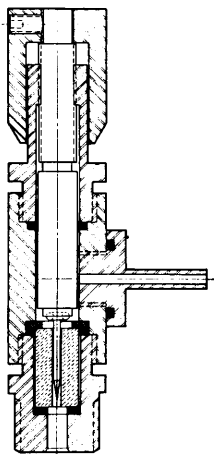
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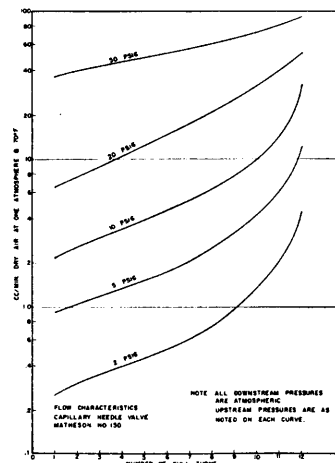
The Lab-Stat is a proportional controller, free from the cycling experienced with standard thermostats and on-off controllers. It has a transistorized circuit, stabilized against supply voltage fluctuation and ambient temperature changes. The Lab-Stat can also be used as an on-off controller, or a high limit shut off. Applications: 1. Unattended control of temperature for distillations, heat up for melting point determinations, control of reaction temperatures and general heating and cooling. 2. Control of vacuum for vacuum distillation, vacuum drying or any vacuum system. 3. Control of reaction feed streams by control of system pressure, or liquid level. For full information, send for our 4 page bulletin.



2. New Micro-Flow Control Valve

A unique valve. This valve is free from the type of flow surges that usually accompany the use of standard needle valves. Accurate flow settings can be reproduced with little or no flow hysteresis. See the accompanying graph showing flow vs. turns of the handwheel.

Our new valve works by combining a precision bore glass capillary and a closely-fitting, precision-ground stainless steel rod. Thus, laminar flow through a capillary annulus is achieved. At a pressure differential of 1 p.s.i., a minimum flow as low as 10 cc/hr. of air can be controlled. The end of the precision rod is a needle point so that the valve can also be used as a conventional needle valve over the last few turns. Maximum use temperature is 100°C.; it is suitable for pressures up to 2000 p.s.i.g. This valve is equipped with a 1/4" NPT inlet and 1/4" tubing outlet. Available in brass or stainless steel, this valve is recommended for use in mass spectrometry, gas chromatography and high vacuum systems or wherever low flows must be accurately controlled and reproduced. Full information and prices can be obtained from our bulletin. Send for a copy.



3. New Low Flow Flowmeter

This is an accurately machined rotameter style flowmeter capable of metering low flows never before capable of accurate measurement with this style of flowmeter. This high precision permits accurate coverage of a large flow range.

Air: 0.33 to 100.00 cc/minute

Water: 0.003 to 1.4 cc/minute

All meters separately calibrated for air and water and provided with individual calibration curves. This flowmeter is ideal for highly corrosive gases as well as for the more common gases.

A data sheet describing how this rotameter can be used and more about its construction and price is available from us. Use the coupon below.

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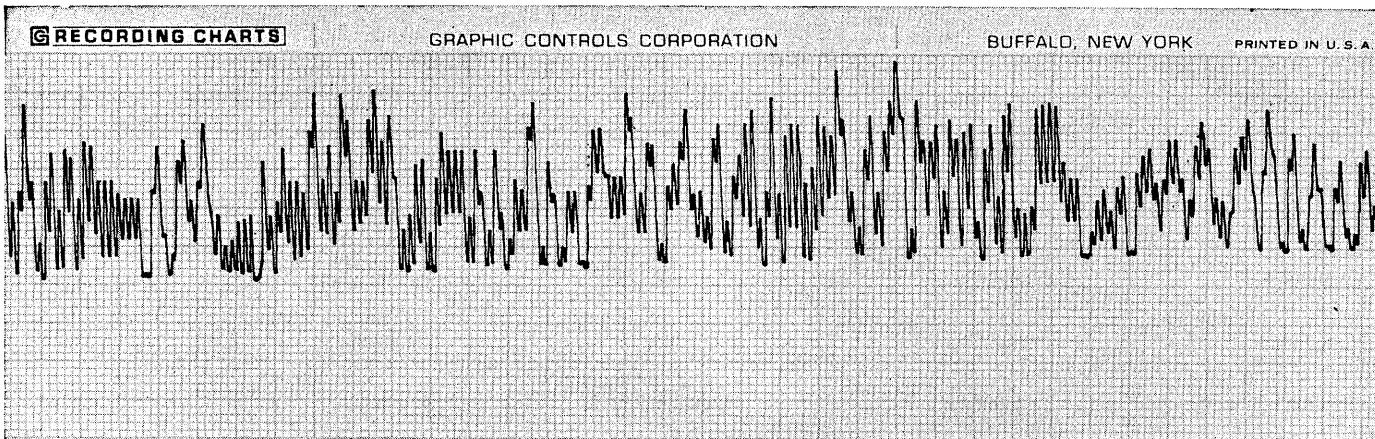
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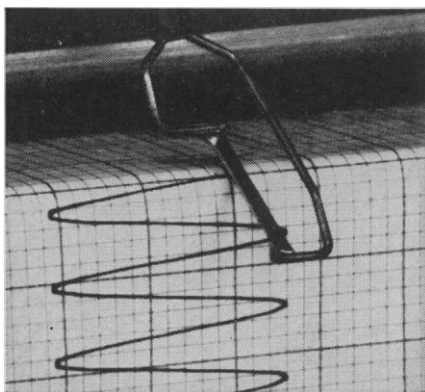
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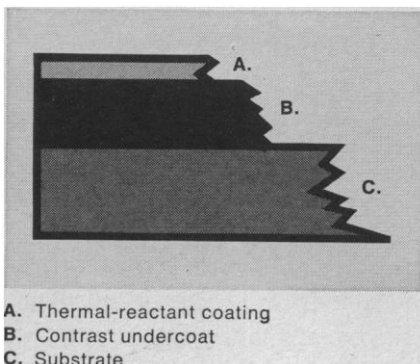


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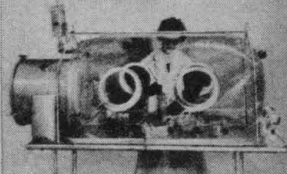
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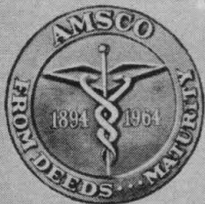
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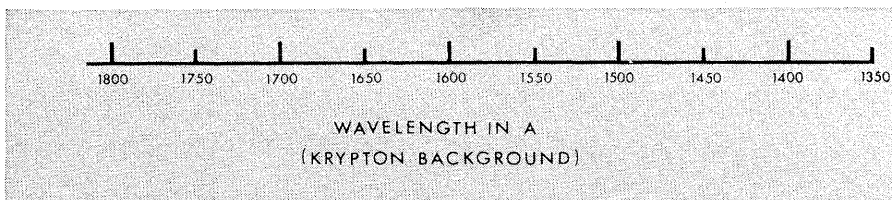
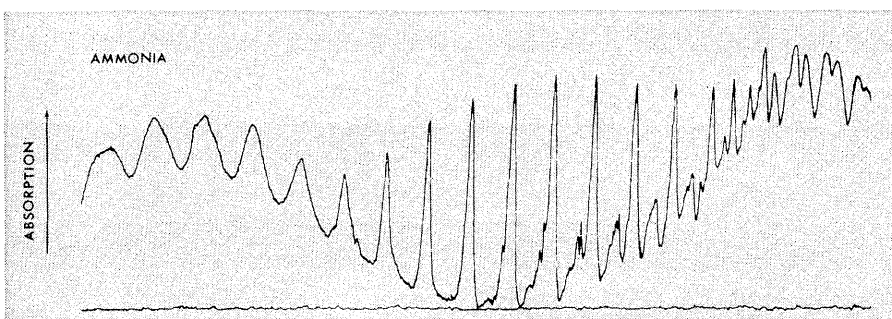
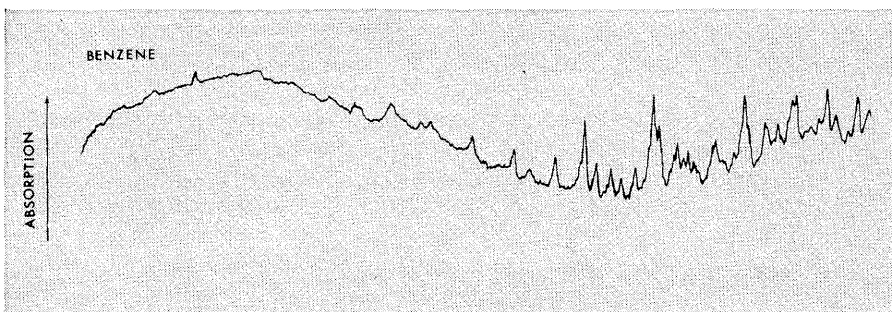
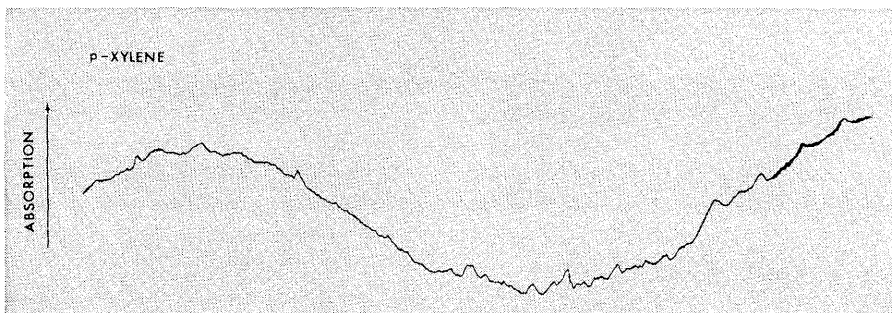
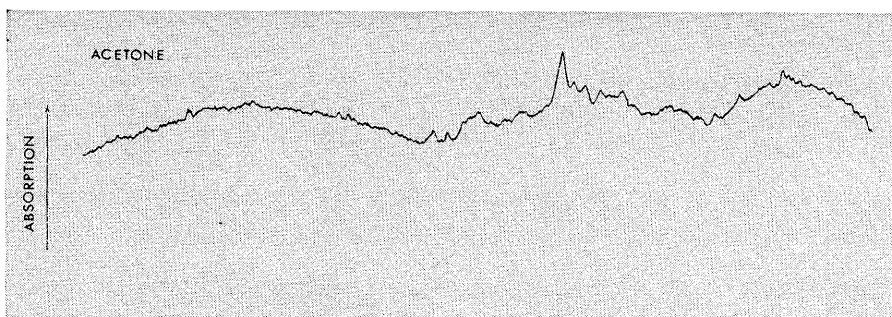
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When will it wear out?

Most things we know about—and this includes biological systems—begin to wear out as soon as they go into service. Survival rates do not follow a Gaussian distribution. Life is not symmetrical. For the person concerned with reliability, the problem is to find a realistic mathematical representation of the wear-out phase of components.

In a break from classical reliability statistics, GM Research mathematicians were among the first to use the relatively little known Weibull distribution function . . . a remarkable generalized way of handling skewed distributions by one family of straight lines. To demonstrate its appropriateness, they've developed a number of easy-to-use graphical techniques for planning and interpreting life tests, fatigue experiments, and even incomplete field service data. Among their pioneering contributions:

A new method using median ranks for graphically describing experimental main effects and interactions;

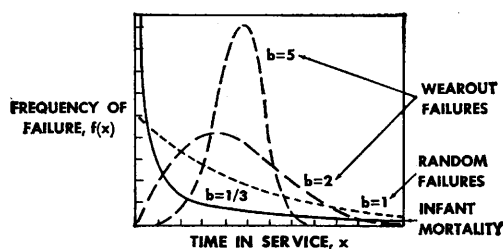
New ways of slashing test times and optimizing experimental designs;

A new method (theory of suspended items) for analyzing endurance data in which some items have failed and some are still running.

Now an accepted standard in the bearing industry, their graphic Weibull techniques have filled numerous papers and two books now on press. It's one of the ways GM researchers and engineers are working to bring improved reliability to both space and earth-bound hardware.

General Motors Research Laboratories

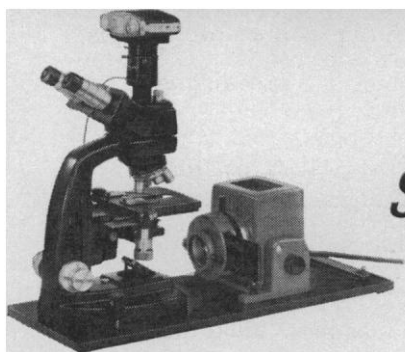
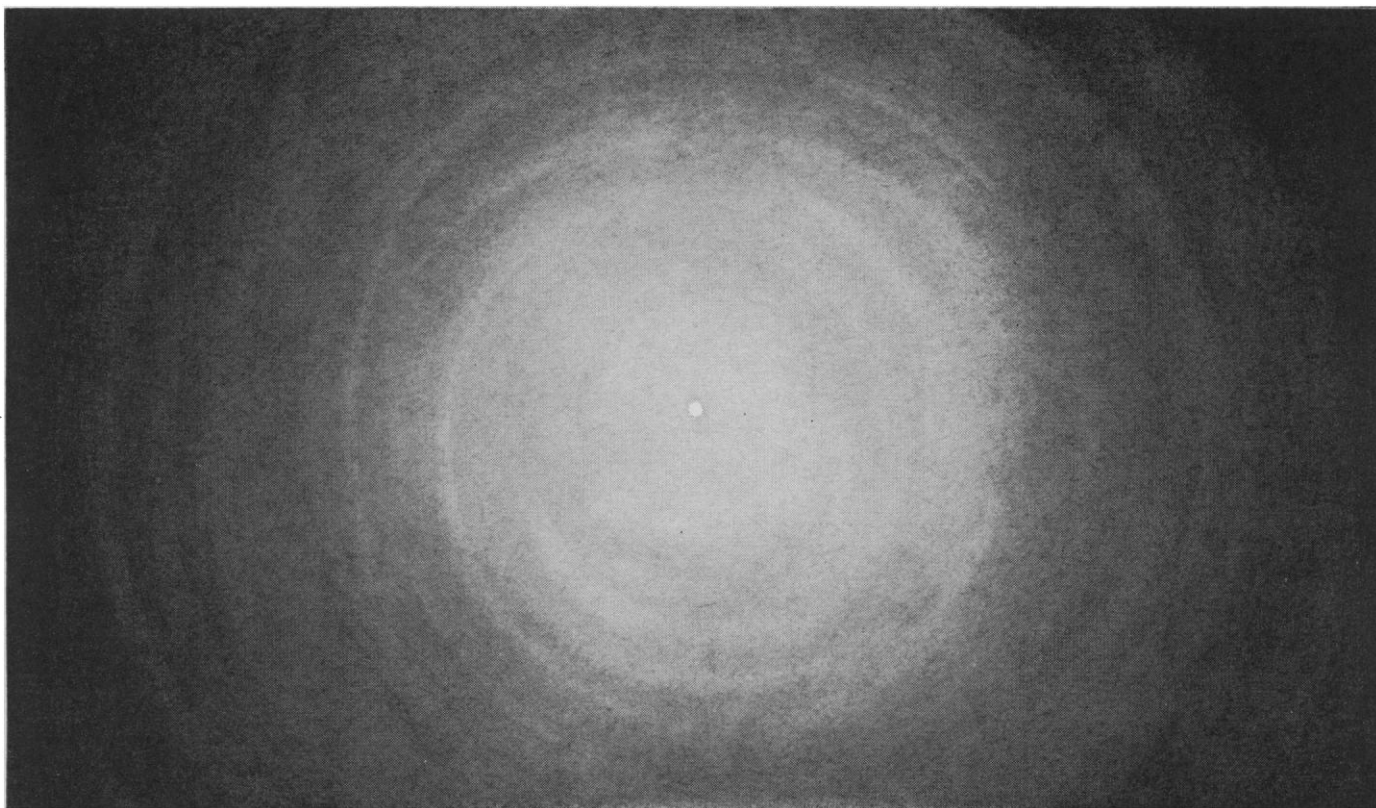
Warren, Michigan



Varying one parameter (b) in the Weibull distribution function allows the characterization of many types of reliability phenomena.

BAUSCH & LOMB

(on the light side)

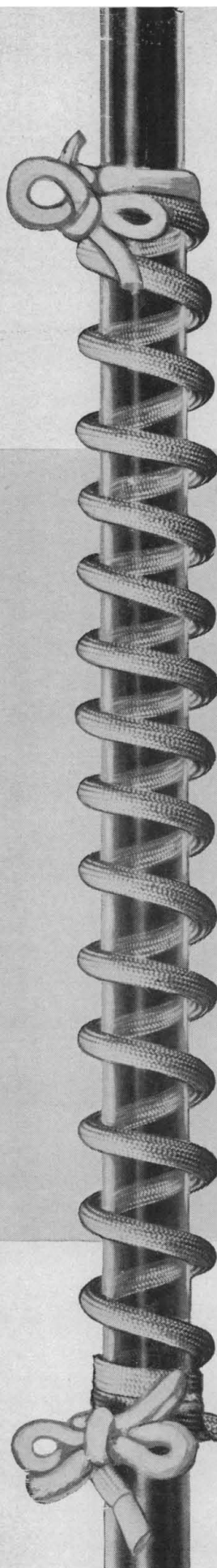


Six different kinds of light, that is.

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High temperature in a hurry with CAL-CORD* for the lab

Just wrap it and plug it in...

This reliable, cord-type heating unit was developed specifically for laboratory work. Easy-to-use Cal-Cord is as flexible as an appliance cord. Delivers uniform temperatures up to fabric limits of 400°C for glass fabric, or 600°C for quartz fabric. Paralleled ribbon-type heating elements terminate at one end into a single twistlock connection for joining to supply cord. No troublesome, unsafe loose terminals on the ends. Cal-Cord comes complete with power supply cord and plug. Eight new sizes now available.

Cal-Cord Specifications

400°C Medium Cal-Cord Made of glass fabric material	Cat. No.	Length	Wattage	Price
	C-C 2	2 ft.	80W, 115V	\$ 6.50
	C-C 3	3 ft.	120W, 115V	9.00
	C-C 4	4 ft.	160W, 115V	11.00
	C-C 6	6 ft.	240W, 115V	15.00
	C-C 8	8 ft.	340W, 115V	19.00
	C-C 10	10 ft.	400W, 120V	23.00
	C-C 12	12 ft.	480W, 220V	27.00
	C-C 14	14 ft.	560W, 220V	31.00
600°C Super Cal-Cord Made of quartz fabric material	C-C 16	16 ft.	640W, 220V	35.00
	Cat. No.	Length	Wattage	Price
	SC-C 2	2 ft.	200W, 115V	\$ 8.00
	SC-C 3	3 ft.	300W, 115V	13.75
	SC-C 4	4 ft.	400W, 115V	16.75
	SC-C 6	6 ft.	600W, 230V	19.50
	SC-C 8	8 ft.	800W, 230V	25.50

Cal-Cord Temperature Control

Thermolyne Stepless Type 800 temperature controller is ideally suited for use with any Cal-Cord. Specifications: 1500W, 115V; maximum amps, 13. Price \$15.75.



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ADVANCE in the assault on the protein molecule...



*new automated technic provides rapid preparative and quantitative information on peptides
... their size, occurrence and distribution ... and assures detection.*

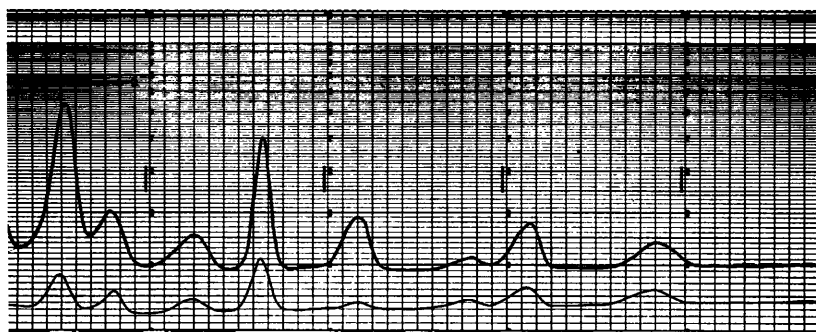
The Technicon AutoAnalyzer system you see above may well make history in protein research. By an ingenious extension of multiple-analysis chromatography, it not only separates peptides for preparative purposes, but at the same time gives quantitative information.

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In doing this, the system takes up where paper chromatography, electrophoresis and UV monitoring leave off. These methods are generally adequate enough for limited qualitative findings only.

The Technicon® peptide system is automated from beginning to end with thoroughgoing AutoAnalyzer efficiency, rapidity, and reliability. This versatile AutoAnalyzer reduces to *hours* the *days* now conscripted to the tedious task of peptide analysis.



Section of a chromatogram showing tryptic hydrolyzate of performic acid oxidized bovine pancreatic Ribonuclease before and after alkaline hydrolysis.



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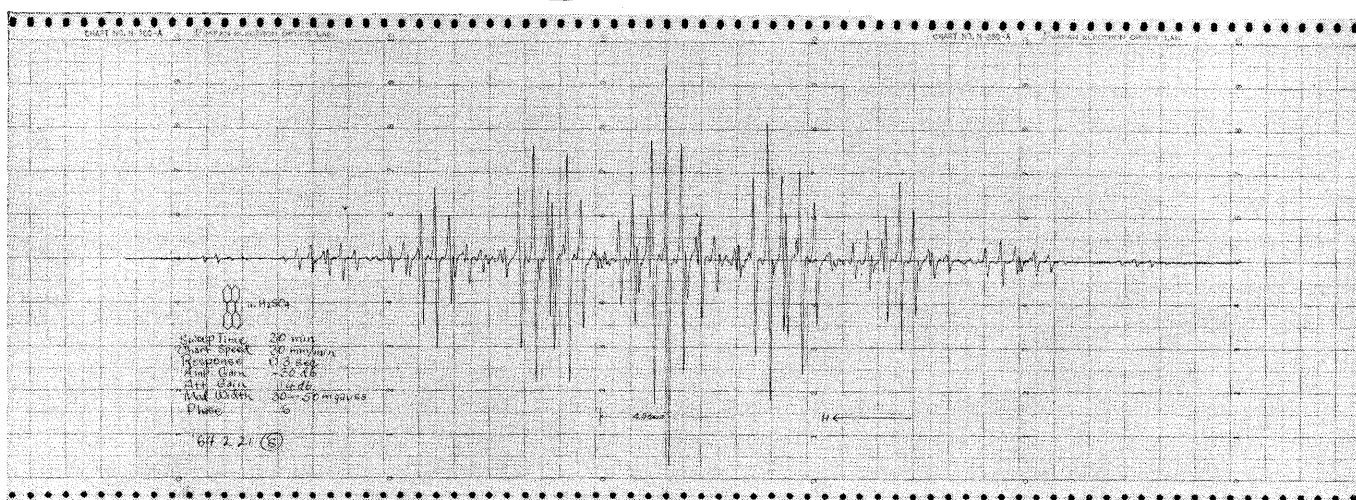
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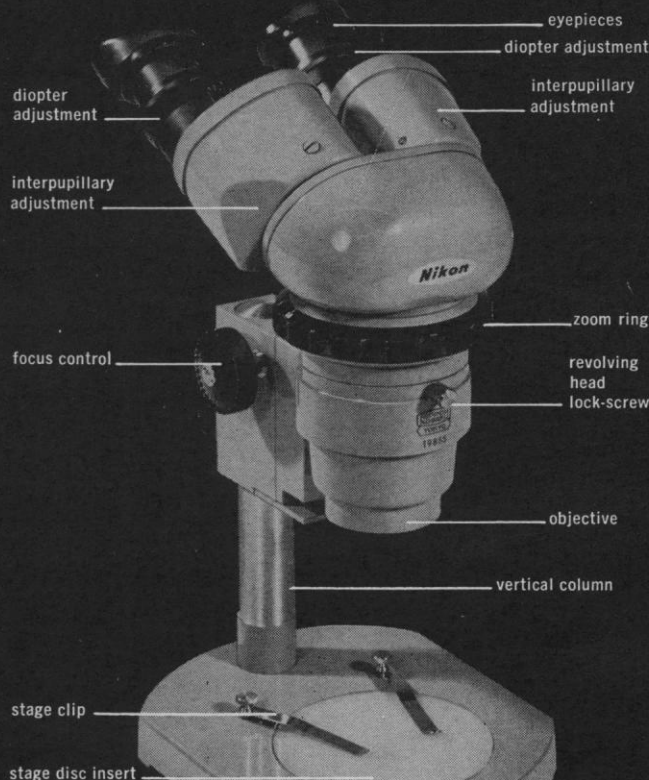
ESR spectrum of perylene positive ion in sulphuric acid showing highly resolved hyperfine structure due to interaction with proton spins.

SENSITIVITIES TO 1×10^{11} SPINS/GAUSS, RESOLUTION 1×10^{-5}

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NIKON SMZ STEREOSCOPIC ZOOM MICROSCOPE



matched 0.8x to 4x zoom objectives provide wide magnification range with precise parfocality

The Nikon SMZ is equipped with matched 5-to-1 zoom objectives. Used with a pair of 10x oculars it provides a continuously variable range of magnifications from 8x to 40x without any change in focus or working distance. Magnification ranges from 4x to 120x are also obtainable with other eyepieces and by adding supplementary meniscus objective lenses. The following table gives complete details:

OBJECTIVES	SUPPLEMENTARY OBJECTIVE LENSES	EYEPIECES						WORKING DISTANCE
		10X		15X		20X		
		mag.	field dia.	mag.	field dia.	mag.	field dia.	
0.8X to 4X zoom	none	8X to 40X	29.7mm to 5.6mm 1.17 in. to .22 in.	12X to 60X	15.3mm to 2.9mm .60 in. to .11 in.	16X to 80X	14.2mm to 2.7mm .56 in. to .11 in.	77.5mm 3.05 in.
	0.5X	4X to 20X	45.5mm to 9.4mm 1.79 in. to .37 in.	6X to 30X	24.8mm to 5.1mm .98 in. to .2 in.	8X to 40X	22.2mm to 4.5mm .87 in. to .18 in.	103mm 4.06 in.
	0.7X	5.6X to 28X	38.0mm to 7.3mm 1.50 in. to .29 in.	8.4X to 42X	19.8mm to 3.9mm .78 in. to .15 in.	11.2X to 56X	18.2mm to 3.5mm .72 in. to .14 in.	95.5mm 3.76 in.
	1.5X	12X to 60X	21.0mm to 4.1mm .83 in. to .16 in.	18X to 90X	11.0mm to 2.1mm .43 in. to .08 in.	24X to 120X	9.0mm to 1.8mm .35 in. to .07 in.	45mm 1.77 in.

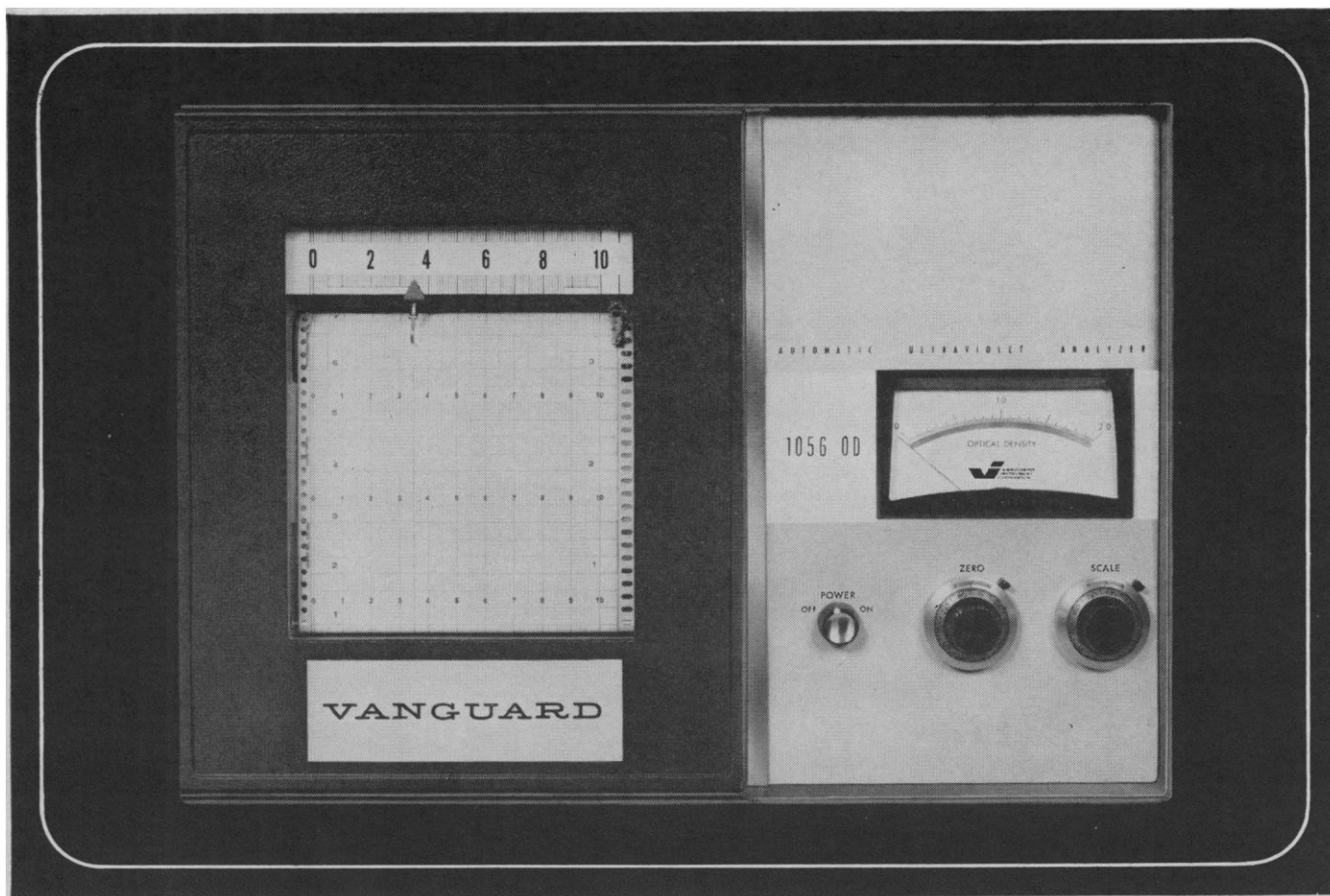
One of the advantages of the SMZ is the precise in-focus tracking of the right and left images over the entire zoom range. This is due to meticulously

matched optics, and to the fact that the eyepiece tubes are both adjustable for dioptric power. There is a distinct sense of visual ease and comfort even with prolonged use.

Equally evident is the pronounced 3-dimensional effect, brightness of field, and almost incredible image definition. These, too, are traceable to the quality of the optics, their precise collimation and alignment, and to the use of high quality, coated prisms rather than mirrors. In fact, all glass-to-air optical surfaces are anti-reflection hard-coated for increased light transmission and reduced glare.

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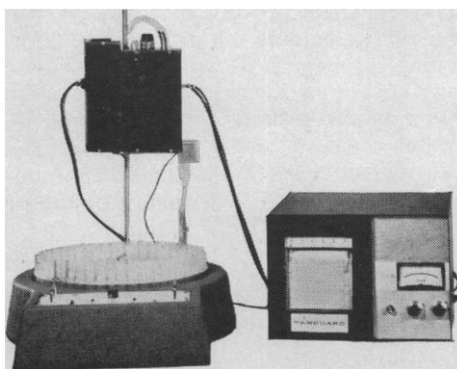
new automatic optical density ultra-violet analyzer

Vanguard Model 1056-OD Automatic Ultra-Violet Analyzer provides the investigator with unequaled reliability and versatility. Through the use of two independent logarithmic converters, this instrument provides a chart recording of the optical density of the effluent from a chromatographic column—the ordinate of which is linear with optical density. In addition, a plain diffraction grating monochromator enables the operator to select any wave length from 200 millimicrons into the visible spectrum.

■ Dual beam operation utilizing sample and reference cuvettes provides continuous base line

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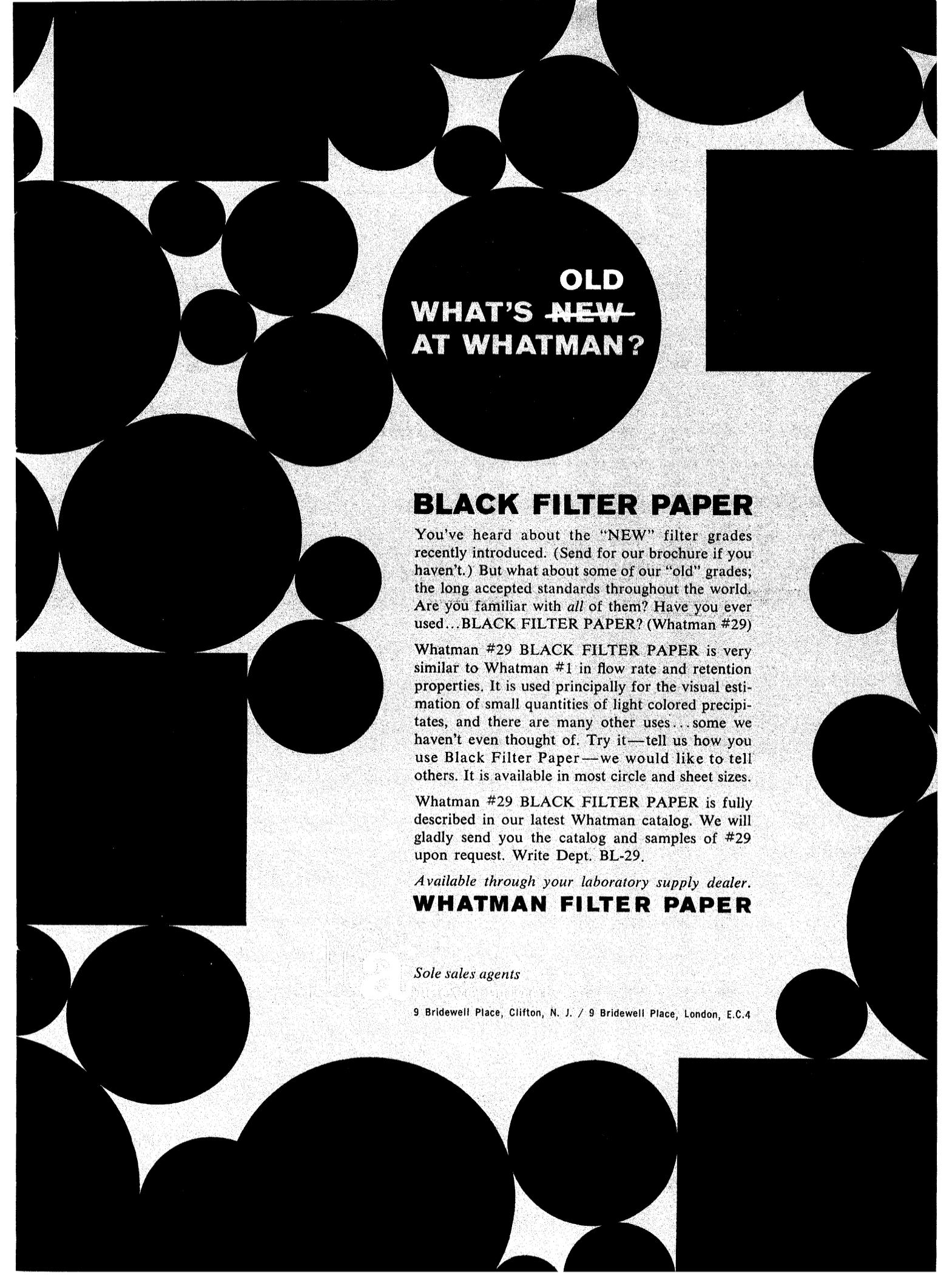
For complete specifications on the Model 1056-OD Automatic Ultra-Violet Analyzer, send for new informative literature. For immediate information, call or write to the address below.



Model 1056-OD Automatic Ultra-Violet Analyzer shown with Model 1000 Fraction Collector. Model 1056-OD is compatible with all Fraction Collectors.



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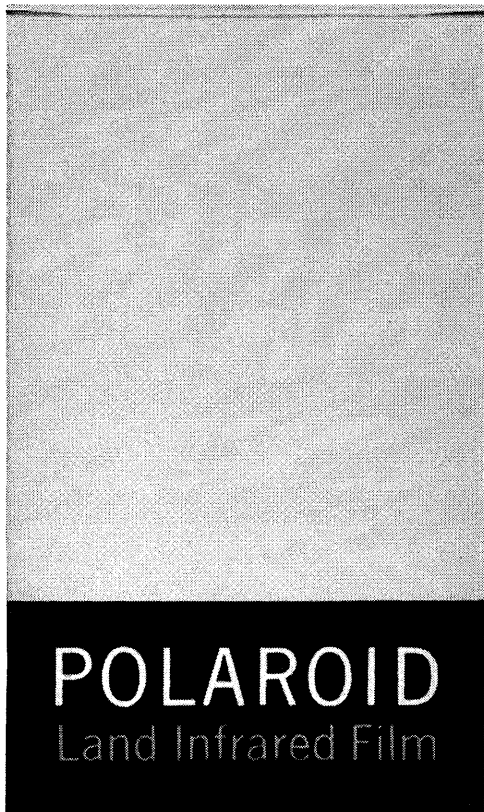
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Polaroid announces infrared film.

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You may know we've been field testing it for the past several months. Well, we're ready with it now. And it's available in unlimited quantity.

It's called Polaroid Type 413 Land Infrared Film. Its sensitivity to radiation extends from the visible region of the spectrum to beyond 9000 Å in the infrared, peaking at about 8400 Å. It is a high-contrast material. H & D reflection gamma is 2.1. It comes as a roll film with 8 exposures to the roll. It fits all standard Polaroid Land cameras and camera backs using series 40 film (except the J-66). And it's as easy to use as any other Polaroid Land film.

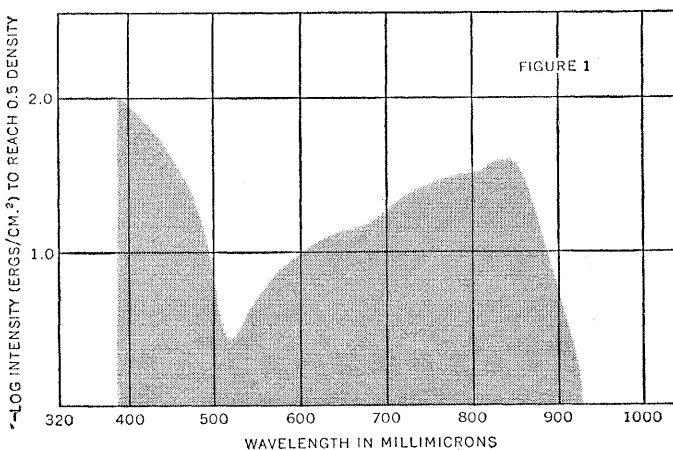
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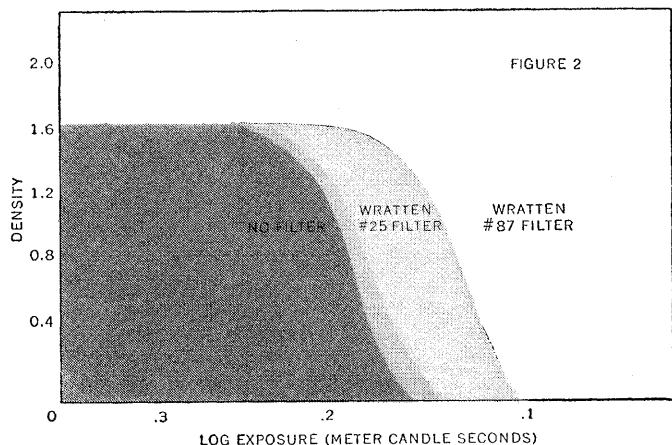
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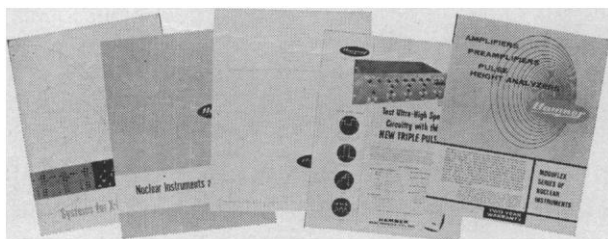
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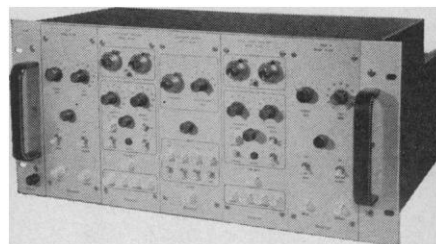
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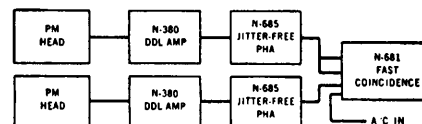


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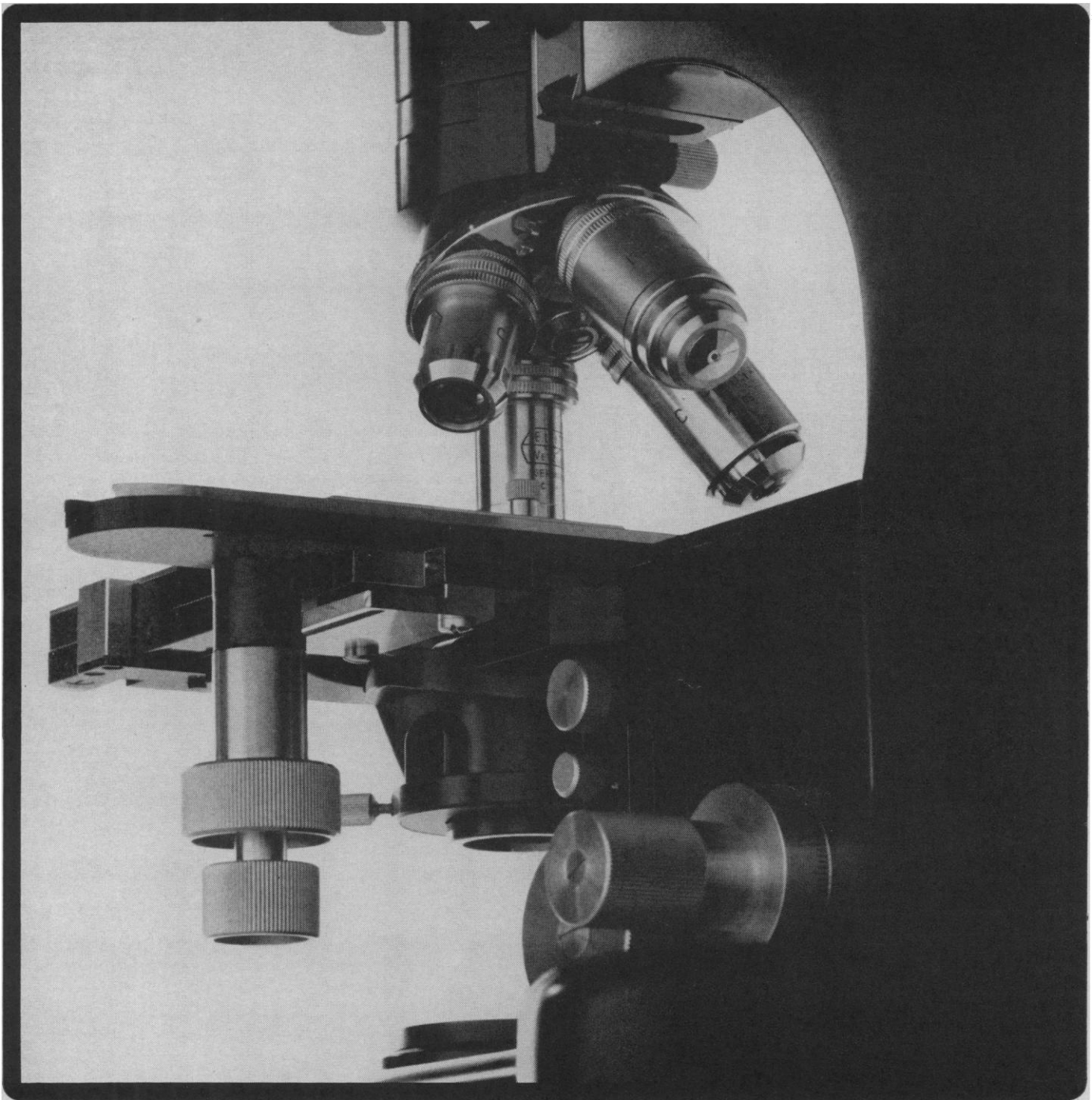
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Conventional versus Nuclear Power

The intense economic competition presently existing between conventional and nuclear power is bringing benefits to this nation on a scale that in the next decade may exceed a billion dollars a year. The pace of technological advance in power generation has been especially fast during the past 2 years. In this period the cost of generating nuclear power has been cut drastically and the cost of producing conventional power has also diminished.

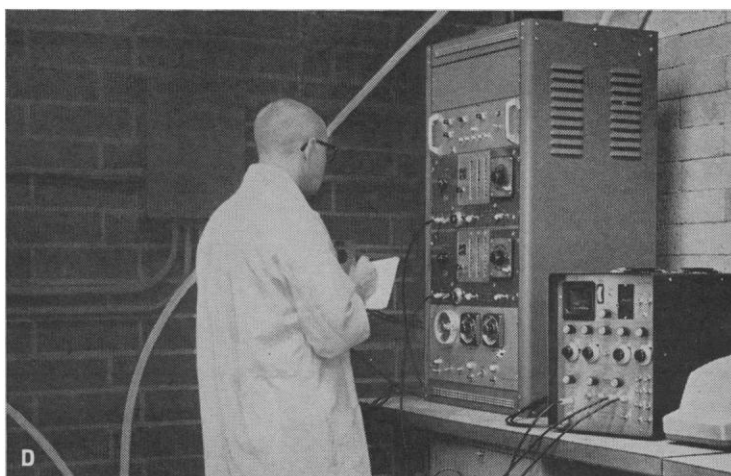
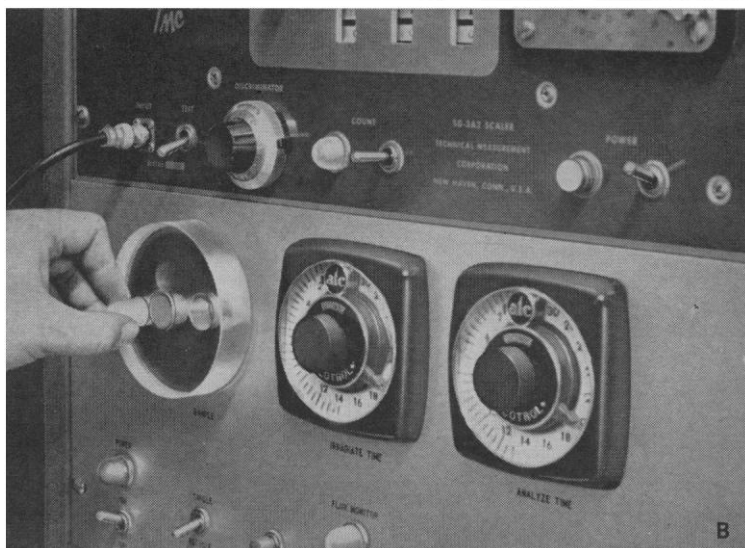
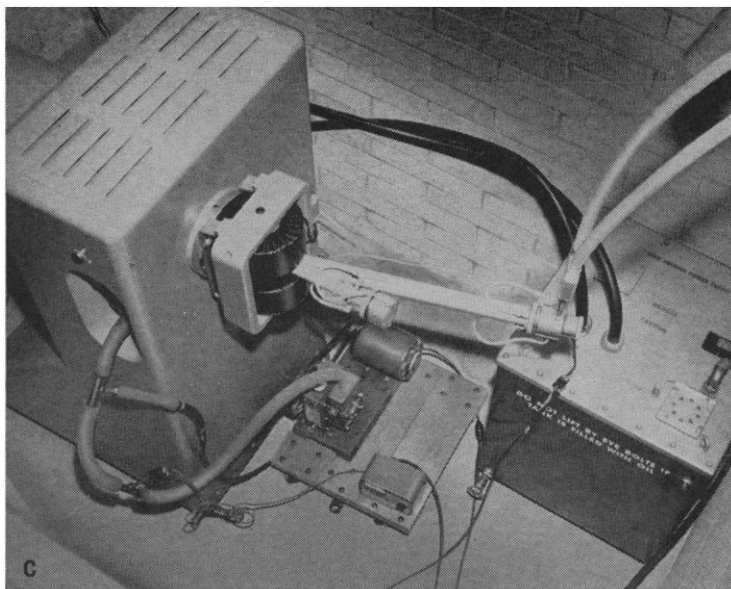
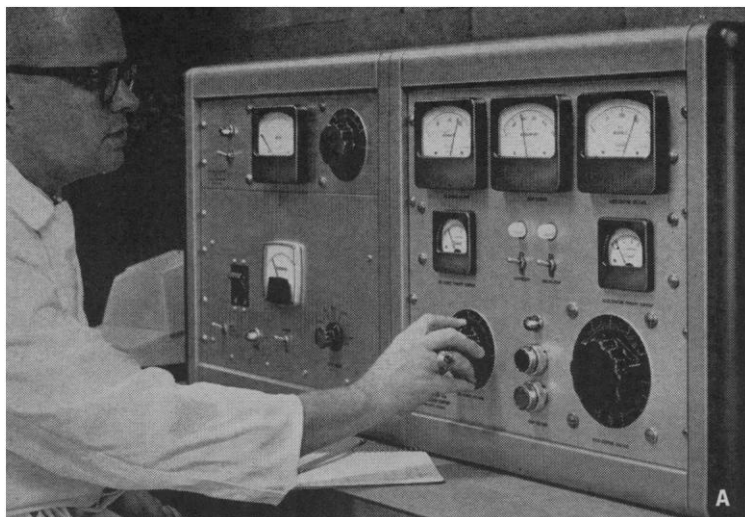
It is instructive to analyze statements on the matter by Philip Sporn, a leading spokesman of the electrical industry. In 1962, when Sporn estimated future costs of nuclear and conventional power, he flatly stated that nuclear power was not competitive with conventional energy. He also estimated that in the period 1973-78 nuclear power would cost between 6.17 and 6.89 mills per kilowatt-hour, whereas costs of conventional power would vary from 3.9 mills in favorable areas to 5.6 mills in high-cost fuel zones. Thus, in 1962 a leading expert considered that even after 15 more years nuclear power would not be competitive.

In 2 years the outlook has changed surprisingly. The General Electric Company has entered into a contract to build a nuclear installation at Oyster Creek in New Jersey. This plant, to be completed in 1967-68, is expected to deliver power at a cost as low as 3.66 mill/kw hr. Sporn has prepared a new analysis of the competitive status of conventional and nuclear power, and his views are different from those of 2 years ago. He is unwilling to accept the Oyster Creek plant costs as typical, contending that the General Electric Company has priced its plant too low, for competitive reasons, and perhaps has been too bold in guaranteeing performance. Even so, he concedes that there has been "an impressive . . . reduction in total energy costs" for nuclear power during the past 2 years.

In his report Sporn also emphasizes the continuing improvements in the conventional approach to power, and he credits these, at least in part, to the competition between the two major sources of energy. In his own company, a plant using low-priced coal, to be completed in 1967, is expected to deliver power at 3.59 mill/kw hr, a cost below his earlier estimate of what might be achieved in the period 1973-78.

Perhaps the most impressive feature of Sporn's analysis is the change in his view of the energy competition. He now believes that this competition has reached the stage where nuclear power "is capable of joining this battle armed only with its own remarkable record of achievement and the promise of advancing further the established record of cost and performance without justification for, or need of, Federal assistance."

It appears that another federal review of the energy situation is inevitable and may occur during the next session of Congress. Up to the last year or so, subsidies have been necessary to enable nuclear energy to compete. In the light-water reactor field that need is no longer clear, since the Oyster Creek plant will be constructed without direct government support. Nevertheless, it is to be hoped that Congress will move cautiously in changing the rules of the game. We are witnessing a beneficial competition which should not lightly be interfered with. In addition, development of breeder or advanced converter reactors should be given high priority. Success in this effort would have tremendous long-term significance. Our nuclear scientists and engineers should be given every encouragement and incentive to maintain their record of superlative achievement.—PHILIP H. ABELSON



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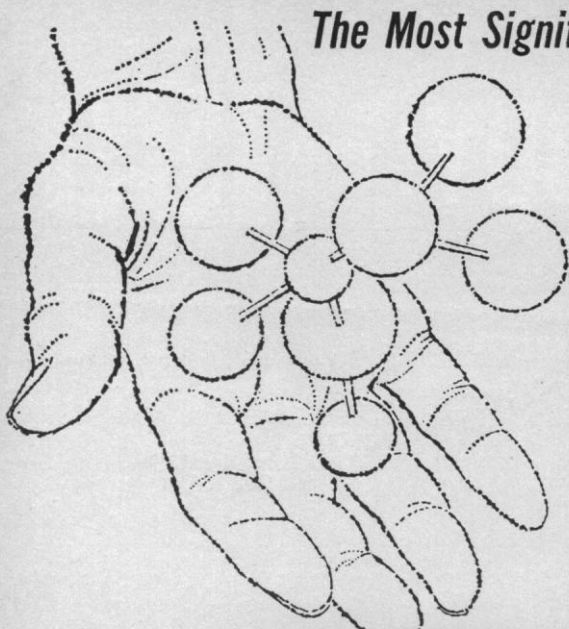
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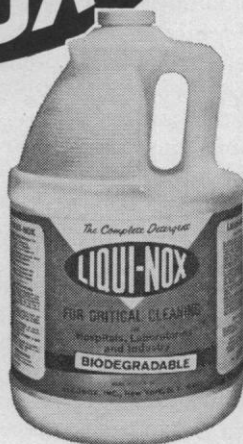
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an initially very blue color. The denser protogalaxies reddened most rapidly, becoming the elliptical galaxies and stellar objects that we see today; the less dense ones have evolved more slowly to Irr I and Sc types, and the least dense ones are probably unobservable. He points out that the lack of scattered points on this plot (no blue galaxies of high density, for instance) implies a single age for all galaxies—possible evidence against the steady-state cosmology.

It was pointed out that a volume change in collapsing gas clouds would increase $\log \rho$ by 3 or more during the life of a galaxy, in which case the evolutionary tracks could well be along the sequence from Irr I through Sc, Sb, Sa, SO, and Irr II to E. Moreover, other types such as dwarf ellipticals are not yet represented, and may not fall along the narrow sequence.

Page reported calculations which showed that evolving stars would not have the observed values of $M/L = 50$ to 100 after lifetimes of 10^{10} years unless a large proportion of the newly formed stars were of very low mass (0.01 sun) and said that this could not be corrected by changing n , the power of σ_K in Schmidt's formula for the rate of star formation. He expects that the size of smallest star formed depends on turbulence in the protogalaxy gas cloud, and notes that the angular momentum (roughly estimated from inclinations of lines in spectra of galaxies) shows a trend from low values for E galaxies to higher values for Sc types. There is a possibility that some of the mass in E galaxies with low angular momentum has collapsed to densities exceeding the Schwarzschild limit, in which case it would be invisible in all electromagnetic radiation, but would still influence the gravitational potential in its vicinity.

Although Bondi and McVittie disagreed with this possibility, G. Burbidge and Fowler upheld it, and Zwicky reported observations of "compact galaxies" that support it. He and Herzog have discovered on Palomar photographs 300 fuzzy images, forming a sequence from 10 seconds of arc to less than 1 second of arc, in such numbers that he expects that there is an average of one brighter than the 17th magnitude for every 2 square degrees all over the sky. Spectra of 16 of them show broad lines indicating large mass and red shifts from 1,000 to 30,000 km/sec. Quasars are probably one extreme of this sequence, and clus-

ters of galaxies like the Coma Cluster may form the other extreme.

Other reports and comments confirm the general impression that the study of evolution of galaxies is now in an early stage of development comparable to that of the study of stellar evolution in 1935. There is an evolutionary pattern evident in the various correlations and sequences, and possibly in the variety of peculiar galaxies. More observations are needed to fill in the gaps indicated by theoretical studies, and new instruments were discussed for such purposes. Three new spectrographs have been built for the larger telescopes in the southern hemisphere (at Pretoria, South Africa, Cordoba, Argentina, and Mt. Stromlo, Australia). Leo Goldberg described far ultraviolet spectra down to x-ray wavelengths obtained by rockets fired above the earth's atmosphere. The Canadian "Alouette" satellite will carry a radio telescope above the ionosphere for measurements at frequencies down to 1 Mc/sec, and the NASA Orbiting Astronomical Observatory program may have a 100-inch optical telescope in space by 1975.

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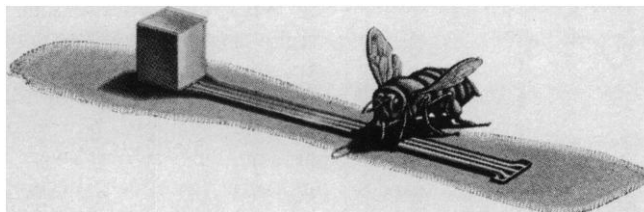
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High-Energy Physics

At the 12th International Conference on High-Energy Physics which was held in Dubna, Russia, 5-12 August, a most exciting report was presented by J. Cronin and V. Fitch (Princeton) giving evidence for the apparent nonconservation of CP (C, charge reflection; P, parity or spatial reflection) in K_s^0 decays. The experiment was carried out in a simple and elegant manner at the alternating-gradient synchrotron accelerator at Brookhaven National Laboratory and consisted in observing that K_s^0 s (the long-lived particle mixture of K^0 and \bar{K}^0 mesons) decay into π^+ and π^- mesons with a charged-particle branching ratio of $2.0 \pm 0.4 \times 10^{-3}$. Earlier



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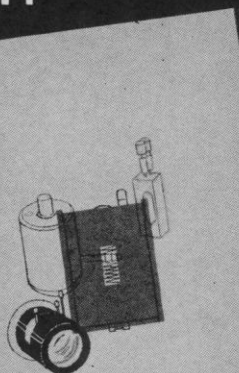
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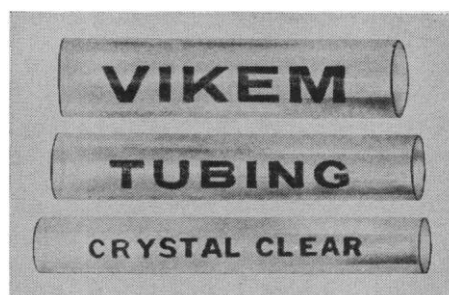
experiments had established an upper limit for this decay mode, which is forbidden by CP invariance, of approximately $1/300$. Since the invariance of all known interactions under the transformation TCP (T, time reversal) has not been challenged (TCP invariance predicts equal mass and lifetime for particle and antiparticle), the violation of CP invariance also implies the violation of time reversal invariance for the weak interactions. This result will surely trigger a new round of difficult experiments in the search for time reversal noninvariance in other weak decay interactions. No theoretical papers on this subject were presented, but there was much speculation during informal discussions concerning the incorporation of terms that will allow for time reversal noninvariance into existing weak-interaction theory. These ideas included weak-interaction terms of the types (i) $\Delta S = -\Delta Q$ (Sachs), (ii) $\Delta I = 3/2$ (Amati) (S being strangeness, Q being charge, and I being isotopic spin), or (iii) "currents of the second kind" (Cabibbo). Since the meeting, several theorists have offered explanations for this new result which suppose a new type of long-range interaction coupled to hypercharge ($+1$ and -1 for K^0 and \bar{K}^0 , respectively), much weaker than the β -decay interaction and even weaker than gravitation. Such a new force would have little impact on other elementary particle behavior but could have cosmological significance.

Detailed talks on experimental aspects of the weak interactions were presented by A. K. Mukhin (Dubna) on nonstrange particles and by I. V. Chuvilo (Dubna) on strange particles. All data presented on other aspects of weak interactions were consistent with current theoretical ideas which include: universality of the coupling of muons and electrons, lepton conservation, conserved vector current, the strangeness-changing leptonic decays satisfying the $\Delta S + \Delta Q$ and the $\Delta I = 1/2$ rules, and finally nonleptonic decays satisfying the $\Delta I = 1/2$ rule. The Cabibbo theory of weak interactions that relates the neutron β -decay to the hyperon β -decays by way of the SU_3 symmetry of strong interactions is consistent with the data. A special report on neutrino physics was presented by G. Bernardini (Centre Européen de la Recherche Nucléaire). The beautiful experiment on high energy neutrino interactions conducted at CERN for the past 2 years has confirmed the existence of two neutrinos, ν_e and ν_μ , which couple to

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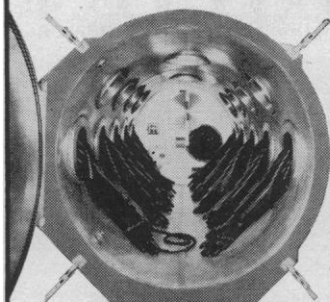


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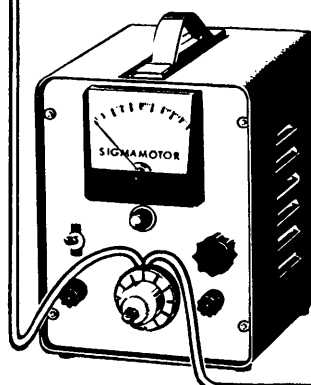
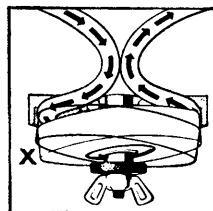
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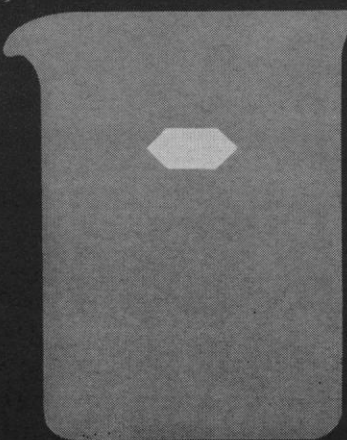
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electrons and muons, respectively. The search for a charged intermediate vector meson that decays into (μ^+, ν_μ) or (e^+, ν_e) has been unsuccessful. A lower limit for the mass of 1.8 Gev has been set for this theoretically conjectured particle that is supposed to transmit the weak interaction between pairs of spin $\frac{1}{2}$ particles.

The review by N. Ramsay (Harvard) of electromagnetic interactions revealed no violation of quantum electrodynamics up to momentum transfers ~ 1 Gev/c. The mysterious muon continues to behave exactly as an electron in all observed electromagnetic interactions [including μ^-, μ^+ pair production (Friedman) and $\mu^- + p \rightarrow \mu^- + p$ scattering (Tinlot)]. No theoretical ideas exist that explain the large mass ratio $(m_\mu/m_e) = 207$. Electron scattering cross section experiments on protons at the Cambridge Electron Accelerator continue to display a smooth fall off with increasing momentum transfer, $\leq (7 \text{ Gev/c})^2$ (Wilson, Harvard).

A myriad of experimental results on strong interactions of p , n , π^\pm , K^\pm , \bar{p} , Λ and Σ^\pm particles on protons were presented. Talks by Yu. M. Kazarinov (Dubna) and S. J. Lindenbaum (Brookhaven) on $\pi - n$ interactions (up to and above 1 Gev), S. Ya. Nikitin (Moscow) on pion resonances, R. Armenteros (CERN) on strange-particle resonances and D. Miller (Berkeley) on strange-particle physics, could hardly do justice to the material. The hope that the analytic properties of the S matrix coupled with simple Regge trajectory hypotheses could explain cross sections in the region of 10 to 30 Gev is not borne out by experiment. New experiments at CERN, Harwell, and Brookhaven confirm the existence of a substantial real part in the $p - p$ scattering amplitude at high energies (first found by a Russian group at approximately 8 Gev a few years ago). A similar real part is also found in (π, p) elastic scattering (Lindenbaum) and allows for the possibility of testing dispersion relations (based on microscopic causality) in the energy regime of 10 to 20 Gev. Several new N^* resonances at energies ranging up to 2825 Mev have been discovered (Kycia), and the properties of many other N^* resonances have been elucidated. Among the meson resonances, the existence of a ninth pseudoscalar meson, X^0 , of mass 960 Mev has been well established [Samios (Brookhaven), Kalbfleisch (Berkeley), and Ticho (U.C.L.A.)]. Other new resonances include $B(1215$

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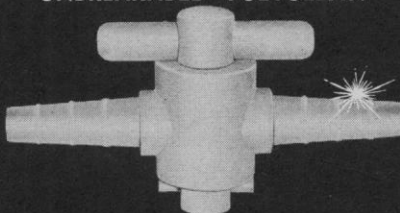
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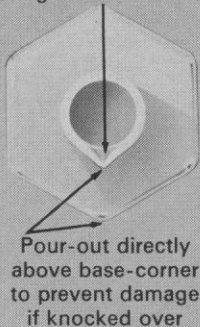
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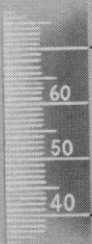
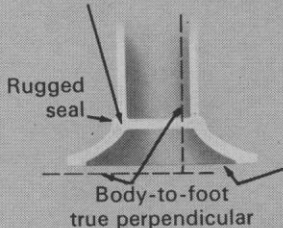
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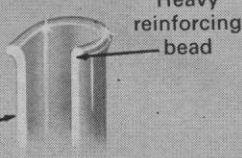


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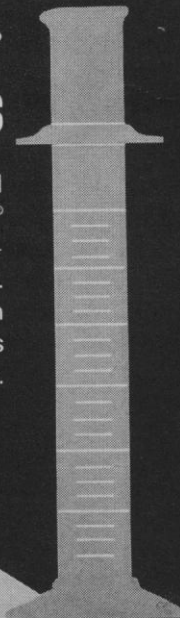
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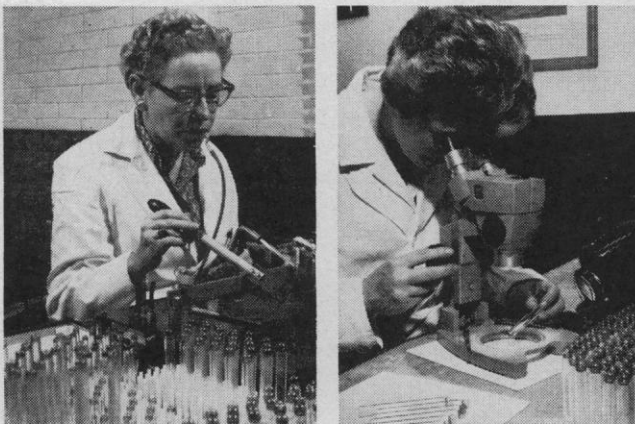


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$\text{Mev}) \rightarrow \omega \pi$; $A_2(1310 \text{ Mev}) \rightarrow \rho \pi$, $K\bar{K}$ with spin and parity 2^+ , and many more controversial objects, called A_1 , C , E , H , κ , etc., whose existence as well as spin, parity, and decay modes are not well established. As for hyperon resonances, the existence of Ξ^* (1810 Mev) has been confirmed, and the Y^*_{11} (1660) has had its parity changed from plus to minus. It is clear that the world of elementary particles and resonant states is richer than most physicists had imagined, and much more work is needed.

The idea of M. Gell-Mann and Y. Neeman that the strong interactions obey an approximate symmetry called SU_3 has brought some order into the picture. The crowning point of the success of this theory was the prediction of the Ω^- , a hyperon with hypercharge $Y = -2$. Two examples were found a few months ago by a team at Brookhaven, and these were reviewed in a convincing fashion by Samios. The success of this theory has led to many new theoretical extensions (SU_4 , $SU_3 \times SU_2$, . . .) and exciting speculations, most of which were reviewed by Salam (Imperial College). The low mass, strongly interacting particles, have been assigned to SU_3 group representations of dimension 1, 8, and 10. However, as the name suggests, this theory also allows for fundamental triplet representations. Many theorists, including Gell-Mann (California Institute of Technology), Schwinger (Harvard), Van Hove (CERN), and others not at this meeting have conjectured that these triplets are the fundamental building blocks out of which matter, as we know it in the form of nucleons and pions, is composed. These speculations have triggered a new experimental search for such triplets (either of fractional charge or integral charge). To date, this search at existing accelerators has been unsuccessful, but the idea is sufficiently attractive to last a long time. The heavier the mass, of course, the higher the energy needed to produce these objects. The answer to the crucial question concerning the order of magnitude of the mass expected varies among the "experts" from about several Gev to very heavy ($\approx 100 \text{ Gev}$). In the latter case, even the next generation of high-energy accelerators will not suffice as a source, but there remain cosmic rays.

The Russian physicists were wonderful hosts at this meeting, and their energetic efforts to get revised manuscripts promptly into the hands of the

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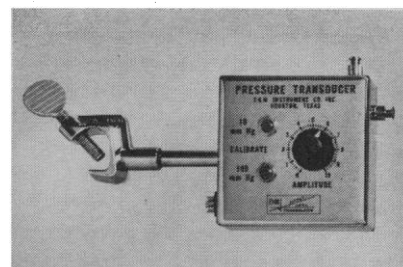
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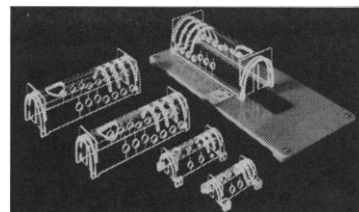
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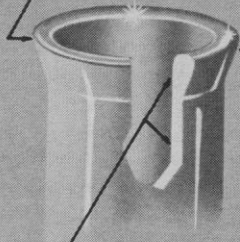
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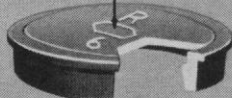
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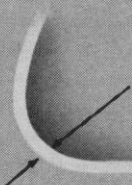


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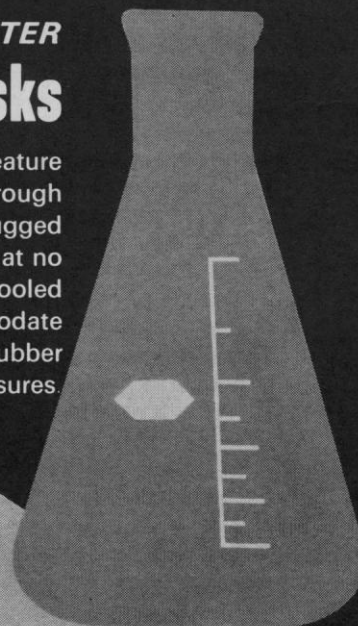
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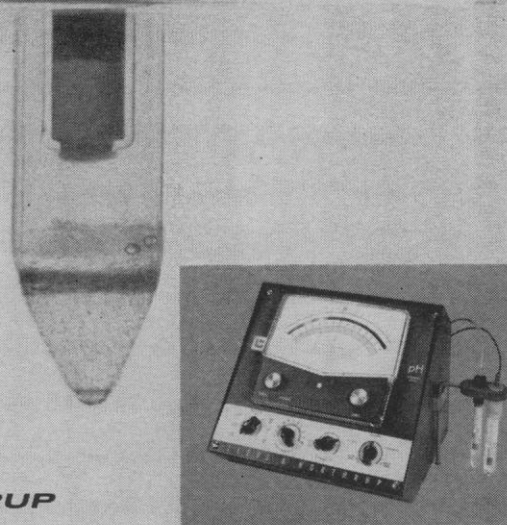
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translators (Russian and English were the official languages) suggest that the proceedings will also be published without too much delay. A 13-hour boat trip down the Volga and a 4½-hour evening entertainment were also provided. The length of these entertainments were well matched to the length of the physics sessions.

GEORGE SNOW

Department of Physics and Astronomy,
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Forthcoming Events

November

12-14. **Paleomagnetism**, 2nd U.S.-Japan seminar, U.S.-Japan Cooperative Science Program, Univ. of California, Berkeley. (J. Verhoogen, Dept. of Geology and Geophysics, Univ. of California, Berkeley)

13-15. **American Inst. of Professional Geologists**, 1st annual, Denver, Colo. (AIPG, W. A. Newton, Public Information Committee, P.O. Box 836, Golden, Colo. 80402)

13-15. **Clinical Scientists Assoc.**, annual, Washington, D.C. (ACS, F. W. Sunderman, Jr., Univ. of Florida, College of Medicine, Gainesville 32603)

14-19. **American Acad. of Ophthalmology and Otolaryngology**, Chicago, Ill. (W. L. Benedict, 15 Second St., SW, Rochester, Minn. 55901)

14-21. **Pan American Medical Women's Alliance**, 9th congr., Los Angeles, Calif. (E. M. Hohl, 1234 N. Vermont Ave., Hollywood, Calif.)

15-17. **Water in the Arid Zones** of the Old World, symp., Halle an der Saale, East Germany. (Deutsche Akademie der Naturforscher Leopoldina, August-Bebel Str. 50 a, Halle an der Saale)

15-19. **American Soc. of Agronomy**, Crop Science Soc. of America, Soil Science Soc. of America, annual, Kansas City, Mo. (L. A. Richards, Amer. Soc. of Agronomy, 677 S. Segoe, Madison, Wis.)

15-19. **Society of Exploration Geophysicists**, Los Angeles, Calif. (C. G. Ferris, E. V. McCollum & Co., 515 Thompson Bldg., Tulsa, Okla.)

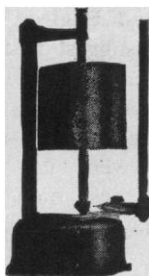
16. **Ammonia Metabolism**, symp., Brooklyn, N.Y. (D. M. Kirschenbaum, Dept. of Biochemistry, State Univ. of New York, Downstate Medical Center, 450 Clarkson Ave., Brooklyn 3)

16-17. **Basic Sciences**, 3rd annual conf., New York, N.Y. (A. Gelbart, Yeshiva Univ., Amsterdam Ave. and 186th St., New York)

16-19. **Gulf and Caribbean Fisheries Inst.**, conf., Ocho Rios, Jamaica. (Executive Secretary, Gulf and Caribbean Fisheries Inst., 1 Rickenbacker Causeway, Miami, Fla. 33149)

16-19. **Magnetism and Magnetic Materials**, Minneapolis, Minn. (J. B. Goodenough, Lincoln Laboratory C182, Lexington, Mass. 02173)

16-20. **Interagency Chemical Rocket Propulsion Group**, Mechanical Behavior Working Group, 3rd annual, Redstone Arsenal, Ala. (T. H. Duerr, AMSMI-RKP, Redstone Arsenal, Ala. 35809)



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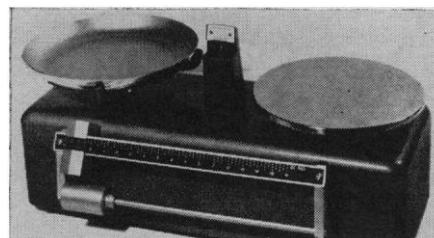
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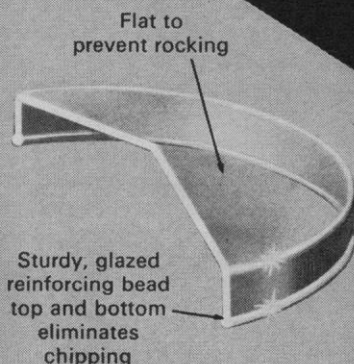
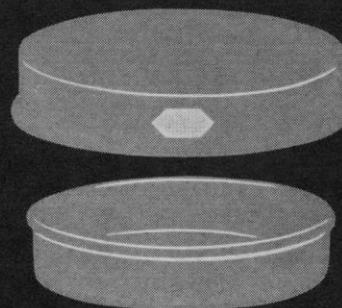


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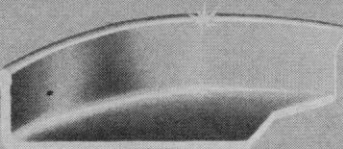


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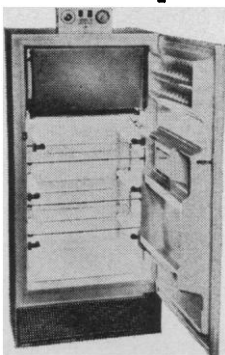
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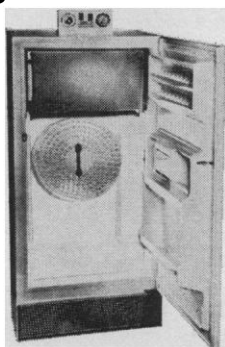
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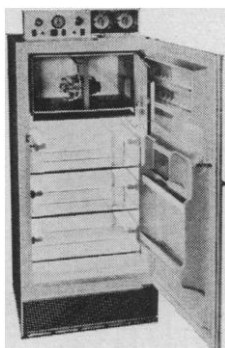
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16-20. Soil Science Soc. of America, annual, Kansas City, Mo. (W. E. Jeske, 7515 N.E. Ankeny Rd., Ankeny, Iowa)

17-18. Allied Air Force Medical Conf., 10th annual, Fontainebleau, France. (Officier Administratif, Division Médicale d'Aircent, Camp Guynemer, Fontainebleau)

18-20. Navy Research and Development, Philadelphia, Pa. (clearance). (H. G. Sparks, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

18-20. Northeastern States Navy Research and Development Clinic, Philadelphia, Pa. (N. R. Droulard, Franklin Inst. Laboratories, 20th and Parkway, Philadelphia 19103)

18-21. Neurological Surgeons, 14th congr., Bal Harbour, Fla. (J. R. Russell, 1815 N. Capitol Ave., Indianapolis, Ind.)

19-21. Geological Soc. of America, Miami Beach, Fla. (J. W. Peoples, 10 Wesleyan Place, Middletown, Conn.)

19-21. Paleontological Soc., Miami Beach, Fla. (R. L. Langenheim, Jr., Dept. of Geology, Univ. of Illinois, Urbana)

19-21. National Council of Teachers of Mathematics, Atlanta, Ga. (J. D. Gates, 1201 16th St., NW, Washington, D.C.)

19-22. American Anthropological Assoc., 63rd annual, Detroit, Mich. (E. R. Service, Dept. of Anthropology, Univ. of Michigan, Ann Arbor)

21-22. American Geological Inst., Miami Beach, Fla. (L. Hoover, 1444 N St., NW, Washington, D.C. 20005)

21-24. American Speech and Hearing Assoc., San Francisco, Calif. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington, D.C.)

23-24. Water for Texas, 9th annual, Texas A&M Univ., College Station. (E. T. Smerdon, Water Resources Inst., Texas A&M Univ., College Station)

23-25. American Physical Soc., Fluid Dynamics Div., Pasadena, Calif. (R. J. Emrich, Dept. of Physics, Lehigh Univ., Bethlehem, Pa.)

23-27. Dosimetry of Irradiations from External Sources, intern. symp., Health Physics Soc., French section, Paris, France. (M. Gras, 5, rue Armand, Gauthier, Paris 18°)

23-27. Use of Radioisotopes in Animal Nutrition and Physiology, symp., Intern. Atomic Energy Agency, Food and Agriculture Organization of the UN, Prague, Czechoslovakia. (Symp. Secretariat, Kärntnering 11, Vienna 1, Austria)

23-28. Internal Medicine, 8th intern. congr., Buenos Aires, Argentina. (Secretariat, Melo 2081, Buenos Aires)

24. Manufacturing Chemists' Assoc., 14th conf., New York, N.Y. (Manufacturing Chemists' Assoc., 1825 Connecticut Ave., NW, Washington, D.C.)

26-28. Central Assoc. of Science and Mathematics Teachers, 64th annual, Detroit, Mich. (Sister Mary Ambrosia, Gesu Convent, 17180 Oak Drive, Detroit 48221)

27-28. National Council for Geographic Education, Minneapolis, Minn. (L. Kenamer, Univ. of Texas, Austin)

29-1. Applications of Fundamental Thermodynamics to Metallurgical Processes, conf., Pittsburgh, Pa. (G. R. Fitterer, Engineering Research Div., Schools of Engineering and Mines, 405 Engineering Hall, Univ. of Pittsburgh, Pittsburgh)

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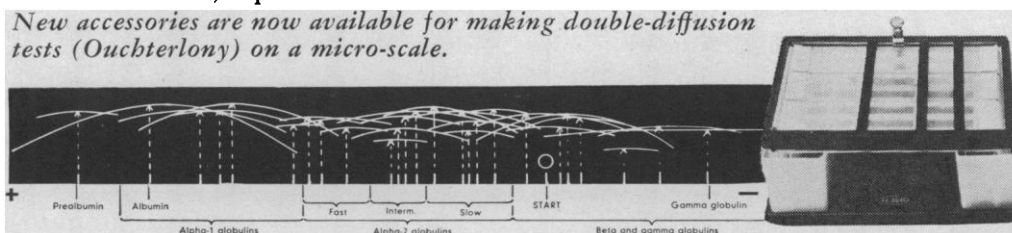
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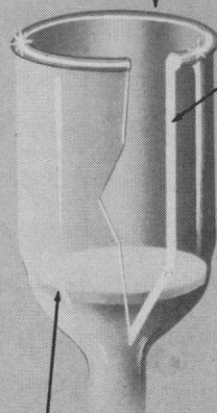
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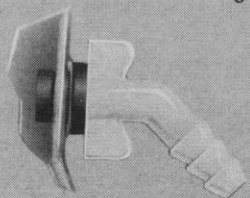
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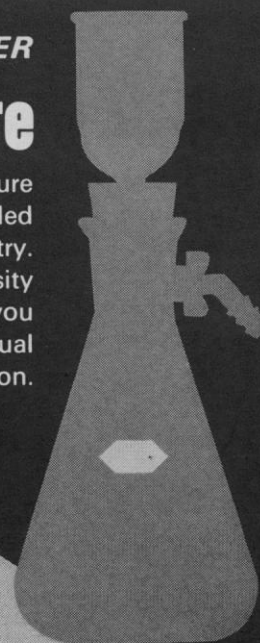


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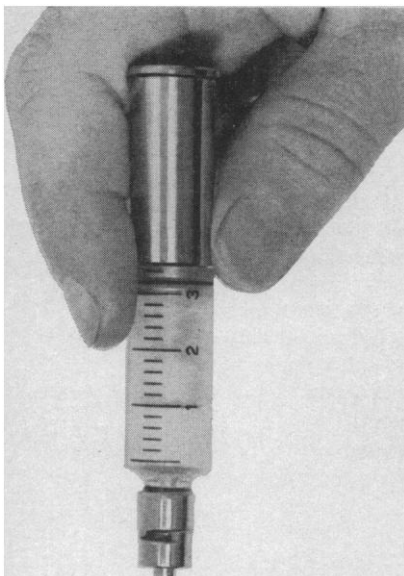


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29-1. Association for Research in **Ophthalmology**, Minneapolis, Minn. (H. Kaufman, J. Hillis Miller Health Center, Univ. of Florida, Gainesville)

29-4. American Soc. **Mechanical Engineers**, annual, New York, N.Y. (D. J. Sengstaken, ASME Nuclear Engineering Div., Long Island Lighting Co., 175 Old Country Rd., Hicksville, L.I., N.Y.)

29-4. **Radiological Soc. of North America**, Chicago, Ill. (M. D. Frazer, 1744 S. 58 St., Lincoln, Neb.)

30. **Food and Drug Administration and Law Inst.**, 8th annual conf., Washington, D.C. (S. T. Grey, Bureau of Education and Voluntary Compliance, FDA, Washington 25, D.C.)

30-1. **Mechanisms of Dental Caries**, New York Acad. of Sciences, New York, N.Y. (J. F. Fredrick, New York Research Laboratories, 3425 Boston Post Rd., Bronx, N.Y. 10469)

30-2. New Horizons in **Solid State Electronics**, seminar, Rochester, N.Y. (A. DeWinter, Rochester Inst. of Technology, Extended Services Division, Rochester 8)

30-2. **Pacific Air Force Medical conf.**, Fuchu Air Station, Tokyo, Japan. (Lt. Col. R. J. Carter, 14th PACAF Medical Conf., USAF Hospital Tachikawa, APO 323, San Francisco, Calif.)

30-2. **Thalamic Regulation of Sensorimotor Activities**, symp., New York, N.Y. (M. D. Yahr, New York Neurological Inst., 710 W. 168 St., New York 10032)

30-3. **Atomic Industrial Forum**, annual, San Francisco, Calif. (Atomic Industrial Forum, 850 Third Ave., New York, N.Y.)

30-3. **Entomological Soc. of America**, annual, Philadelphia, Pa. (ES, 4603 Calvert Rd., College Park, Md.)

30-3. **American Nuclear Soc.**, winter meeting, San Francisco, Calif. (W. H. Nutting, Pacific Gas and Electric Co., 245 Market St., San Francisco)

December

1. **Food Standards**, symp., Washington, D.C. (Food Law Inst., Inc., 205 E. 42 St., New York 10017)

1. **New Polyolefin Copolymer Plastics**, regional technical conf., Philadelphia, Pa. (E. A. Jeffreys, Registration Chairman, c/o Allied Chemical Corp., 901 Catalapa Rd., Warminster, Pa.)

2-4. **Communication Wires and Cables**, 13th annual symp., Atlantic City, N.J. (J. Spergel, WCS, U.S. Army Electronics R&D Laboratories, Fort Monmouth, N.J. 07703, Attn: SELRA/PEE)

2-5. **Crystalline Lens**, symp., Minneapolis, Minn. (J. E. Harris, Dept. of Ophthalmology, Univ. of Minnesota Medical School, Minneapolis 55455)

3-5. **American Chemical Soc.**, 20th annual southwestern regional meeting, Shreveport, La. (ACS, 1155 16th St, NW, Washington, D.C. 20036)

3-5. **Sociological Questions Pertaining to the Medical Field**, East German Hygiene Soc., symp., Berlin, East Germany. (German Acad. of Sciences, Mohrenstrasse 39, Berlin W.8.)

3-5. **Texas Acad. of Science**, annual, Dallas. (S. O. Brown, Texas A&M Univ., Box 33, College Station)

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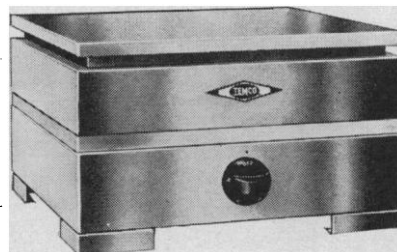
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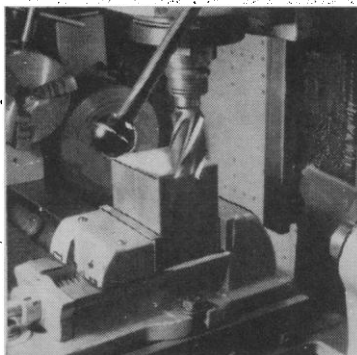
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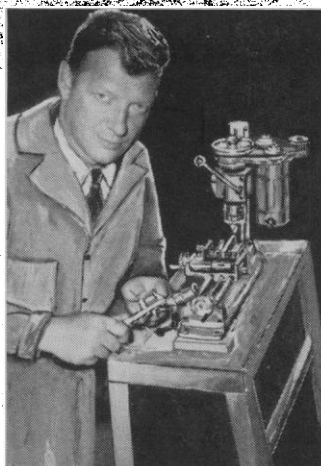
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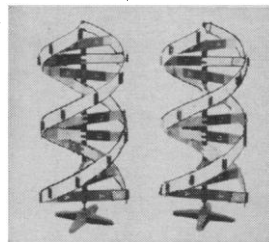
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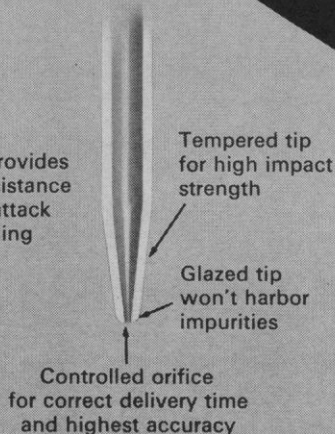
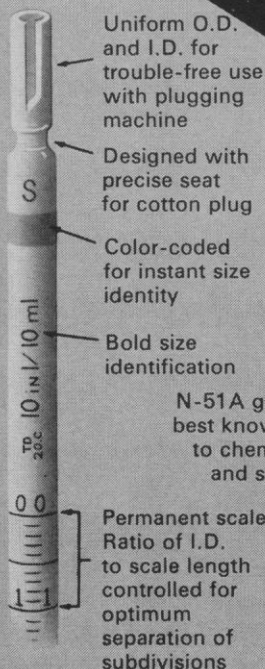
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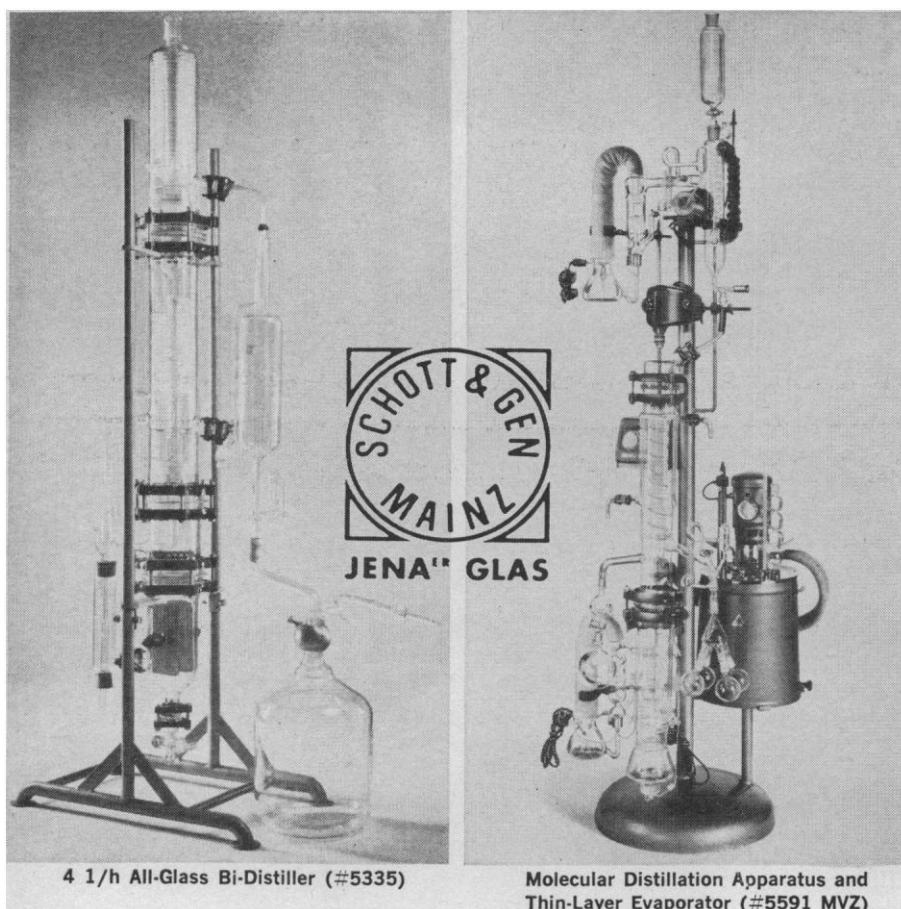
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4-5. **American Rheumatism Assoc.**, an-
 nual, Washington, D.C. (J. A. Coss, Jr.,
 20 E. 76 St., New York 10021)

4-5. **American Rheumatism Assoc.**, 11th
 interim scientific session, National In-
 stitutes of Health, Bethesda, Md. (G. W.
 Speyer, ARA, 10 Columbus Circle, New
 York 10019)

4-5. Association for Research in **Nerv-
 ous and Mental Diseases**, New York, N.Y.
 (R. J. Masselink, ARNMD, 700 W. 168
 St., New York 10022)

4-5. **Oxygen in Biosystems**, basic science
 symp., New York, N.Y. (Miss J. Newkirk,
 New York Heart Assoc., 10 Columbus
 Circle, New York 10019)

4-5. **Oxygen**, symp., New York, N.Y.
 (A. P. Fishman, New York Heart Assoc.,
 10 Columbus Circle, New York 10019)

4-5. Southern Soc. for **Pediatric Re-
 search**, Houston, Tex. (F. K. Edwards,
 Emory Univ. School of Medicine, Thomas
 K. Glenn Memorial Bldg., 69 Butler St.,
 Atlanta, Ga. 30303)

4-6. American **Psychoanalytic Assoc.**,
 fall meeting, New York, N.Y. (APA, 1 E.
 57 St., New York 10022)

4-9. American Acad. of **Dermatology**,
 Chicago, Ill. (S. E. Huff, AAD, 636
 Church St., Evanston, Ill.)

5-6. Academy of **Psychoanalysis**, mid-
 winter meeting, New York, N.Y. (A. H.
 Rifkin, AP, 125 E. 65 St., New York
 10021)

6. American Acad. of **Dental Medicine**,
 mid-annual meeting, New York, N.Y. (S.
 C. Conrad, 133-28 228th Street, Laurelton,
 L.I.)

6-10. American Inst. of **Chemical Engi-
 neers**, annual, Boston, Mass. (J. Henry,
 AIChE, 345 E. 47 St., New York 10017)

6-12. Latin American Congr. on **Micro-
 biology**, 3rd, Bogota, Columbia. (O. Ju-
 liao, Instituto Nacional de Salud, Aptdo,
 Aereo 3495, Bogota)

7. American Institute of **Mining, Metal-
 lurgical and Petroleum Engineers**, annual,
 Tucson, Ariz. (H. N. Appleton, AIME,
 345 E. 47 St., New York 10017)

7-9. Performance of **High Temperature
 Systems**, Pasadena, Calif. (G. S. Bahn,
 16902 Bollinger Dr., Pacific Palisades,
 Calif. 90272)

7-9. Southern **Surgical Assoc.**, meeting,
 Hot Springs, Va. (G. H. Yeager, Univer-
 sity Hospital, Baltimore 1, Md.)

7-11. Chemical Effects Associated with
**Nuclear Reactions and Radioactive Trans-
 formations**, symp., Vienna, Austria. (P.
 Ghelardoni, Div. of Scientific and Tech-
 nical Information, International Atomic
 Energy Agency, Karntnerring 11, Vienna
 1)

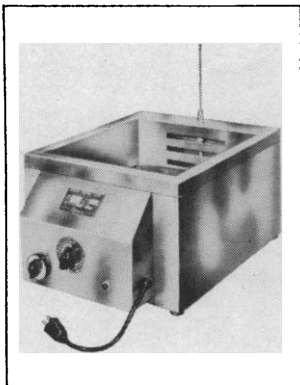
8-9. Ciba Foundation Guest Sympo-
 sium on **Measurement of Oxygen Tension**,
 London, England. (Ciba, 41 Portland Pl.,
 London, W.1)

8-11. American Soc. of **Agricultural
 Engineers**, New Orleans, La. (J. L. Butt,
 ASAE, 420 Main St., St. Joseph, Mich.)

9-11. **Antiviral Substances**, conf., New
 York Acad. of Sciences, New York, N.Y.
 (B. K. Forscher, Publications Section,
 Mayo Clinic, Rochester, Minn.)

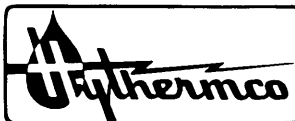
12-15. American Acad. of **Optometry**,
 annual, Columbus, Ohio. (C. C. Koch,

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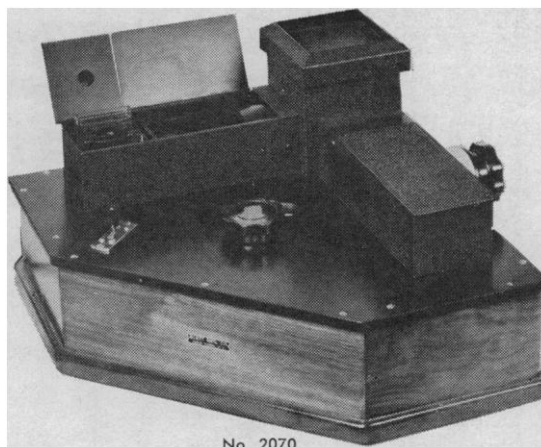


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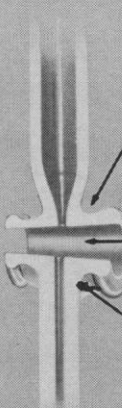


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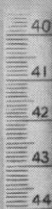
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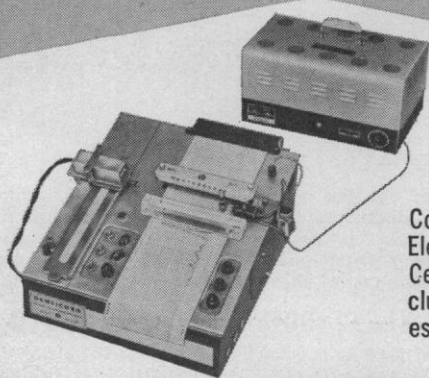
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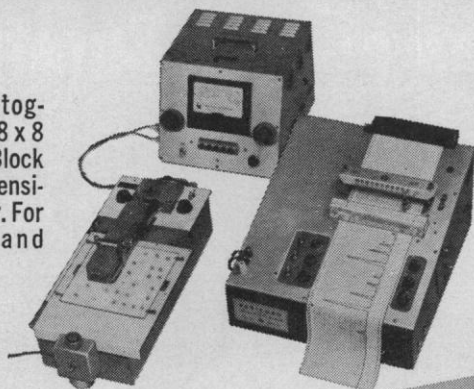


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14-16. **Hahnemann Medical College**, 13th symp., Philadelphia, Pa. (J. H. Moyer, Dept. of Medicine, Hahnemann Medical College, Philadelphia)

14-16. **Reticuloendothelial Soc.**, meeting, New York, N.Y. (N. R. Di Luzio, Univ. of Tennessee Medical Units, Memphis)

14-17. **Adipose Tissue Metabolism and Obesity**, conf., New York, N.Y. (B. N. Brodoff, New York Acad. of Sciences, 2 E. 63 St., New York)

14-18. Conference on **Nuclear Electronics**, Bombay, India. (International Atomic Energy Agency, Karntnerring 11, Vienna 1, Austria)

14-22. **International Geological Congr.**, 22nd, New Delhi, India. (Secretary-General of the Congress, c/o Geological Survey of India, 27, Chowringhee, Calcutta 13)

14-22. **International Mineralogical Assoc.**, 4th general, New Delhi, India. (J. V. Smith, c/o Dept. of Geophysical Sciences, University of Chicago, Chicago, Ill.)

15-16. **Periodic Functions in Live Matter**, Czechoslovak Meteorological Soc., conf., Prague. (J. Novak, First "Prof. Konopik" Dermatology Clinic, Prague 2, Apolinarska 4)

15-18. **High Energy Astronomy**, symp., Univ. of Texas, Austin. (Office of Aerospace Research, 4th and Independence Avenue, SW, Washington, D.C. 20233)

15-18. **Relativistic Astrophysics**, symp., Univ. of Texas and Southwestern Center for Advanced Studies, Austin. (Mrs. J. Wardlaw, Dept. of Physics, Physics Bldg. 438, Univ. of Texas, Austin 78712)

16-21. Inter-American Congr. of **Psychology**, 9th annual, Miami, Fla. (V. D. Sanua, Yeshiva Univ., 110 W. 57 St., New York 10019)

20-24. **Theoretical and Applied Mechanics**, congr., Kanpur, India. (M. K. Jain, Indian Inst. of Technology, Kharagpur, India)

21-23. **American Physical Soc.**, Berkeley, Calif. (W. Whaling, California Inst. of Technology, 1201 East California St., Pasadena)

21-23. **Biology of Marine Microorganisms**, conf., Univ. of California, Berkeley. (R. Newton, Letters and Science Extension, Univ. of California, Berkeley 94720)

26-29. Society of **Systematic Zoology/American Soc. Zoologists/Herpetologists' League**, annual, Univ. of Tennessee, Knoxville. (J. G. Rozen, Jr., Dept. of Entomology, SSZ, American Museum Natural History, Central Park West and 79th St., New York, N.Y.; A. G. Richards, ASZ, Dept. of Entomology, Univ. of Minnesota, St. Paul 55101; J. M. Legler, HL, Dept. of Zoology, Univ. of Utah, Salt Lake City)

26-31. **American Assoc. for the Advancement of Science**, annual, Montreal, Canada. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

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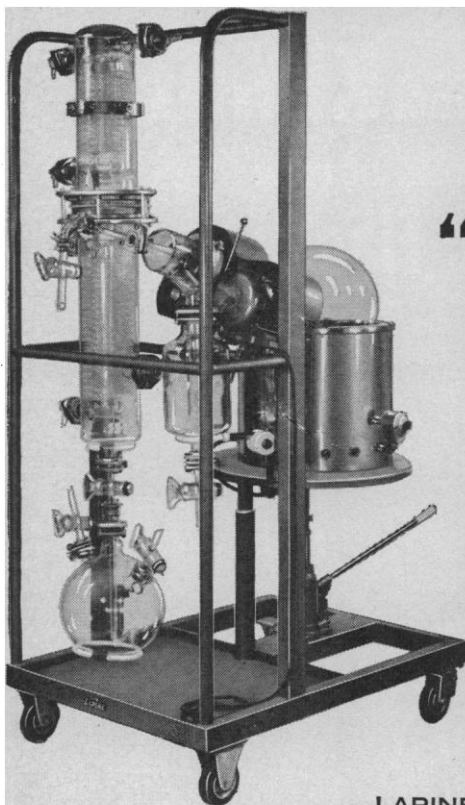
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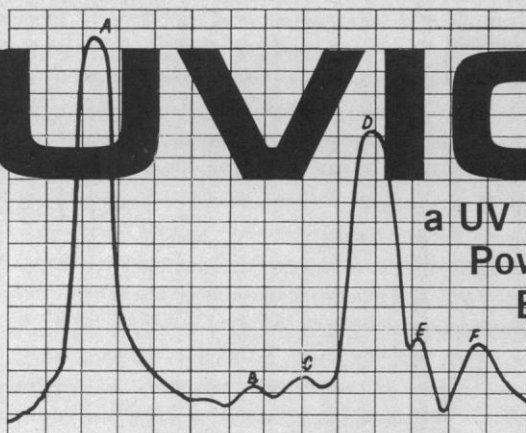
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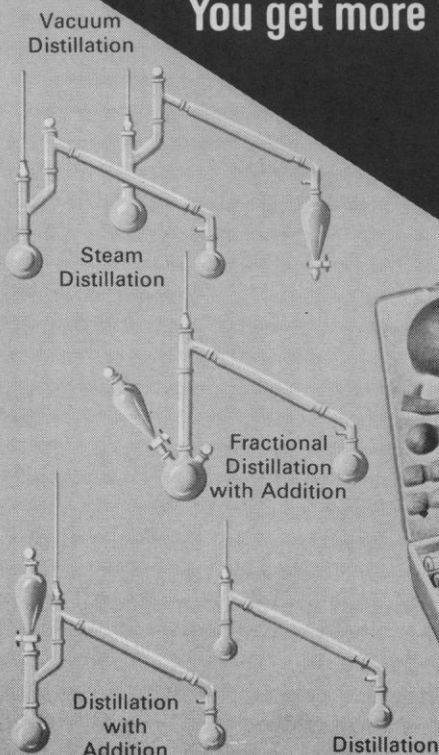
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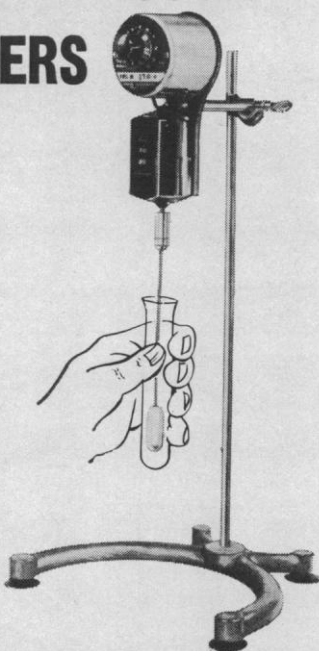
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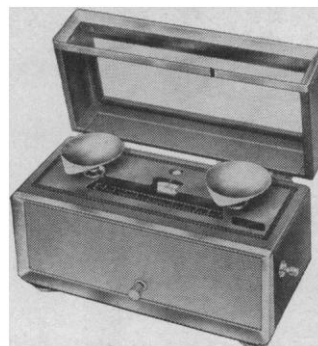


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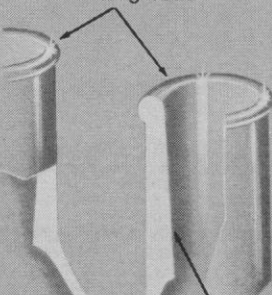
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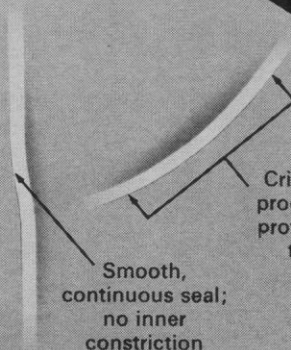
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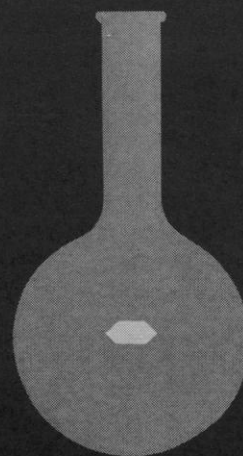
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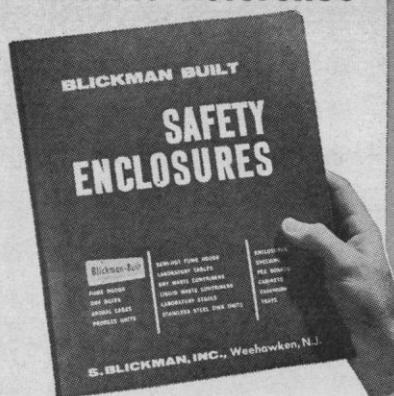


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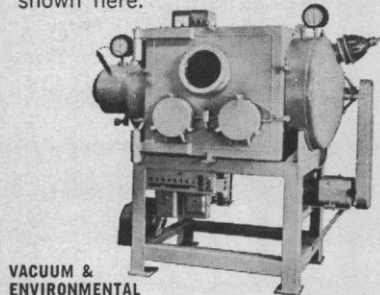
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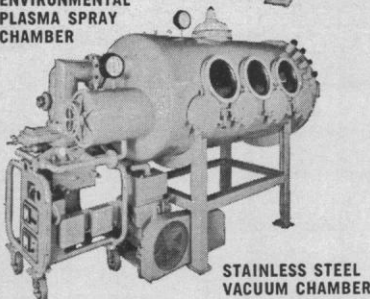
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12-14. **Reliability and Quality Control**, symp., Miami, Fla. (H. D. Hulme, Westinghouse R&D Center, Bldg. 601-1346, Churchill Boro, Pittsburgh, Pa.)

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18-20. **Solar Radiation Simulation**, intern. conf., Los Angeles, Calif. (H. F. Sander, Inst. of Environmental Science, 34 S. Main St., Mount Prospect, Ill.)

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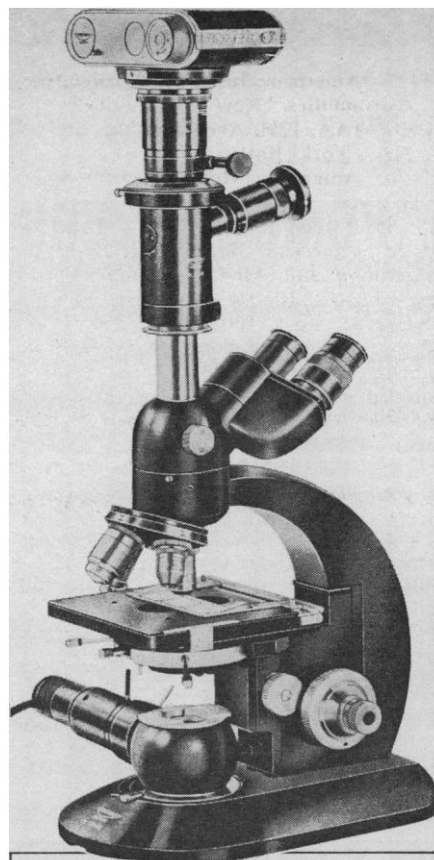
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22-23. **Blood**, annual symp., Detroit, Mich. (W. H. Seegers, Dept. of Physiology and Pharmacology, Wayne State Univ. College of Medicine, Detroit)

25-26. **Fundamental Phenomena in the Material Sciences**, 3rd annual symp., Boston, Mass. (D. B. Fay, Ilikon Corp., Natick Industrial Centre, Natick, Mass.)

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28-30. American **Geophysical Union**, southwest regional, Socorro, N.M. (J. B. Franzini, Civil Engineering Dept., Stanford Univ., Stanford, Calif.)

28-30. International **Medical Assembly** of Southwest Texas, San Antonio. (S. E. Cockrell, Jr., 202 W. French Pl., San Antonio 12)

28-30. **Large-Scale Air-Sea Interaction**, symp., Bombay, India. (UNESCO, Office of Oceanography, Pl. de Fontenoy, Paris 7^e, France)

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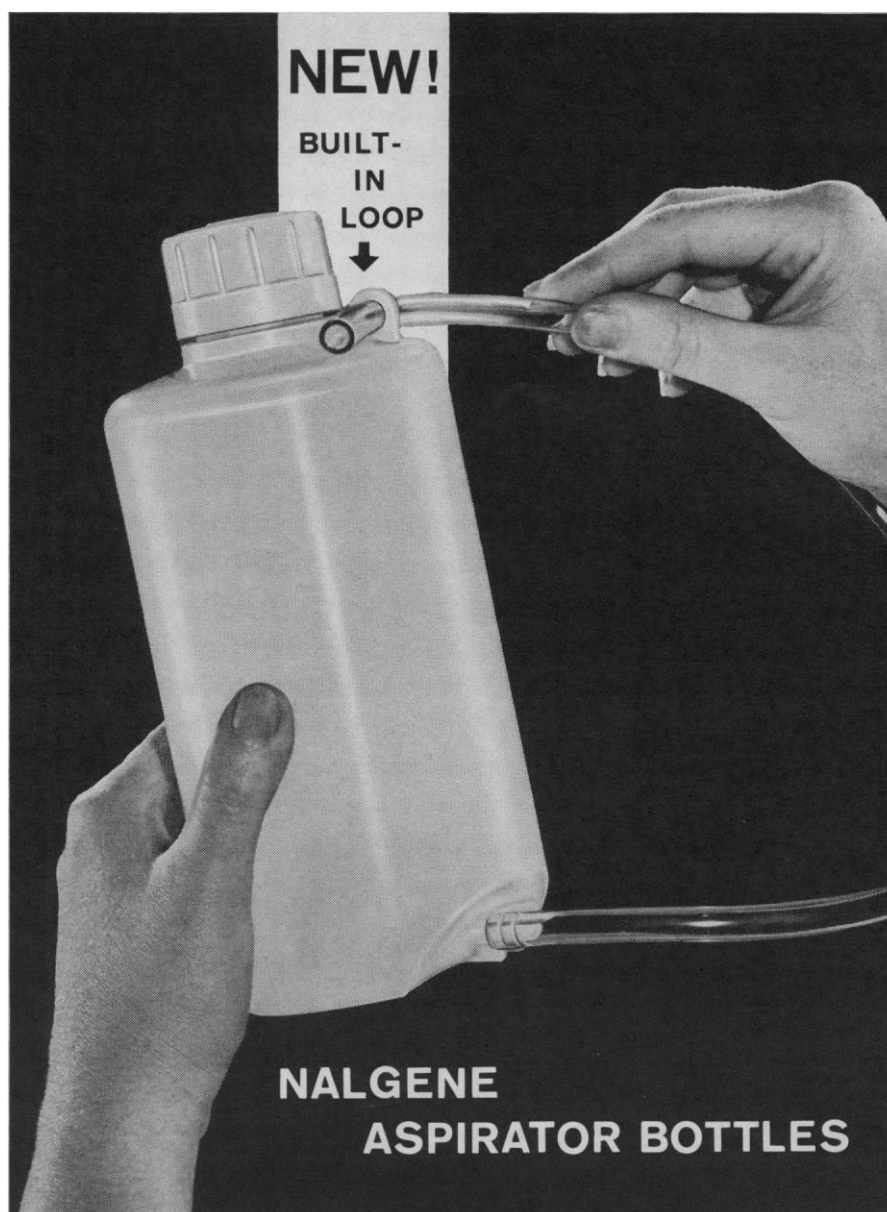
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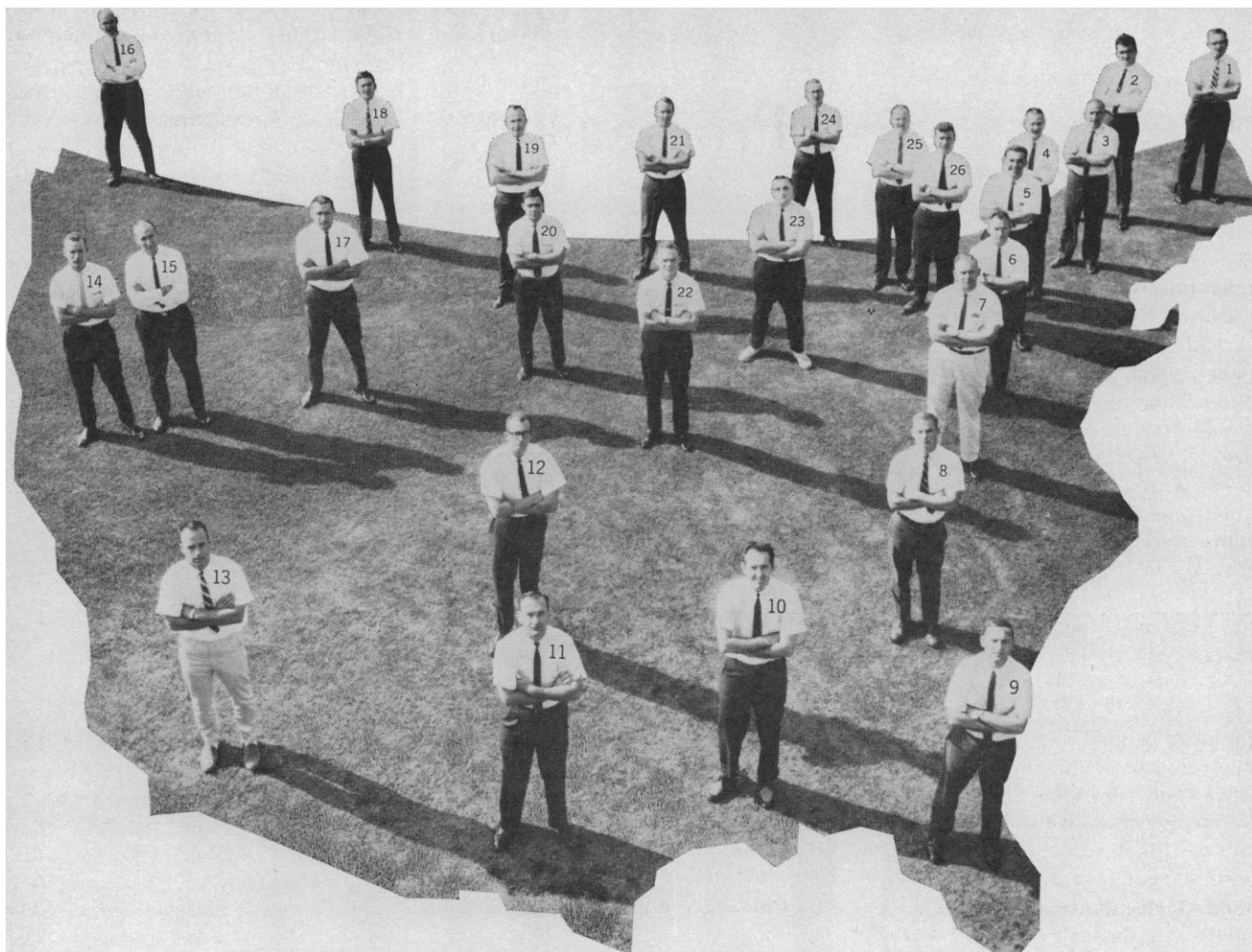
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New Products

Bench-top fermentor, 24 by 21 by 29½ inches, eliminates the conventional water bath by circulating temperature-regulated water through hollow baffles from an integral recirculating system. This baffle system which fits inside the fermentor vessel is a single four-tube assembly with tubes for water circulation and one for oxygenation. A single instrument accepts four interchangeable vessels of 2, 5, 7½, and 14 liters, all of which are designed for repeated sterilizations in a 20-inch autoclave. A thermistor controller maintains temperature of the culture medium within a range from 5°C above water supply temperature to 60°C. Control tolerance and temperature gradient are both maintained within $\pm 0.25^\circ\text{C}$. Close thermal regulation is achieved by the electronic controller which energizes an in-line immersion heater or a cold-water-feed solenoid valve. Automatic circulation of cold water through the baffles overcomes the temperature influences of impeller friction, exothermic reactions, and the high-intensity lights used in photosynthetic investigations. A lock-in control knob prevents accidental change in the temperature setting. Smooth, reproducible agitation is attained by an electronically controlled drive mechanism which delivers full power, regardless of line voltage fluctuations and changes in viscosity of the culture medium. The fermentor's design is ideal for irradiating cultures with intense illumination for photosynthetic studies of algae and photosynthetic bacteria. Semicircular light manifolds are avail-

able with removable fluorescent or neon lamps. The plug-in manifold is readily installed directly behind the fermentor vessel to provide uniform illumination over a wide area. A variable transformer can be furnished to regulate light intensity. For automatic control of light and dark cycles, a special electronic programmer can be supplied. The fermentor can be adapted to individual requirements by adding available accessories, which include: automatic pH controller with autoclavable electrodes, automatic foam control system, a strip chart temperature recorder, sintered disc sparger and ring sparger, stainless-steel fermentor jar with sub-surface viewing window, variable-pitch impellers, and overhead and submersible ultraviolet light.—D.J.P. (New Brunswick Scientific Co., Inc., Box 606, New Brunswick, N.J.)

Circle 1 on Readers' Service card

Laboratory glassware partially coated with conductive and semiconductive films provides rapid and uniform electrical heating of contents. Heat is supplied through an electrical heating element which clamps onto a groove in the side of the piece of glassware. The conductive films, fused to the surface of the vessel, conduct the heat from this element over the surface in such a way as to eliminate uneven heating and "bumping." Various sizes of beakers, flasks, funnels, a chromatographic column, and other standard items are available with coatings suitable for 200°C operation; 360°C coatings are available on special order. The contact clamps are spring brass double-contact types molded into epoxy resin handles which can be safely handled with the current on. Several sizes of clamps are offered, depending on the size of the individual vessel to be used. Power to the clamp is provided by a power supply consisting of a double-wound transformer with multiple-tapped secondary. Eleven steps of 3 and 4 volts supply voltages from 3 to 34 volts, with currents up to 7 amp, continuous duty, possible. The 11-posi-

tion tap switch is on the top of the supply; the power switch, indicator light, 0- to 10-amp meter, and power receptacle are on the front panel. For flasks of 50 ml and smaller, an additional autotransformer is required. This new laboratory equipment is said to provide superior temperature regulation, more rapid heating, quick response to changes in control setting, easier handling, and longer glass life.—D.J.P. (Ace Glass Inc., Vineland, N.J.)

Circle 2 on Readers' Service card

Expanded scale pH meter is a direct-reading, line-operated, pushbutton-controlled instrument designed to provide accurate pH and millivolt determinations. In addition, this meter can be the readout element of a modular, electrochemical-potential measurement system. Used with the proper accessory, it can measure specific ions (such as Na^+ , Cl^- , Li^+ , NH_4^+ , K^+ , and Ag^+), blood pH, gaseous oxygen, dissolved oxygen and carbon dioxide in blood, oxidation-reduction potentials, and end-point determinations in Karl Fischer and other electrometric titrations. The large, direct-reading meter has taut-band suspension and an 8.2-inch scale length. The meter has three scales for readout: a standard 0 to 14 pH (and ± 1400 mv) scale; an expanded scale for greater sensitivity; and a 2-decade logarithmic scale that relates pH to hydrogen-ion activity. The expanded scale of the Beckman Expandomatic displays any two pH units, 200 mv, or 200 mm of partial pressure (for oxygen determinations) full scale, with readability to the nearest 0.002 pH. The scale is divided into 200 increments, each of which corresponds to 0.01 pH, 1 mv, or 1 mm of partial pressure. The front panel of this instrument has dial controls for pH standardization and temperature compensation (0° to 100°C) and pushbutton controls for selecting meter function. Optional scale expansion accessories offer the operator additional readout versatility. A range selector accessory makes it possible to expand any 4, 2, 1, or 0.5 pH units (or equivalent millivolts) full scale, with temperature compensation over the 0° to 100°C sample temperature range. Simple, plug-in 1-pH scale expansion accessories are also available to expand any 1-pH unit full scale at fixed temperatures. It is unnecessary to restandardize the instrument when switching from one range to another so long as the span (for example, 1-pH unit full scale) remains

The material in this section is prepared by the following contributing writers:

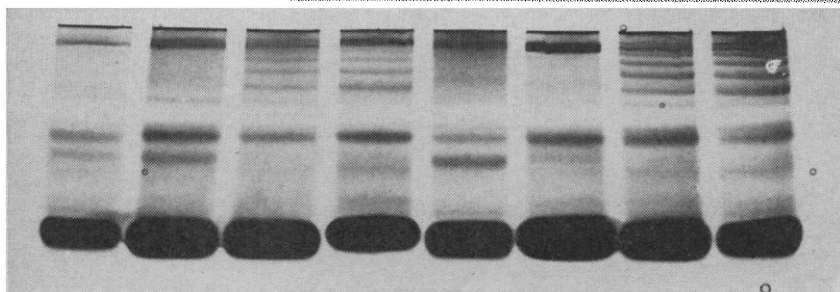
Robert L. Bowman (R.L.B.), with the assistance of Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

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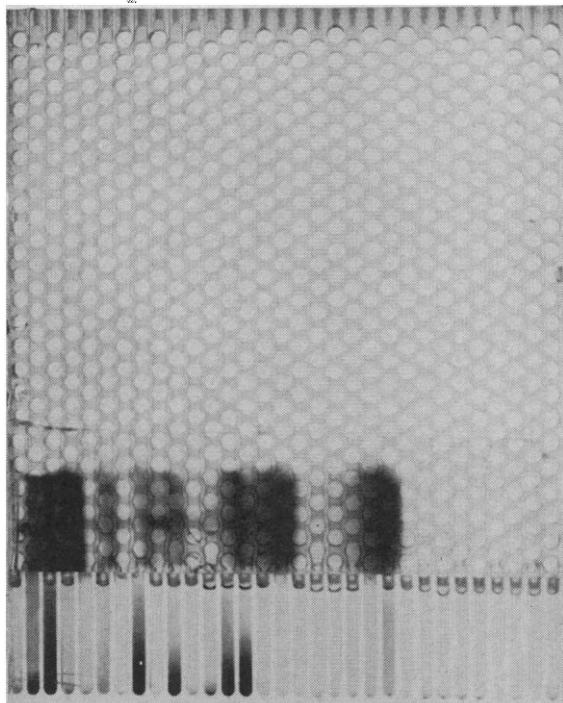
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the same. Accuracy with scale expansion can be as good as ± 0.003 pH, compared to ± 0.05 pH with the standard scale. Repeatability is ± 0.001 pH compared to ± 0.015 pH.—D.J.P. (Beckman, Scientific and Process Instruments Div., 2500 Harbor Blvd., Fullerton, Calif. 92634)

Circle 3 on Readers' Service card

Bacteria colony counter provides a convenient method of making marks and simultaneously counting the total number of marks made. The Markounter is a device for holding a pen or pencil, which, when used to make a mark, operates an internal micro-switch. Operation of the switch produces one or more digital readouts which can be set to zero at the end of each count or left for addition to later counts. The device utilizes the mechanical advantage of the lever to actuate the micro-switch with a minimum of marking force. Maximum counting speed is about ten per second, and the switch can control 5 amp at 230 volts a-c. In addition to colony counting, other applications requiring rapid, convenient counting can be handled by this simple device. The counter and a digital display unit are available separately or together.—D.J.P. (Scientifica, 148 St. Dunstan's Ave., Acton, London, W.3., England)

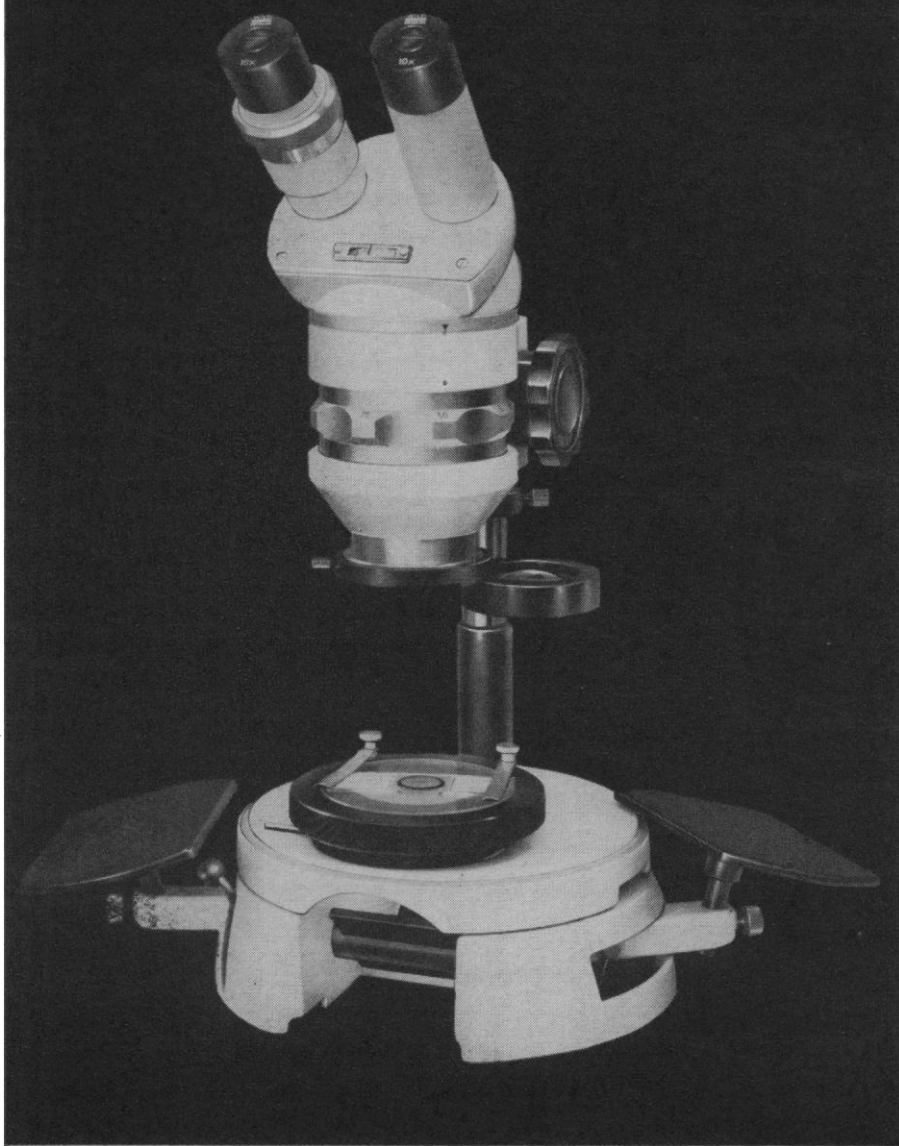
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Automatic radiochromatogram scanner records the exact location and intensity of separated low-energy beta emitters on paper strips and glass plates used in thin-layer chromatography (TLC) as well as emitters of higher energy used in thick gel applications. Up to 100 ft of assembled strips can be loaded onto spools whose width can be adjusted to accept chromatograms up to 1½ inches wide. Both sides are counted simultaneously as the paper strip passes vertically between two gas-flow detectors made of oxygen-free copper. For standard operations, windowless detectors are used. However, ultrathin windows (less than 100 $\mu\text{g}/\text{cm}^2$) or mylar windows (0.9 mg/cm^2) are available on request. Where beta energies are high enough, the use of windows helps reduce gas consumption. A choice of four collimators (1.5, 3, 4.5 and 6 mm) may be used. The specially designed detectors have a high sensitivity and a small volume which reduces the background. For paper strip counting, the background is lowered further by a lead shield which

completely surrounds the detectors. Half of the upper shield swivels on a hinge to give unobstructed access to the paper strip and detectors. Background is 12 to 14 count/min. Model RSC-363 has three gas-flow detectors. Two are used in the paper strip mode while the third is for thick gels and TLC. A front-panel control enables the operator to switch the flow of geiger gas from the paper system to the gel/TLC system. However, only one gas inlet is required for all operations. Gas input and output flow meters regulate the flow of geiger gas and help detect gas leaks. Efficiency for paper strips is 1 to 2 percent for tritium and 5 to 10 percent for carbon-14. The instrument also includes provision for counting thick gels and glass plates used in thin-layer chromatography. It accepts plates 2 inches wide and up to 32 inches long with a maximum thickness of $\frac{1}{4}$ inch. The plates or gels are placed in a gear-driven tray and pass under a shielded, 2-pi OFC detector in the rear of the scanner. A vernier dial permits an infinite selection of collimation widths from 0 to 12 mm. The detector has a special ultrathin window less than $100 \mu\text{g}/\text{cm}^2$. For higher energies, mylar windows are available on request. Efficiency for TLC/gels is 10 percent for carbon-14. The Deluxe Scanner includes an automatic event marker and an automatic gas and power shut-off circuit. A special pen in the recorder makes an impression whenever a solvent front, leading or trailing edge, passes the detector. When the last strip or plate has been scanned, the gas and a-c power are turned off automatically. A single channel, rectilinear galvanometric recorder drives the scanner by direct coupling in the same gear ratio. The resulting graph represents an exact picture of the location and intensity of activity on the chromatogram. A simple rotary switch instantly selects any one of ten chart speeds: $\frac{1}{2}$, 1, 2, 4, or 8 inches per minute or per hour. The rate meter, which is suitable for other laboratory applications, provides seven linear ranges from 0 to 100,000 count/min and seven time constants from 0.3 to 300 seconds. Recorder output is 0 to 1 ma, 0 to 100 mv. Accuracy of the rate meter is better than 2 percent on all ranges. The complete Deluxe Scanner weighs 200 lb. A model is available without the provisions for gels and TLC.—D.J.P. (Atomic Accessories, Inc., 811 West Merrick Rd., Valley Stream, N.Y.)

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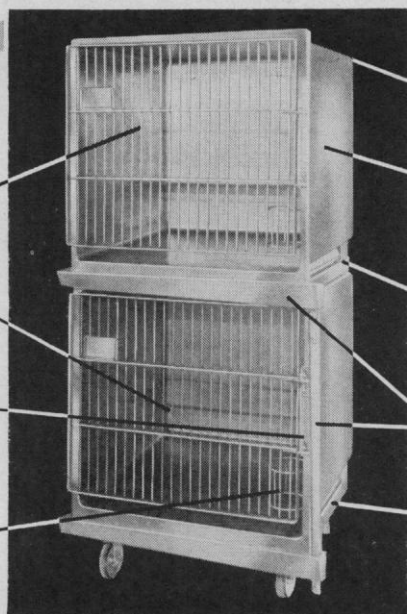
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NEW BOOKS

(Continued from page 761)

Applications of NMR Spectroscopy in Organic Chemistry: Illustrations from the Steroid Field. Norman S. Bhacca and Dudley H. Williams. Holden-Day, San Francisco, Calif., 1964. 208 pp. Illus. \$7.95.

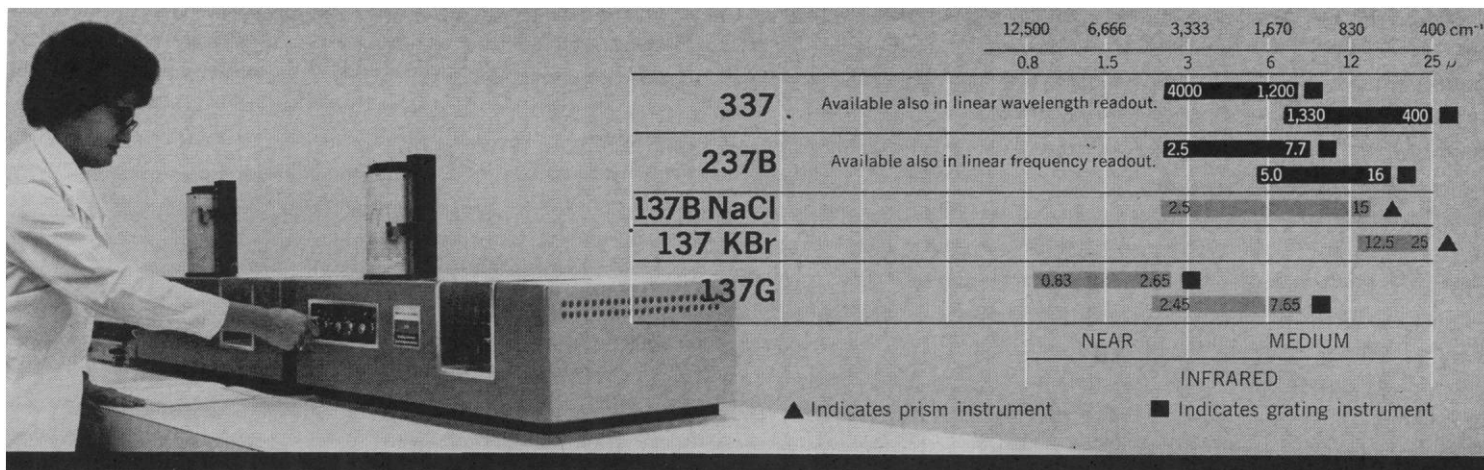
Arctic Communications. Proceedings, 8th meeting, AGARD Ionospheric Research Committee (Athens, Greece), July 1963. B. Landmark, Ed. Published for North Atlantic Treaty Organization by Pergamon, London; Macmillan, New York, 1964. 307 pp. Illus. \$15. 25 papers.

Aspects of Theoretical Mineralogy in the U.S.S.R. M. H. Battey and S. I. Tomkeieff, Eds. Translated from the Russian. Pergamon, London; Macmillan, New York, 1964. 515 pp. Illus. \$30. Thirty-five papers on the definition and classification of minerals, the classification of individual groups of minerals, and the correlation of the properties of minerals with their crystal chemistry.

Astronomy Highlights. *Apollo and the Moon*, Franklyn M. Branley (32 pp.); *Birth and Death of the Stars*, Kenneth L. Franklin (32 pp.); *Captives of the Sun: The Story of the Planets*, James S. Pickering (32 pp.); *Design of the Universe*, S. I. Gale (32 pp.); *Man in Space*, Fred C. Hess (32 pp.); *Space Age Astronomy*, Kenneth L. Franklin (32 pp.); *The Sun in Action*, Thomas D. Nicholson (32 pp.); *Time and the Stars*, Joseph M. Chamberlain (32 pp.). Published for the American Museum-Hayden Planetarium by the Natural History Press, Garden City, N.Y., 1964. Illus. Paper, 50¢ each. Popularizations based on lectures given at the Hayden Planetarium. They are intended for junior high school and high school students as well as laymen.

Asymptotic Solutions of Differential Equations and Their Applications. Proceedings of a symposium (Madison, Wis.), May 1964. Calvin H. Wilcox, Ed. Wiley, New York, 1964. 259 pp. Illus. \$4.95. Ten papers presented at a symposium sponsored by the Mathematics Research Center, U.S. Army, at the University of Wisconsin. Papers: "Asymptotic expansions for ordinary differential equations: Trends and problems" by Wolfgang Wasow; "Solvable related equations pertaining to turning point problems" by Hugh L. Turruttin; "Asymptotic methods for the solution of dispersive hyperbolic equations" by Robert M. Lewis; "Asymptotic solutions and indefinite boundary value problems" by Robert W. McKelvey; "Some examples of asymptotic problems in mathematical physics" by C. C. Lin; "On the problem of turning points for systems of linear ordinary differential equations of higher orders" by Yasutaka Sibuya; "Error bounds for asymptotic expansions, with an application to cylinder functions of large argument" by Frank W. J. Olver; "Asymptotic solutions of elastic shell problems" by Robert A. Clark; "The integral equations of asymptotic theory" by Arthur Erdélyi; and "Application of Langer's theory of turning points to diffraction problems" by Nicholas D. Kazarinoff.

Atoms, Radiation, and Nuclei. Thomas H. Osgood, Arthur E. Ruark, and



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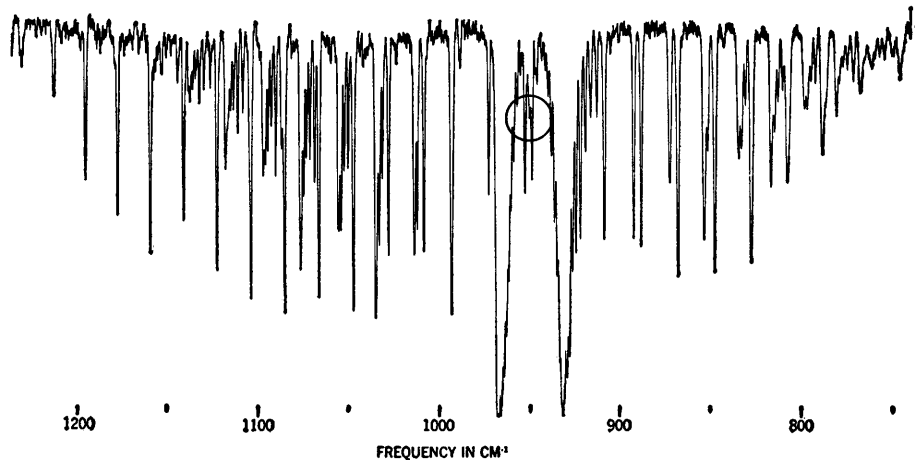
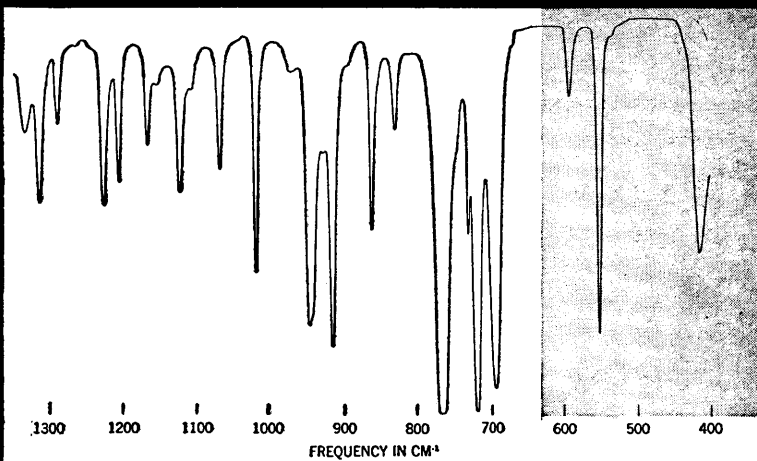
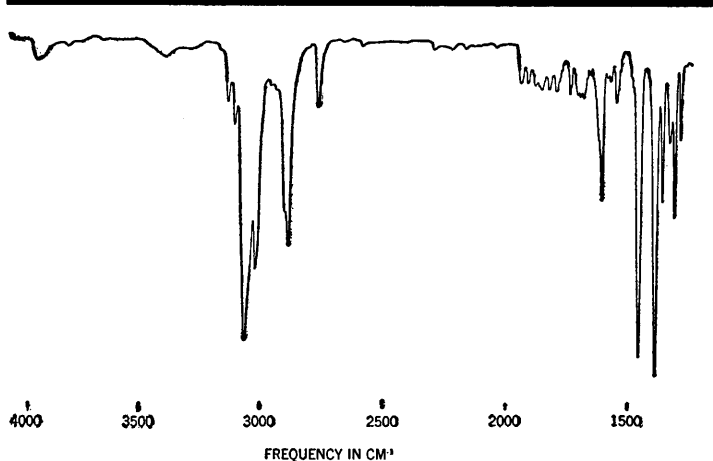
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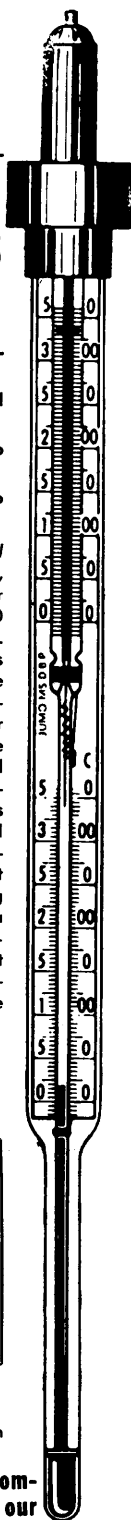
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Electromagnetism for Engineers. An introductory course. P. Hammond. Pergamon, London; Macmillan, New York, 1964. 223 pp. Illus. \$5.

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in Condensed Systems. Morris E. Fine. Macmillan, New York, 1964. 143 pp. Illus. Paper, \$3.40.

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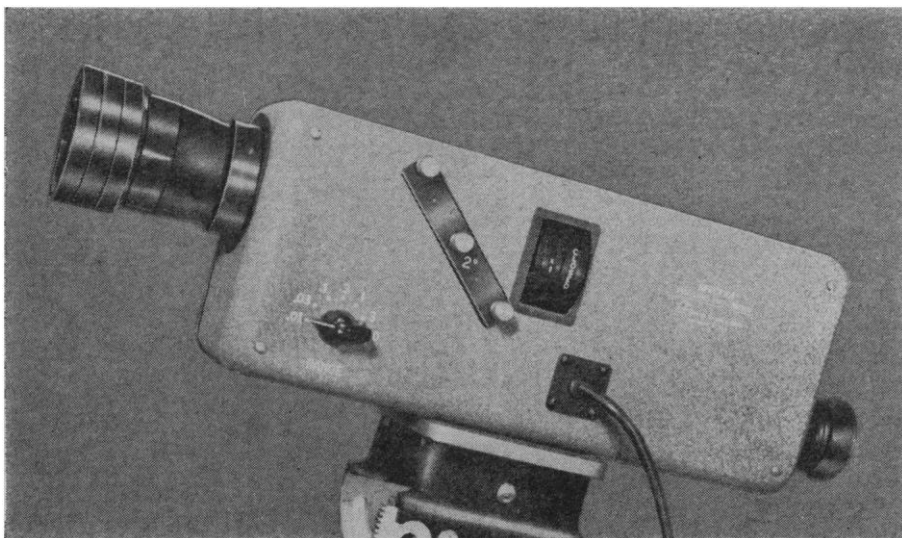
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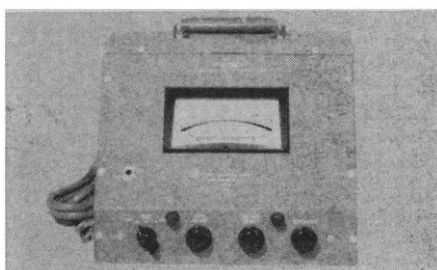


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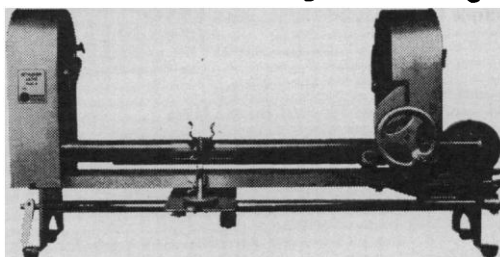


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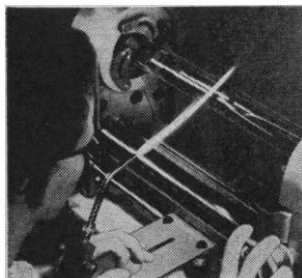
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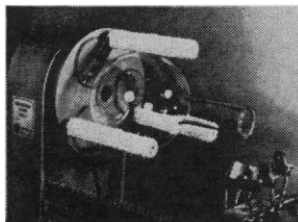


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most of which are summarized in both French and English, relating to the agenda item "Prospection of geothermal fields and investigations necessary to evaluate their capacity." The papers are presented in alphabetical order by the authors' names. Six additional volumes of proceedings papers have been announced.

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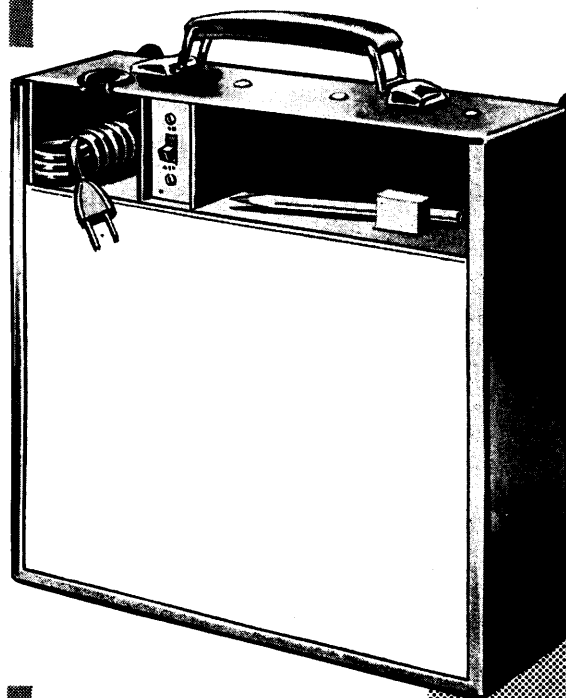
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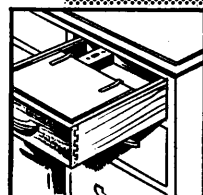
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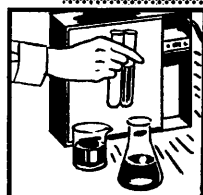
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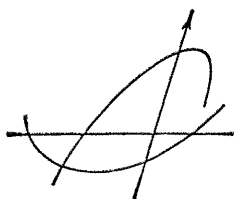
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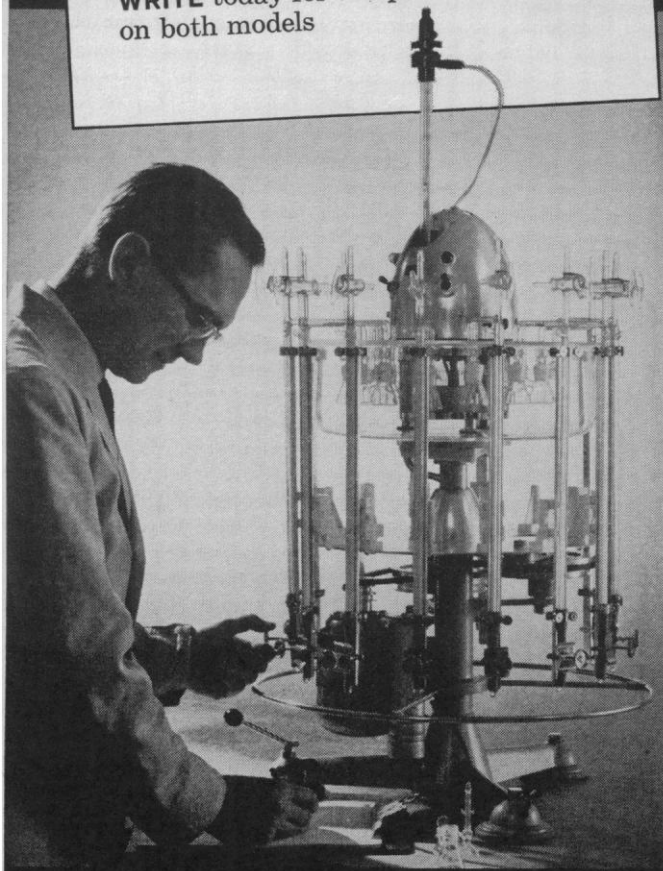
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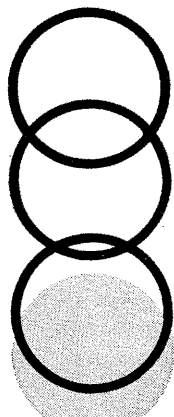
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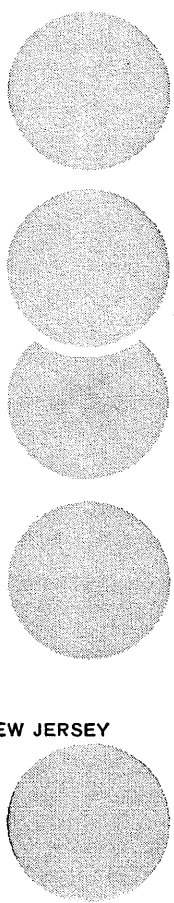
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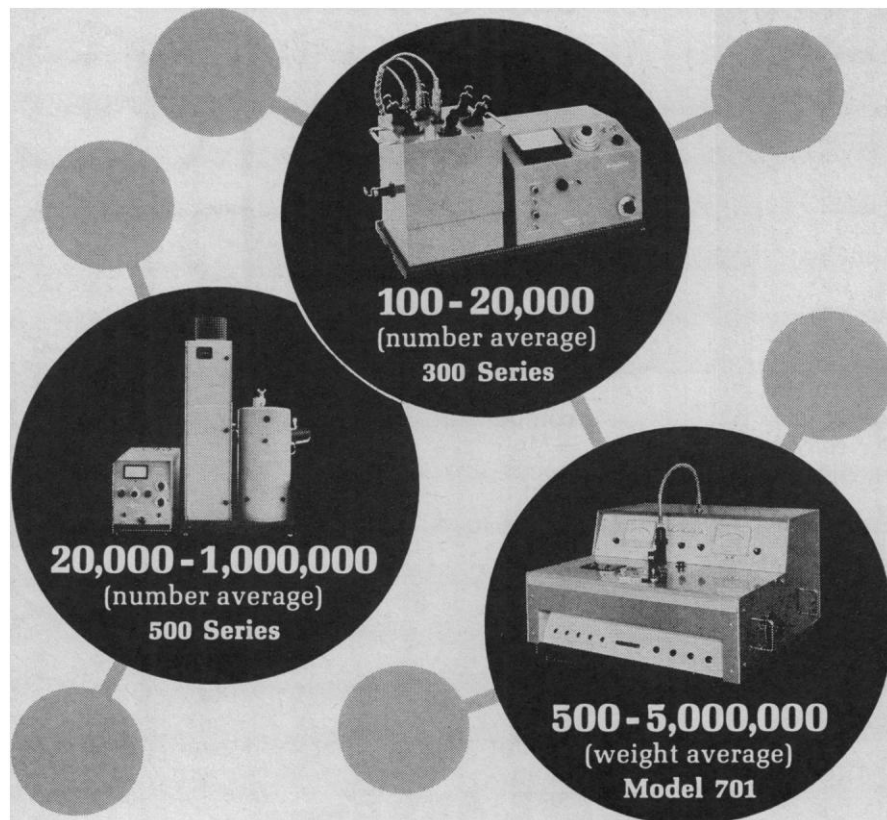
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(Continued from page 754)

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Scientists in the News

Leslie E. Orgel, formerly with the chemistry department at the University of Cambridge, England, has been appointed resident fellow at the Salk Institute for Biological Studies in San Diego, California.

Gordon W. Perkin, formerly assistant director of clinical research for the Ortho Research Foundation, has been appointed associate medical director of the Planned Parenthood-World Population organization.

William R. Upthegrove, research metallurgist with the International Nickel Company, Bayonne, N.J., has been appointed professor of mechanical engineering at the University of Texas.

Fred Wendorf, formerly with the University of New Mexico, has been appointed professor of anthropology and director of an anthropological research center at Southern Methodist University.

George Adomian, head of theoretical studies groups, Hughes Aircraft Co., has been named professor of engineering research at Pennsylvania State University's ordnance research laboratory.

Mariano A. Estoque, chairman of the department of meteorology at the University of Hawaii, has been ap-

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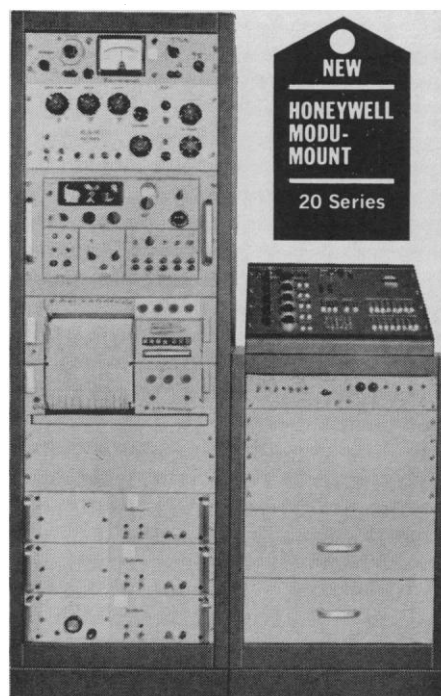
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COMPOUND	SPECIFIC ACTIVITY (mc/mM)
Δ^4 -Androstene-3, 17-dione-4-C14 [Benzene solution]	15-35
Cholestenone-4-C14 [Benzene solution]	15-35
Cholesterol-4-C14 [Benzene solution]	15-35
Cholesterol-26-C14 [Benzene solution]	15-25
Cholesteryl linoleate-1-C14 [Benzene solution]	2-20
Cholesteryl-4-C14 linoleate [Benzene solution]	15-35
Cholesteryl oleate-1-C14 [Benzene solution]	2-20
Cholesteryl-4-C14 oleate [Benzene solution]	15-35
Cholesteryl palmitate-1-C14 [Benzene solution]	2-20
Cholesteryl-4-C14 palmitate [Benzene solution]	15-35
Cortisol-4-C14 [Hydrocortisone-4-C14] [Benzene 10% ethanol solution]	15-25
Cortisone-4-C14 [Benzene 2% ethanol solution]	20-30
Cortisone-4-C14 acetate [Benzene solution]	15-25
Dehydroepiandrosterone-4-C14	15-30
Diethylstilboestrol-(monoethyl-1-C14) [Benzene solution]	5-20
DL-Epinephrine-(carbinol-C14) DL-bitartrate	2-15
DL-nor-Epinephrine-(carbinol-C14) DL-bitartrate	2-15
Estradiol-4-C14 [Benzene 2% methanol solution]	20-40
Estrone-4-C14 [Benzene 5% methanol solution]	20-40
17 α -Hydroxyprogesterone-4-C14 [Benzene solution]	10-40
Δ^5 -Pregnenolone-4-C14 [Benzene solution]	15-25
Progesterone-4-C14 [Benzene solution]	15-25
Testosterone-4-C14 [Benzene solution]	15-30
Testosterone-4-C14 propionate [Benzene solution]	10-20
19-nor-Testosterone-4-C14 [Benzene solution]	15-30

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NUC-G-4-247



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pointed visiting professor of atmospheric science at the school of environmental and planetary sciences at the University of Miami, Florida, for the 1964-65 academic year.

Recent Deaths

Walter A. Anderson, 61; dean of the New York University School of Education; 26 October.

Ernest Clare Bower, 74; retired astronomer and former consultant on mathematical astronomy for the Rand Corporation and North American Aviation; 2 September.

Alexander Graham Christie, 83; past president of the American Society of Mechanical Engineers, and professor of engineering at Johns Hopkins University, 1914-1948; 26 October.

George Miles Conrad, 53; director of the board of trustees and staff of *Biological Abstracts*; 9 September.

Edward M. Dorr, 62; president-elect of the American Association of Maternal and Child Health and head of the obstetrical section of Chicago Wesley Memorial Hospital; 26 October.

John David Evans, 53; associate professor of physiology, Temple University; 20 October.

Dwight Gunder, 61; special adviser on rockets and missiles to the Navy Bureau of Ordnance, Washington, D.C., and former head of the department of engineering mechanics, Cornell University; 20 October.

Walter Emil Heck, 49; associate clinical professor of otolaryngology, University of California School of Medicine, San Francisco; 19 September.

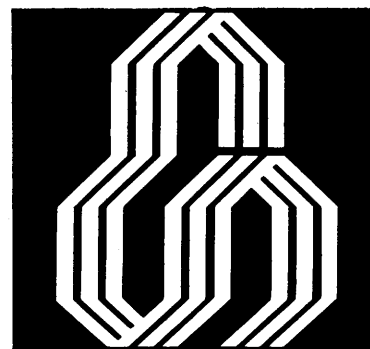
Walter C. Jacob, 49; associate head of the department of agronomy at the University of Illinois; 4 September.

Gardner M. Riley, 54; professor of obstetrics and gynecology, University of Michigan School of Medicine; 26 September.

Games Slayter, 67; retired vice president of research and development, Owens-Corning Fiberglas Corporation; 15 October.

Richard L. Weaver, 53; professor of conservation, University of Michigan; 16 October.

Erratum: In the report "Chromatography of ribonuclease-treated myosin extracts from early embryonic chick muscle" by E. F. Baril, D. S. Love, and H. Herrmann (16 Oct., p. 413) the key in the legend to Fig. 1 should have read: "Solid line (optical density at 280 m μ), and short dashes (optical density at 260 m μ), after treatment with 0.005 percent ribonuclease. Long dashes (optical density at 280 m μ) and crosses (optical density at 260 m μ), untreated."

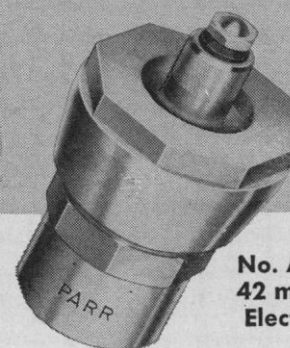


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